To the Graduate Council:

I am submitting herewith a dissertation written by Bruce D. Bainum entitled "The Neuropsychological State of the Problem Drinker." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Psychology.

William H. Calhoun, Major Professor

We have read this dissertation
and recommend its acceptance:

Accepted for the Council:

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THE NEUROPSYCHOLOGICAL STATE OF THE PROBLEM DRINKER

A Dissertation

Presented for the

Doctor of Philosophy

Degree

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Bruce D, Bainum

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DEDICATION

This dissertation is dedicated to an individual who has been a constant source of support, encouragement, help, and friendship throughout the graduate school process. Together we have shared the joys and sorrows that are involved in writing a dissertation. Her support and encouragement came at a time when she herself was involved in the dissertation process. It is to my future wife, Charlene Kubo, that I dedicate this work.

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ABSTRACT

Fifty-seven problem drinkers were administered the Halstead Neuropsychological Test Battery. Half of these were tested one time after at least 4 months in an outpatient treatment center while the other half was tested once at the beginning of treatment and once more following 2 to 3 months in treatment. Detailed drinking history, and demographic information was obtained for all participants. Results showed a Halstead Impairment Index indicative of brain damage in approximately 50 percent of all problem drinkers tested. As a group the 57 participants performed significantly worse than a normative group of 191 controls on the Category Test, the Tactual Performance Test-Time, the Speech-sounds Perception Test, and the Halstead Impairment Index. These neuropsychological deficits were shown to be the same ones found to exist in chronic alcoholic populations. The group of participants available for retesting after a period of 2 to 3 months in treatment showed significant improvement on 5 out of the 10 neuropsychological measures employed. Certain demographic and drinking history variables were found to be significant predictors of the Halstead Impairment Index. Implications of these results for both the treatment of younger non-alcoholic problem drinkers and future research involving these individuals were discussed.

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CHAPTER I

INTRODUCTION

The Economic and Health Costs of Alcohol

This country is currently demonstrating a preoccupation with healthful living which has not previously been emphasized to such an extent. People today seem to be more concerned about regular exercise, good eating habits, clean air and water, food additives and leisure activities than ever before in our country's history. Despite this preoccupation with healthful living, the daily pressures, tensions and anxieties that come with our rather competitive and aggressive culture are prevalent. From antiquity to the present these pressures and tensions have often been dealt with by the use of a substance which is quite effective, readily available, and relatively inexpensive--ethyl alcohol. Without a doubt the majority of those who drink alcohol do so in a responsible manner without injury to themselves or others. Nevertheless an estimated 10 million Americans (7 percent of the estimated population) cause harm to themselves and others, and heartache to their families because of excessive consumption of alcohol.

Alcohol abuse is a major social problem in this country today. Of all adults who drink, 36 percent can be classified as either problem drinkers or potential problem drinkers (10 percent--problem drinkers; 26 percent--potential problem drinkers). In addition to these adult problem drinkers there are approximately 19 percent (3.3 million) of

all youth between the ages of 14 and 17 who are considered to have a problem with drinking.[1]

The economic cost of alcohol-related problems to the United States in 1975 was almost 43 billion dollars.[2] Table 1 shows the breakdown of this sum.

TABLE 1

ECONOMIC COSTS OF ALCOHOL MISUSE AND ALCOHOLISM IN THE UNITED STATES, 1975

Item	Cost (Billion $)
Lost Production	19.64
Health and Medical	12.74
Motor Vehicle Accidents	5.14
Violent Crime	2.86
Social Responses	1.94
Fire Losses	.43
Total	$42.75

In addition to these tremendous economic losses caused by alcohol abuse there are many other losses upon which a price tag cannot be placed.

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[1] National Institute on Alcohol Abuse and Alcoholism, Third Special Report to the U.S. Congress on Alcohol and Health from the Secretary of Health Education and Welfare, NIAAA, Rockville, Maryland, June 1978, pp. 1-14.

[2] Ibid.

For example, the Third Special Report to the U.S. Congress on Alcohol and Health from the Secretary of Health, Education and Welfare estimated that one-half of all traffic fatalities and one-third of all traffic injuries are alcohol related. More than one-third of all suicides involve alcohol and a disproportionately large number of people with drinking problems commit suicide. It is also reported that some studies have found up to 40 percent of fatal industrial accidents, 69 percent of drownings, 83 percent of fire fatalities and 70 percent of fatal falls to be alcohol related. In addition excessive consumption of alcohol has been associated with child abuse, child molesting, and marital violence.

The physical deterioration caused by alcohol is great. Heavy drinking has been shown to increase the risk of developing cancer of the tongue, mouth, oropharynx, hypopharynx, esophagus, larynx and liver.[3] These cancer sites account for 6 to 9 percent of all cancers in the white population of this country. Alcohol has also been linked to cardiomyopathy, a disease of the heart muscle and atrial fibrillation. Cirrhosis of the liver is widely accepted as being alcohol related (in up to 95 percent of all cases). In 1975 cirrhosis of the liver was responsible for the deaths of 31,623 individuals. This represented the highest number of alcohol-related deaths after traffic fatalities for that year.[4]

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[3] Ibid., pp. 25-37.

[4] Ibid., pp. 1-14.

Alcohol and Brain Damage

As reflected in the above statistics, many aspects of an individual's life and health may be adversely affected by alcohol consumption. One of the more serious health consequences of alcoholism and one which occurs in a surprisingly large number of alcoholics is that of brain damage. Brain damage may occur indirectly due to severe head injuries sustained during intoxication, however, most physiological change in the alcoholic's brain is probably due to the direct toxic effects of ethyl alcohol or possibly nutritional deficiencies. The study of brain damage in the alcoholic patient should be an important area of concern to workers in the field of alcoholism for the following reasons:

(a) Neuropsychological impairment associated with brain damage appears to occur in a surprisingly high percentage of alcoholics.

(b) Relatively little is known about the nature, extent, or causes of brain damage in the alcoholic population.

(c) Virtually nothing is known about the nature, extent, or causes of brain damage among problem drinkers or potential problem drinkers.

(d) The occurrence of brain damage in a problem drinker may have serious implications for the treatment of that individual.

Brain damage in the alcoholic population may be one reason traditional treatment regimes have met with less than desirable degrees of success.

It is possible that the alcoholic who experiences certain cognitive deficits may have difficulty grasping or adapting to new concepts required for successful rehabilitation.

Certain terms used frequently in this paper may be defined in numerous ways. In order to clarify the intended meanings of brain damage, neuropsychological deficits, alcoholic, and problem drinker as used in this paper, a brief discussion follows. For the purposes of this study, brain damage will refer to a physiological lesion or atrophy located somewhere in the cerebrum, cerebellum or brain stem. This lesion or atrophy may have been brought about by any one of a large number of causes, both alcohol-related and otherwise, although for the most part in the research reviewed below as well as the present study it was attempted to exclude individuals who were known to have brain damage from a non-alcohol-related cause such as a tumor or severe head injury. The occurrence of brain damage has been directly observed through means of autopsy or various radiological techniques, however, in the research reviewed below the presence or absence of brain damage is often inferred indirectly through means of various neuropsychological tests, some of which have been shown to be valid predictors of brain damage.

Neuropsychological deficit refers to that behavior which is indicative of "poor" performance on the measure in question. "Poor" performance is determined by comparing the experimental group's test performance with that of a non-alcoholic comparison group. An individual's poor test performance may also be compared to established criterion scores shown to differentiate clinical cases of brain damage

and non-brain-damaged individuals. The fact that an individual shows neuropsychological deficits does not prove that brain damage as defined above exists. It cannot be said with certainty that brain damage causes the neuropsychological deficits, merely that the two are associated. Neuropsychological impairment will be used interchangeably with neuropsychological deficit.

A definition of alcoholism will be borrowed from the Third Special Report to Congress on Alcohol and Health[5]. Here, alcoholism is defined as follows:

> Alcoholism is addiction to alcohol (and is) . . . characterized by a compulsion to take alcohol on a continuous or periodic basis to experience its psychological and physical effects, and sometimes to avoid the discomfort of its absence. Tolerance may or may not be present.

In this study an alcoholic is defined as an individual displaying the characteristics of alcoholism defined above. Additionally, the term alcoholic used in this study will imply a chronic, long-term state of alcohol-related disablement. Often a problem drinker is defined as any individual experiencing alcohol-related disabilities. This definition would include alcoholics since alcoholics definitely have problems brought about by the use of alcohol. However, in this study the term problem drinker will refer to an individual who experiences alcohol-related difficulties in one or more areas of life functioning such as legal, vocational, familial, educational, financial, or social, but who is not considered to be an alcoholic. A problem drinker is an individual who has problems caused by excessive use of

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[5]Ibid.

alcohol but who is not suffering from a progressive disease, as alcoholism is so often described. When the term problem drinker is used in this study it will imply a state of alcohol-related disablement which is less chronic than that of the alcoholic. Also inherent in this distinction between the alcoholic and the problem drinker is the notion that the alcoholic tends to be older and to have had a problem drinking for a greater number of years when compared to the problem drinker.

Many questions arise concerning the nature of brain damage in alcoholism. Most basic of all are the questions revolving around its existence and nature. Does brain damage and/or neuropsychological impairment exist in the chronic alcoholic and if so, what is the nature and extent of its occurrence? What areas are and are not impaired, and what are the behavioral manifestations, if any, of this physical brain damage? A second area of investigation revolves around the characteristics of those drinkers who do encounter brain damage or neuropsychological impairment. Who is affected? Does drinking history play a significant role? Does duration of drinking or amount of alcohol consumed play a determining role? Do non-alcoholic drinkers such as problem drinkers or potential problem drinkers exhibit signs of brain damage? A third set of questions deals with the question of recovery. Does recovery of neuropsychological impairment occur, and if so, to what extent? Is recovery partial or complete? Is total abstinence necessary for recovery to occur, and if so, how long a period? Does reversibility of neuropsychological impairment depend upon the previous drinking history of the individual alcoholic?

These questions will be the subject of the following literature review. Some of them have been answered, but many more remain to be answered.

A Review of the Literature

Evidence for the Existence of Brain Damage

There is a substantial amount of evidence suggesting that brain damage may occur in the alcoholic patient. One study reported by Page and Linden (1974) suggests that about 70 percent of the alcoholic population may be within the probable brain-damaged range. The alcoholics studied in most of the research reviewed here typically have been heavy drinkers for an average of from 10-15 years. Evidence for such an impaired state comes generally from two types of studies--clinical investigations of a medical nature and psychometric studies. Clinical autopsy air encephalography observations and more recently computerized axial tomography procedures have been reported, but by far the majority of studies have used various psychometric techniques to look for impaired neuropsychological performance in the alcoholic population.

Clinical Evidence. One of the earlier observations was reported by Alexander (1941) who investigated the brains of deceased alcoholics. He reported that almost all brains of chronic alcoholics showed shrinkage or atrophy. Cortical atrophy appeared most prominently in the frontal lobes. Courville (1955) reported a large incidence of cerebral atrophy in the frontal lobes of the chronic alcoholic, appearing as early in life as the forties. He suggested that the

atrophy was caused by the direct toxic effect of ethanol rather than malnutrition. Tumarkin, Wilson, and Snyder (1955) have shown that a group of alcoholics with a mean age of 32 showed abnormalities on the digit span and digit symbol subtests of the Wechsler-Bellevue Intelligence Test. They also exhibited abnormal electroencephalograms (EEGs). Pneumoencephalograms of these patients showed diffuse cortical and subcortical atrophy in the parietal and frontal areas. Brewer and Perrett (1971) used air encephalography as well as psychometric techniques in assessing brain damage in alcoholics. Seventy percent had radiologically significant atrophy and 65 percent of these showed impairment based upon the psychometric measures.

This rather high percentage is supported by other research. Parsons (1977) summarized 12 studies investigating brain atrophy in alcoholics. The percentage of patients with significant atrophy ranged from 50 to 100 percent depending on the selection criteria. The percent of unselected alcoholics seeking treatment who exhibited brain atrophy ranged from 50 to 70 percent.

Without suggesting specific sites of brain damage, Bennett, Mowery, and Fort (1960) described what they called the intermediate stage of alcoholic brain disease. Based upon clinical observations, electroencephalograms and pneumoencephalograms of 227 alcoholics, Bennett classified 98 in the acute stage. In the intermediate stage of alcoholic brain disease the personality changes, blackouts occur, the EEG is abnormally slow, and cortical atrophy is observed, but the impairment is thought to be still reversible if cessation of drinking occurs. Of those classified as being at the intermediate stage of alcoholic brain disease, 79 percent had abnormal EEGs.

Intelligence Testing. If cortical atrophy does occur in the alcoholic population, then what, if any, neuropsychological functions are impaired? It appears that verbal intelligence is not adversely affected by chronic ethanol intake. Bauer and Johnson (1957) reported that alcoholics did not differ from non-alcoholics on the Wechsler Adult Intelligence Scale (WAIS) or the Ravens Progressive Matrices Test. In fact elsewhere (Peters, 1956) it has been reported that alcoholics have above average intelligence as measured by the WAIS with no differences between verbal and performance IQ. Fitzhugh, Fitzhugh, and Reitan (1960, 1965) compared alcoholics, brain-damaged subjects, and a control group of non-alcoholics on the Wechsler-Bellevue and the Halstead Neuropsychological Test Battery. Alcoholics were not different from the control group on the intelligence measures but were different from the brain-damaged group. Similar findings were reported by Tarter and Jones (1971) who found no difference between alcoholics and the control group on the Shipley-Hartford Institute of Living Scale. On the other hand, Blusewisz, Schenkenberg, Dustman, and Beck (1977) reported young non-alcoholics scored better on the verbal and performance subtests of the WAIS than young alcoholics and that both older and younger non-alcoholics scored better on the performance and full scale parts of the WAIS than the group of young alcoholics. Alcoholics were not found to be deficient in verbal ability as measured by the WAIS, but performed poorly on the block design and digit symbol subtests of the WAIS when compared to a control group (Schau and O'Leary, 1977). Further evidence exists for a discrepancy between verbal and performance intelligence in alcoholics. Jones (1971)

found that alcoholics were no different from a control group on verbal intelligence but scored significantly lower on a visual-spatial intelligence test. Williams, Ray, and Overall (1973) compared the WAIS scores of 158 alcoholics to WAIS norms of organicity and mental aging. They reported that alcoholics differed significantly from the norms indicating accelerated mental aging and evidence for organicity. Though some evidence exists indicating impaired intelligence in the alcoholic compared to the non-alcoholic, more evidence exists supporting no differences at least in verbal intelligence. If differences do occur, they seem to be on performance tasks involving abstraction and visual-spatial tasks as opposed to verbal intelligence. There is, however, a discrepancy between studies which show no difference on nonverbal measures of intelligence and those which show a deficit in these areas. Perhaps difficulty in matching groups could explain part of this discrepancy.

Neuropsychological Testing. There does not seem to be clearcut evidence that intelligence is adversely affected by chronic consumption of alcohol. However, some neuropsychological abilities do indeed seem to be affected. For example, Fitzhugh, Fitzhugh, and Reitan (1960, 1965) administered the Halstead Neuropsychological Test Battery to groups of alcoholic, brain-damaged, and control subjects. They found that the alcoholics were similar to the brain-damaged group on the neuropsychological indicators that were sensitive to brain damage and scored significantly lower than the control group on these measures. Differences were found on the Category Test, Tactual Performance Test for time, Impairment Index and the Trail-Making Test parts A and B.

Alcoholics performed even worse than the brain-damaged subjects ($p < .10$) on the Category Test, a test which taps abstraction and conceptual abilities. These findings are similar to those of other researchers. Goldstein and Shelly (1971) gave 50 alcoholics the Rod and Frame Test, the Halstead Battery, and the WAIS. Alcoholics did well on language and memory tasks, but performed poorly on psychomotor, abstraction, problem solving, perceptual, and spatial memory tasks. Similarly, Smith, Burt, and Chapman (1973) reported that alcoholics with above average IQs coming from upper socioeconomic backgrounds showed a high incidence of impaired neuropsychological abilities as measured by the Halstead Battery. Thirty-five percent of the alcoholics fell in the brain-damaged range on Halstead's sensitive Impairment Index. O'Leary, Donovan, and Chaney (1977) also found abstraction and problem-solving difficulties in alcoholics compared to controls. They also reported a positive relationship between field dependence and amount of impairment in both the alcoholics and controls. Problem-solving ability was found to be poorer in alcoholics compared to controls when measured by the Category Test, the Tactual Performance Test-Time, and the Trail Making Test B from the Halstead Battery (Schau and O'Leary, 1977). Performance on the block design and digit symbol subtests of the WAIS was also shown to be significantly lower in alcoholics than in controls. Blusewicz, Dustman, Schenkenberg, and Beck (1977) gave the Halstead Battery to young non-alcoholics, young alcoholics, and elderly non-alcoholics. The mean Impairment Index (a sensitive measure of neuropsychological impairment comprised of the test results of the entire Halstead Battery) for each of these groups is shown below as Table 2.

TABLE 2

MEAN IMPAIRMENT INDEXES FOR ALCOHOLICS AND NON-ALCOHOLICS AS REPORTED IN BLUSEWICZ'S STUDY

Group	Mean Impairment Index*	N
Young non-alcoholic	.16	20
Young alcoholic	.46	20
Elderly non-alcoholic	.68	20

*Neuropsychological deficit is indicated with an Impairment Index greater than 0.50.

Tarter and Parsons (1971) administered the Wisconsin Card Sorting Test to 24 alcoholics, 24 students, and 24 controls. The alcoholics made more errors and took more trials to reach a criterion level. They concluded that categorizing deficits in chronic alcoholics are a result of problems in shifting or in sustaining a pattern of search and persistence in problem solving. Jones and Parsons (1972) gave the Category Test, Shipley-Hartford Verbal Abstraction Test, and Embedded Figures Test to alcoholics and controls. Alcoholics did worse on the Category Test but not the other two tests, suggesting that the abstraction deficit is a very specific one, most likely of a visual-spatial nature.

For the most part the studies mentioned above used the complete Halstead Neuropsychological Test Battery, or parts of it, to measure neuropsychological deficit. Many other instruments, however, have been used to assess the cognitive state of the alcoholic. Kaldegg (1956)

used the Bender-Gestalt, the Rorschach, and the Wechsler-Bellevue on 21 alcoholics. Irregularities in all three of these tests resulted. Substantial differences between verbal IQ and performance IQ were also found. The General Aptitude Test Battery, a test measuring verbal, spatial, and numerical ability, as well as form perception and motor coordination was given to 90 alcoholics and the results compared with age-related norms (Kish and Cheney, 1969). The results indicated impairment of numerical aptitude, motor coordination, and finger and manual dexterity. Claeson and Carlsson (1970) concluded that one-half of all alcoholic subjects tested after two weeks in treatment showed moderate to severe cerebral dysfunction based upon their performance on several tests including the Synonyms Test, Figure Classification, Koh's Block Test, and Figure Turning Test. Heilbrun, Tarbot, and Madison (1979) showed that alcoholics were less able to focus on relevant cues and less able to recall pertinent ideas and possible consequences when measured on the Stroop Color Word Test, the Mirror-Tracing Task, the Wisconsin Card Sorting Test, and a self-monitoring task.

Contrary to most research findings, Hoy (1973) found that very few alcoholics in his study showed undoubted brain damage. He compared 57 alcoholics with 57 psychiatric patients with varying degrees of brain damage on the Benton Corrected Errors Test and on a vocabulary test. He concluded that slight cerebral dysfunction may be common in alcoholics at any age, but those alcoholics with real brain damage are atypical. The measures used may be partially responsible for these results since it has been demonstrated elsewhere (Fitzhugh, et al.,

1960; Peters, 1956) that alcoholics do not tend to demonstrate verbal deficits.

Performance on the Group Embedded Figures Test (GEFT), a test for field dependence, was found to be correlated with deficits measured by the Memory-For-Designs Test and the Shipley-Hartford Test in alcoholics (Donovan, Queisser, and O'Leary, 1976). Alcoholics defined as field dependent on the GEFT showed significant impairment in abstract reasoning, perceptual-motor function, and short-term visual-spatial memory when compared to field-independent alcoholics. Donovan suggests that the GEFT is a useful tool for assessing cognitive impairment in alcoholics. Goldstone, Lhamon, and Wurnberg (1977) reported that hospitalized alcoholics transmitted less information in a time discrimination task than social drinkers, indicating what they interpreted to be a deficit in temporal lobe functioning.

Location and Possible Causes of Impairment. There are basically three hypotheses concerning the specific location of brain damage in the alcoholic. It has been demonstrated that atrophy occurs in the frontal areas of the brain (Alexander, 1941; Courville, 1955). There is additional support for the frontal-limbic diencephalic area as a focal point of brain damage. Tarter (1975) after reviewing the evidence for psychological deficits among alcoholics suggests that the evidence points toward this region of the brain.

Furthermore, Segal, Kushnarev, Urakov, and Misionzhnik (1970) observed that the symptoms of the alcoholic withdrawal syndrome are very similar to those of the hypothalamic syndromes. Both of these exhibit sleep disorders, vasovegetative paroxysms, cardiovascular and

temperature regulation disorders, electroencephalograph changes, and emotional symptoms. The close connection between the frontal lobes and hypothalamic centers has been stressed by Nauta (1972). Parsons (1975) pointed out that the difficulty of inhibiting a response by alcoholics plus impairment of sequential problem solving and the visual-spatial difficulties could all be explained by frontal lobe dysfunction. Most evidence at this time supports the hypothesis of a frontal-limbic location for brain damage in alcoholics. The other two hypotheses which do not have as much support include the notion of a general diffuse atrophy and secondly, the right hemisphere hypothesis which suggests the right hemisphere as a location of impairment since language functions are generally intact in the alcoholic but functions of the right hemisphere are not.

The manner in which alcohol acts either directly or indirectly to bring about cerebral atrophy is open to speculation. Moskow, Pennington, and Knisely (1968) discovered that as the blood alcohol concentration rose, the amount of sludging of red blood cells increased in human subjects and the rate of blood flow slowed down. At higher blood alcohol concentrations a substantial number of capillaries had ruptured. The observations were made directly through the eye, but sludging has also been observed in other areas of the body. Moskow, et al. (1968) also detected sludging in the eye capillaries of subjects who had consumed as little as one large beer. From these observations it has been speculated that cell damage results from a loss of oxygen caused by the sludging process in the brain. The higher the blood alcohol concentration, the greater the sludging, and consequently the amount of cell damage is greater presumably due to an anoxic state.

Whether or not sludging is a significant cause of brain damage in alcoholics or only one of a number of contributing factors still remains to be seen. As Ron (1977) pointed out in his review of the literature, it is conceivable that a number of factors bring about brain damage and more than one of these may serve to interact in particular cases. Possible factors include: the prolonged action of alcohol or its metabolites, dietary deficiencies, severe head injuries while intoxicated, or liver damage with portal encephalopathy. Carlen, Wortzman, Holgate, Wilkinson, and Rankin (1978) suggested that the inhibition of protein synthesis caused by alcohol (as documented by Noble and Tewari, 1973) is the mechanism for ethanol's neurotoxic effect.

Summary. Thus far in our discussion we have a substantial amount of evidence for cerebral atrophy in the chronic alcoholic based upon clinical observations. Studies involving the intelligence of alcoholics indicate the relative intactness of this capacity. However, various nonverbal measures of intelligence, more of a performance nature, such as spatial relations or psychomotor tasks, have demonstrated the existence of neuropsychological impairment in the alcoholic. Administration of the Halstead Neuropsychological Test indicates lower scores on the Category Test, Tactual Performance Test, Impairment Index, and Trail Making Test Part B for alcoholic groups when compared to control groups. The alcoholic's ability to solve abstraction type problems and to grasp certain concepts seems to be seriously questioned by this literature. Some of the evidence

suggests that categorizing problems experienced in the Category Test or Wisconsin Card Sorting Test are due to an inability to shift or to sustain a pattern of search or persistence in problem solving. There is some indication that the abstraction deficit is of a visual-spatial nature. Field dependence is a trait which has been observed with a high frequency in alcoholics and has been found to be positively correlated with perceptual-motor impairment, short-term visual-spatial memory deficits, and abstract reasoning deficits. Finally, deficits among alcoholics in numerical aptitude, motor coordination, and manual dexterity have also been observed. In a review of this literature Kleinknecht and Goldstein (1972) similarly concluded that IQ is not affected by chronic alcoholism but two general areas of deficit do occur. These are (a) abstract reasoning and problem solving, and (b) complex perceptual-motor abilities. Current evidence suggests the hypothesis of the frontal-limbic diencephalic area as the focal point of brain damage.

Drinking History and Brain Damage

This section will review the literature regarding the relationship of brain damage and neuropsychological impairment in the alcoholic to the duration of the drinking problem. Other aspects of the alcoholic's drinking history such as type and amount of beverage consumed may also be related to the development of brain damage but have not been as thoroughly investigated.

The majority of the research in this area seems to indicate that a longer duration of drinking correlates positively with neuropsychological impairment, however there also is some evidence that no such

relationship exists. For example, Tarter and Jones (1971) administered the Shipley-Hartford Institute of Living Scale to 98 alcoholics and 71 non-alcoholics. No relationship was found between test scores and the number of years the person described himself as being an alcoholic (r = .06). Similarly, Klisz and Parsons (1977) reported that duration of alcoholism had no effect on problem solving ability when comparing a group of alcoholics whose mean heavy drinking history was five years with a group whose average was about fourteen years. He did, however, find that age was negatively correlated with problem solving ability when duration of drinking was controlled. Bergman and Agren (1974) reported finding no correlation between the progress or course of alcoholism as determined by interviews and various cognitive abilities that were measured in 90 alcoholics (no sign of delirium tremens or severe withdrawal symptoms) when compared to severe alcoholics (delirium tremens and severe withdrawal symptoms) on the Halstead Impairment Index. These two groups were not significantly different from each other. However, it should be noted that there were only 13 in the severe group and only 7 in the non-severe group.

In support of a relationship between drinking history and neuropsychological functioning, Jones (1971) demonstrated that short-term alcoholics did significantly better than long-term alcoholics on the Ravens Progressive Matrices Test, a visual-spatial measure of intelligence. Also, Tarter (1971) in his dissertation reported that long-term alcoholics (alcoholic history more than 10 years) showed impairment in shifting cognitive sets, error utilization, and maintenance of a set on the Wisconsin Card Sorting Task. Long-term alcoholics also committed

more errors than the short-term alcoholics (alcoholic history less than 10 years) who were deficient only at set maintenance. Jones and Parsons (1971) administered the Category Test to 40 alcoholics, 40 controls, and 40 brain-damaged subjects. Deficits on this measure showed a positive correlation with the number of years drinking. They suggested that the aging brain may be differentially susceptible to the effects of alcohol but duration and amount must also be considered. Farmer (1973) administered the Bender-Gestalt to alcoholics at three different times during three months of abstinence. A group identified as being in the early stages of alcoholism and younger than the other alcoholics scored in the normal range on this test after only two weeks of abstinence, whereas other alcoholics showed improvement after 30 days and some not at all. In a study of the acute effects of alcohol ingestion, Parker, Alkana, Birnbaum, Hartley, and Noble (1974) compared moderate drinkers with alcoholics on various cognitive functions, such as registration, recall, learning, and organization of information. They concluded that acute intoxication affects the mneumonic processes of both groups in a similar manner but alcoholics do display poorer category clustering than the moderate drinkers. In further support of a drinking history effect, McLachlan (1974) found that of those alcoholics who had stopped drinking one year from rehabilitation, the ones with a history of binge or continuous drinking improved significantly more on their block design scores from the WAIS than those alcoholics with a mixed history of both binge and continuous drinking. Also, Smith and Smith (1977) administered the WAIS to alcoholic cirrhotics, alcoholic non-cirrhotics, as well as non-alcoholic

non-cirrhotics and found that alcoholic cirrhotics, who presumably have ingested more alcohol than non-cirrhotic individuals, but who also may have liver related brain damage, were more impaired than all others on verbal, performance, and full scale IQ. Finally, Haug (1968) in a pneumoencephalogram study, found that the severity of cerebral atrophy in alcoholics was positively correlated with the length of drinking history and was more severe in patients who had had delerium tremens.

There is evidence in the literature for a relationship between drinking history and impaired neuropsychological abilities. The drinking history studies have dealt primarily with the length of the drinking problem and certainly other factors such as type and amount of beverage need to be investigated. Of the few studies suggesting no relationship between drinking history and neuropsychological functioning some have methodological problems such as a small sample size. If drinking history is a significant factor in neuropsychological functioning as it appears to be, then the treatment of the alcoholic can benefit from detailed drinking histories. The heavier drinkers should be screened more carefully for neuropsychological deficits and appropriate steps taken in their rehabilitation.

Recovery of Neuropsychological Functioning

Since alcoholics demonstrate a surprisingly high incidence of brain damage as discussed previously and since there is evidence (Gregson and Taylor, 1977) that neuropsychological impairment is a good predictor of relapse in alcoholics, the question of reversibility of neuropsychological deficit becomes an important one. Under what

conditions if any can a state of neuropsychological deficit be reversed? Fortunately for the alcoholic evidence suggests that certain of these deficits are indeed reversible. For example, Jonsson, Cronholm, and Izikowitz (1962) administered tests of verbal understanding, verbal fluency, reasoning ability, spatial thinking, and memory tests to 30 sober alcoholics not in treatment, 30 alcoholics after being treated for a few weeks in a hospital, and 29 controls. All three groups were matched on age, education, residence, and occupational status. Results indicated that the alcoholics who had been treated and therefore were abstinent for a few weeks did better than the non-abstinent alcoholics but worse than the control group, suggesting a partial recovery of deficit after only a few weeks of abstinence. Page and Linden (1974) tested alcoholics every two weeks for an eight week period on the Benton Visual Retention Scale, the Bender-Gestalt, the Trail Making Test, the WAIS, and the Shipley Institute of Living Scale. Alcoholics' performance improved significantly during the first week of abstinence but showed no further improvement after up to two months of abstinence. After two months of abstinence performance was well below standardized norms for these tests, again suggesting only a partial recovery after a very short period of abstinence but no greater improvement with increased abstinence. Sharp, Rosenbaum, Goldman, and Whitman (1977) found that alcoholics had difficulty learning new vocabulary words immediately following cessation of drinking. This ability, however, recovered to normal levels after two weeks of abstinence. Other evidence supporting improvement of neuropsychological functioning following a short period of abstinence

was provided by Farmer (1973) who found improvement in the Bender-Gestalt and Memory-For-Designs Test after three months of abstinence. Also, Bean and Karasievich (1975) reported improved intellectual and perceptual-motor functioning. Most improvement occurred after 30 days of abstinence but some improvement occurred after 60 days. Irish alcoholics scored lower than controls on the similarities, block design, and object assembly subtests of the WAIS (Clarke and Haughton, 1975). After ten weeks of abstinence alcoholics were still significantly below the controls on these four measures of perceptual-motor coordination and abstract reasoning ability, but had at the same time shown significant improvement. Again most improvement occurred after the first few weeks of abstinence.

The studies mentioned above investigated relatively short periods of abstinence of only a few weeks. Longer periods of abstinence, however, may further improve the alcoholic's cognitive functioning. White (1965) compared 25 Alcoholics Anonymous (AA) members who had been abstinent for one to three months with AA members who had abstained for three or more years on the 16 Personality Factor Inventory and an object sorting task. Significant differences were found on 9 of the 16 personality variables. Also the three year group could make abstract-volitional shifts to a significantly greater degree ($p < .001$) than the short-term abstainers. However, this study failed to match the groups on IQ or educational level.

McLachlan (1974) reported a significant improvement on the block design subtest of the WAIS in alcoholics who had been recovered for one year when compared to unrecovered alcoholics. Also Long and

McLachlan (1974) administered the Halstead Battery to alcoholics and controls at the time of rehabilitation and one year later. Groups were matched on age, educational level, occupational status, and verbal IQ. At the initial testing alcoholics were significantly impaired compared to the control group, but one year later the abstinent alcoholics showed significant improvement in all impaired areas except the Trail Making Test.

In a study of cortical atrophy in eight alcoholics Carlen et al. (1978) found evidence of reversible cerebral atrophy in alcoholics who had been abstinent for several months. This study used a computerized tomography scanner to determine extent of cerebral atrophy. Four of the eight alcoholics who were studied, abstained, improved functionally, and showed a partial reversal of cerebral atrophy. Two non-abstinent patients and two abstinent patients who had already improved functionally before the first scan showed no change in atrophy.

The research reviewed here strongly suggests that recovery of cognitive functions are only partial when the alcoholic stops drinking. However, Templer, Ruff, and Simpson (1975) reported that alcoholics after one to two years of abstinence scored the same as control subjects on the Trail Making Test. Their study, however, has been criticized on the grounds that the control subjects were not typical subjects and in fact performed poorly on the Trail Making Test themselves. It is also hard to draw such conclusions using only one neuropsychological measure.

O'Leary, Radford, Chaney, and Schau (1977) also used the Trail Making Test to compare alcoholics with control subjects at the time of

rehabilitation and one year later. They found that alcoholics showed more deficits after one year of "abstinence" than controls but improved significantly more than the controls during the same period. Not all alcoholics were totally abstinent during the one year period. When abstinent alcoholics were compared to non-abstinent alcoholics (only eight non-abstainers) no relationship was found regarding the degree of improvement. However, with such a small sample size it is difficult to draw conclusions concerning the recovery of neuropsychological deficits as related to abstinence versus drinking.

From the evidence presented it appears that deficits in performance on such neuropsychological measures as the Halstead Battery, certain subtests of the WAIS as well as other tests are only partially reversed following a period of abstinence. Furthermore, this reversal occurs to a significant degree after only one to four weeks of abstinence. At the same time, it has not been established that further or complete recovery takes place at all after this initial period of abstinence. Studies indicating improvement after one or more years may have obtained the same amount of improvement had the measures been taken after only one month. Whether or not complete recovery of these various functions is ever possible in the chronic alcoholic is not yet clear. Neither is it known whether or not an alcoholic who learns to regulate consumption of alcohol in a socially acceptable manner will continue to demonstrate neuropsychological deficits.

Summary

Cortical atrophy has been shown to occur in a rather large proportion of alcoholics investigated. This evidence is based primarily upon pneumoencephalographic research, computerized axial tomography studies, and post mortem investigations. Some degree of neuropsychological impairment is associated with cortical atrophy. Affected functions seem to be abstract reasoning, problem solving, and complex perceptual-motor abilities. Intelligence as measured by various intelligence tests appears to be fairly normal in the alcoholic population. Current evidence suggests the frontal areas of the brain as the location of greatest organicity.

There is also evidence suggesting a link between drinking history and severity of neuropsychological deficits. For the most part these studies have investigated length of drinking history, but other variables such as type of drinker and amount consumed could be relevant. Generally speaking, if the period of heavy drinking is longer, the neuropsychological deficits will be greater. Of the few studies showing no relationship between drinking history and neuropsychological deficits some had certain methodological problems.

After periods of abstinence as short as one to four weeks various neuropsychological deficits have appeared to recover. Total recovery has not been reported in the literature even after several months of abstinence. In fact it is not certain whether any further improvement occurs after the first few weeks of abstinence.

Specific Statement of the Problem

From the literature reviewed above it is clear that a surprisingly large proportion of alcoholics are experiencing brain damage as evidenced both by cerebral atrophy and by various neuropsychological deficits. A natural question following from the literature reviewed above involves the point at which an individual starts experiencing significant neuropsychological deficits. For example, would non-alcoholic, problem drinkers show any signs of neuropsychological impairment? Such questions are particularly relevant when considering information contained in the Third Special Report to the U.S. Congress on Alcohol and Health.[6] The report makes a distinction between the alcoholic, the problem drinker, and the potential problem drinker. The alcoholic is characterized by a compulsion to consume alcohol on a continuous or periodic basis in order to experience its psychological and physical effects and often to avoid the discomfort of its absence. Also, the report defines a problem drinker as a person who drinks alcohol in such a manner as to manifest an alcohol-related disability or problem. The problem or problems may be familial, legal, vocational, physical, financial, and so on. Naturally alcoholics would necessarily be problem drinkers since alcohol-related problems would be manifested, but all problem drinkers are not alcoholics. The report to Congress estimates that there are 9.3 to 10 million problem drinkers (including alcoholics) in the adult population. Included in

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[6]Ibid., pp. 1-14.

the 10 million problem drinkers are both those who are alcoholics and those who are otherwise disabled as a result of alcohol. In addition to the 10 percent of the adult drinking population who are problem drinkers there are an estimated 26 percent of all drinkers who are classified as potential problem drinkers. Potential problem drinkers are defined as individuals who experienced two or three of sixteen problem drinking symptoms frequently or four to seven symptoms occasionally. A problem drinker experiences four or more of sixteen problem drinking symptoms frequently or eight or more symptoms occasionally. The point to be emphasized here is that there are an estimated 33 million adults (36 percent of the adult drinking population) who use alcohol to such an extent as to be considered either a potential problem drinker (26 percent) or a problem drinker (10 percent). Of the 33 million adults experiencing alcohol-related problems by far the majority may be considered to be problem or potential problem drinkers rather than chronic alcoholics.

In view of this fact, it is surprising to find virtually no research which has investigated the neuropsychological state of the problem drinker other than the alcoholic. The research reviewed above has investigated patients for the most part who were being treated for alcoholism in residential inpatient programs often at a V.A. Hospital.

Knowledge pertaining to the neuropsychological state of the non-alcoholic problem drinker is important for a number of reasons. First of all, there is such a large number of individuals who fall into this category. Non-alcoholic problem drinkers are often younger

than your typical chronic alcoholic and consequently it might be argued that at least some of today's problem drinkers will be tomorrow's alcoholics. Efforts at prevention concentrating on this group could be aided by a knowledge of the neuropsychological deficits occurring in this population. If indeed non-alcoholic problem drinkers have the same difficulties as alcoholics in abstraction abilities and conceptual shifting, then learning to reduce consumption of alcohol or to remain abstinent may prove difficult and the result may be the occurrence of alcoholism in later life. Without a thorough knowledge of how alcohol affects the non-alcoholic problem drinker's neuropsychological state efforts at prevention and treatment will seem incomplete. Finally and perhaps most obviously, the experiencing of neuropsychological deficits associated with brain damage is not a desirable state for anyone to find themselves in. Neuropsychological deficits interfere with the leading of successful, happy, and fulfilled lives. As evidenced in the literature reviewed above, some restoration of impaired functions is possible with abstinence from alcohol. Individuals experiencing neuropsychological deficits should be aware first of all of the existence of the deficits, and secondly that steps can be taken to at least partially reverse the impaired performance.

The purpose of this study was to first of all establish the presence or absence of neuropsychological impairment in the non-alcoholic problem drinker (defined in more detail below). The second purpose of the study was to define what abilities, if any, are impaired. In other words, do the impaired abilities found in the problem drinker population correspond to the impairment reported in the chronic alcoholic

literature or is it of an altogether different nature? The third purpose of this project was to look at the recovery of the impaired abilities that may or may not occur during the treatment of the problem drinker. Finally, the relationship of drinking history and severity of neuropsychological deficits was investigated.

Hypotheses

I. Problem drinkers will exhibit signs of neuropsychological impairment as measured by the Halstead Neuropsychological Test Battery.

II. Neuropsychological deficits on the Halstead Battery will be the same ones already shown to occur in the chronic alcoholic population.

III. Problem drinkers will show significant improvement on the Halstead measures upon which they initially performed poorly when retested after a period of reduced alcohol consumption or total abstinence.

IV. Problem drinkers who abstain from alcohol will show a greater pre-post improvement on the Halstead neuropsychological measures than the problem drinkers who continue to drink, but in a reduced manner.

V. Drinking history variables, such as those dealing with the amount of alcohol consumed in the past, will be positively correlated with the Halstead Impairment Index in the problem drinker.

CHAPTER II

METHOD

Subjects

Participants in this study were outpatients at the Dede Wallace Mental Health Center's Alcohol Treatment Program located in Nashville, Tennessee. The Alcohol Treatment Program involved individual counseling designed to establish and help implement an individualized treatment plan based on the specific needs and goals of each patient.

The typical patient seeking treatment at Dede Wallace might be more accurately classified as a problem drinker rather than as a chronic alcoholic. Demographic and drinking history information on past clients bears this out. The clients at Dede Wallace Center, although experiencing genuine alcohol-related problems, seemed able to get by in day to day life. For example, data on past clientele (Sobell, Maisto, Sobell, Cooper, Cooper, and Sanders, 1979) indicate that only about 21 percent are unemployed. Of those employed, an average of only 4.85 days of work were missed because of alcohol-related reasons in the year prior to treatment, despite an average consumption of more than three ounces of absolute alcohol on approximately 170 out of the previous 365 days. The typical patient had avoided previous treatment for alcoholism in any type of residential alcohol treatment facility for the 12 months prior to entering treatment.

Past patients' diagnoses at entry fell into the three DSM-II categories indicated in Table 3. The typical patient at Dede Wallace was

TABLE 3

DIAGNOSES OF PAST CLIENTELE AT DEDE WALLACE CENTER'S ALCOHOL TREATMENT PROGRAMS

Diagnosis	Percent of Subjects
Alcoholism, episodic excessive drinking	25%
Alcoholism, habitual excessive drinking	52%
Alcoholism, alcohol addiction	23%

also younger (38 years) and had a shorter history of problem drinking (7.6 years) than what was usually reported for the chronic alcoholic population. Table 4 shows some basic demographic information for the group of 57 subjects used in this research project. These subjects tended to be even younger than past clientele and have had a problem with alcohol for a fewer number of years. More detailed demographic and drinking history information appears in the results section.

All participants in the study were volunteers having had the opportunity to read, understand, and sign a detailed informed consent form (see Appendix A). A group of 28 participants were obtained upon initial intake into treatment at Dede Wallace Center over a period of approximately 2 months. The other group consisted of 29 outpatients who had been receiving treatment for anywhere from 4 months up to a year and a half. This group followed the same selection procedure and were chosen during the initial two month period. All potential

TABLE 4

BASIC DEMOGRAPHIC INFORMATION ON THE PROBLEM DRINKERS USED IN THE PRESENT STUDY

Variables	Percentage or Mean	Range
Sex		
Male	86%	
Female	14%	
Race		
White	95%	
Black	5%	
Age	33.3 years	17-67
Number of Years Problem Drinking	5.9 years	0-28
Education	11th grade	7-18

participants who signed the informed consent form were selected only if they had no previous history of brain damage due to any one of a number of possible causes.

The initial longitudinal group of 28 participants received a cash incentive of $10.00 to participate in this study, whereas the other 29 subjects received only a $6.00 incentive since less time was required of them. All participants that expressed an interest were given an interpretation of test results at no charge to them. Elsewhere testing of this sort could cost the participant a substantial sum.

Procedure

Fifty-seven participants were selected for the present study as outlined above. Twenty-eight of the subjects were selected at the time of initial intake into the treatment program. This group, known as the longitudinal group, was given the Halstead Neuropsychological Test Battery within approximately two weeks of initial intake into the program. The lag time varied somewhat due to failure to meet scheduled appointments or due to a delay in scheduling appointments in the first place. Approximately two to three months following the initial testing the longitudinal group was retested with the Halstead Battery. A total of 20 from the original 28 participants in the longitudinal group were retested. Every reasonable effort was made to reschedule all 28 participants, however, some had either moved away, were in legal difficulty, or refused to come back to be retested. Also at the time of retesting a drinking history followback questionnaire was given to each of the 20 subjects in order to establish a basis to assess reduction in the consumption of alcohol since initial testing. Demographic information pertaining to the drinking history, drug usage, medical, educational, and vocational histories as well as social and family histories of each client is routinely obtained from all individuals upon admission to the alcohol program. The information was used to (a) confirm a reduction in drinking from pre-treatment to post-treatment in all 55 participants, (b) to define in a rather detailed manner the population under study, and (c) to look for correlates between drinking history variables and neuropsychological impairment. The cross-sectional comparison group composed of 29 problem drinkers who

had been in treatment for four months or longer also filled out the drinking history followback questionnaire and took the Halstead Neuropsychological Test Battery. Unlike the longitudinal group these participants were only tested once. The testing took place at least four months following admission to the program and during the first two months of the study. The blood alcohol concentration (BAC) was tested by a Sober-Meter for all participants just prior to administration of the Halstead Battery. Any participants who exhibited a BAC other than .00 percent at this time were either rescheduled or not tested with the exception of two individuals who showed extremely low BACs. One subject had a .00 percent blood alcohol level at the end of testing, while the other had a .022 percent level following test administration.

Measures

The rather detailed demographic and drinking history questionnaires routinely used by the alcohol program at Dede Wallace Center (see Appendix B) were used in this study. The questionnaires provided quite a detailed description of the population under study and served to establish necessary information regarding important drinking history variables.

In order to establish a reduction of drinking from the time the subject entered treatment and was first tested until the retesting some two to three months later, a followback calendar was employed as well as a short questionnaire (see Appendix C). At each administration the subject was asked to reconstruct as accurately as possible the amount and type of alcoholic beverage consumed on each day of the preceding month. Using anchor dates, memorable occasions such as

parties, holidays, hospitalizations, and so on the subject had little difficulty reconstructing an approximation of the amount consumed over the previous month. Research using this method (Sobell, Sobell, and VanderSpek, in press) indicated that these self-reports are quite reliable as long as the individual is sober at the time the information is obtained. Alcohol consumed was converted into standard drinks for the month prior to testing and was calculated for all participants. One standard drink is equal to one 12 ounce beer, four ounces of wine (non-fortified), or one ounce of hard liquor (80-100 proof).

In addition to the followback calendar, a short questionnaire concerning the amount of alcohol consumed, the number of days upon which alcohol was consumed, and the amount of money spent on alcohol, was given once to all subjects at the time of testing. This same information had also been gathered at the time of entry into the program some months prior to the only testing for the cross-sectional group and at the second testing for the longitudinal group.

The Halstead Neuropsychological Test Battery was used to investigate neuropsychological functioning in the problem drinker. The Halstead Battery has been shown by Reitan (1955a) to be very sensitive to brain damage. Halstead's Impairment Index is a composite score based upon seven discriminating tests. It is computed simply as the proportion of all subtests on which the subject scores above the criterion mark for brain damage. Thus, if a subject scores in the brain damaged range on four of the seven subtests the Impairment Index would be 4/7 = .57. An Impairment Index of 0.50 or greater is a sensitive predictor of brain damage. The seven subtests include the

Category Test, the Tactual Performance Test (three parts), the Seashore Rhythm Test, the Speech-sounds Perception Test, and the Finger Oscillation Test.

The Category Test uses a projection device for presenting the stimulus material. The subject is presented principles based upon such variables as size, shape, color, number, position, and brightness. The subject must then respond indicating that he grasps the concept being presented. The task requires the ability to group the stimulus material according to the proposed criteria, to recognize similarities in successive stimulus exposures in spite of many differences, and to recognize the importance of stimulus details relevant to the overall pattern that is being developed. This subtest is considered to be largely a test of abstraction ability.

The Tactual Performance Test (TPT) is a modification of the Seguin-Goddard form board. The subject is blindfolded and does not see the form board or blocks at any time. The subject places the blocks in their proper spaces with the preferred hand, then the non-preferred hand, and finally with both hands. Total time for this task is one part of the TPT. When the blocks and board have been put out of sight the blindfold is removed and the subject draws the form board with each shape in its proper location. The number of blocks correctly reproduced and correctly put in their place are parts two and three of this subtest. This test requires coordination of tactile and kinesthetic cues with motor performance but is also believed to require abstraction ability.

The Seashore Rhythm Test requires the subject to differentiate between pairs of rhythmic beats some of which are the same and some of

which are different. The Speech-sounds Perception Test consists of 60 spoken speech sounds which are nonsense syllables. The subject listens to the pronunciations on a tape and then chooses the sound that is heard from a possible of four printed on the test form. Both of these tests measure auditory perception--the one, nonverbal perception and the other, verbal perception. Brain-damaged subjects have been shown to score significantly below matched controls on both of these tests.

The seventh test is the Finger Oscillation Test. This task is purely a measure of motor skill as it requires the subject to tap a key as rapidly as possible with the index finger of the preferred hand. On the Finger Oscillation Test, as well as all of the above mentioned tests of the Halstead Battery, brain-damaged subjects perform significantly poorer than matched control subjects.

The Trail Making Test Part A and B is another test sensitive to the effects of brain damage. The test is not used in computing the Impairment Index but is often included with the Halstead Battery. The Trail Making Test Part A requires the subject to rapidly connect numbers in correct order from 1 to 25. Part B requires an alternation between numbers and letters putting them in correct order, for example, 1-A-2-B-3-C, etc. The total time required for each of these parts is the score recorded. Skills measured by this task include alertness, concentration, symbolic recognition and information-integrating ability. Poor performance on this test may suggest the presence of frontal brain lesions (Reitan, 1955b).

CHAPTER III

RESULTS

The organization of this chapter corresponds to the five hypotheses previously stated in the Introduction. The presentation of these results, however, is preceded by a rather detailed description of the problem drinkers who were investigated in this research project.

Demographic and Drinking History Information

A comprehensive description of the subjects used in this study is presented here in order to examine the uniqueness of this population when compared to the chronic alcoholic populations usually used in neuropsychological research. The next five tables show the means and percentages for a number of drinking history and demographic variables broken down for both the cross-sectional and longitudinal groups.

Table 5 gives some general demographic information for the 57 problem drinkers used in this study. Generally speaking these problem drinkers were white males with an average educational level of eleventh grade. The average age of this group was only 33.3 years. This is compared to an average age of 43.9 years for alcoholics used in six other studies (see below in this chapter) using the Halstead Neuropsychological Test Battery. Furthermore, the problem drinkers used in this study have had a problem drinking for an average of only 5.9 years. Fifty-six percent of these individuals were sent to Dede Wallace Center by the courts. After an extensive intake interview, the majority

TABLE 5

GENERAL DEMOGRAPHIC INFORMATION FOR THE CROSS-SECTIONAL AND LONGITUDINAL GROUPS OF PROBLEM DRINKERS

Variables	Cross-Sectional N = 29	Longitudinal N = 28	Total N = 57
Sex			
Male	83%	89%	86%
Female	17%	11%	14%
Race			
White	97%	93%	95%
Black	3%	7%	5%
Referral			
Coercion	69%	43%	56%
Voluntary	10%	39%	25%
Elements of both	21%	18%	19%
Diagnosis			
Alcoholism, episodic excessive drinking	10%	11%	11%
Alcoholism, habitual excessive drinking	72%	79%	75%
Alcoholism, alcohol addiction	17%	7%	12%
Unavailable	0%	4%	2%

	Mean	Range	Mean	Range	Mean	Range
Average age	36.2	20-67	30.3	17-62	33.3	17-67
Average years problem drinking	7.3	0-28	4.5	0.1-17	5.9	0-28
Average educational level	11.4	7-18	10.9	7-16	11.2	7-18

of these individuals (75 percent) received the diagnosis of alcoholism, habitual excessive drinking.

Table 6 gives various marital and legal information on both groups of problem drinkers. Almost a third of all problem drinkers tested had never been married whereas another third had been married and divorced. Only 16 percent were married at the time this information was gathered. As many as 30 percent of these individuals had been married 2 or more times.

With about 75 percent of these problem drinkers having an element of coercion involved in their referral to treatment, it is not surprising to find that 42 percent were arrested at least once for public drunkenness, while 89 percent were arrested at least once for drunken driving. Almost half of the problem drinkers were arrested for a non-alcohol-related reason.

The occupational levels and employment status of the problem drinkers are shown in Table 7. Twenty-six percent of the subjects fell into the Hollingshead category of "machine operators and semi-skilled." The "skilled manual employees" category and the "unskilled" category each accounted for 23 percent of the problem drinkers' occupations. The majority of these problem drinkers were employed. As many as 77 percent were employed either on a full-time or part-time basis. Thirty percent of these individuals reported drinking on the job at one time or another, yet only an average of 4.3 workdays in a year were missed due to alcohol-related factors. As a group these problem drinkers were employed an average of 9.4 months out of the previous year and have been employed an average of 2.6 times.

TABLE 6

MARITAL AND LEGAL INFORMATION ON THE CROSS-SECTIONAL AND LONGITUDINAL GROUPS OF PROBLEM DRINKERS

Variables	Cross-Sectional N = 29	Longitudinal N = 28	Total N = 57
Marital status			
Single	28%	32%	30%
Married	10%	21%	16%
Separated	17%	14%	16%
Divorced	38%	29%	33%
Widowed	7%	4%	5%
Number marriages			
None	28%	32%	30%
One	31%	43%	37%
Two	38%	18%	28%
Three	0%	4%	2%
Unavailable	3%	4%	4%
Arrests--public drunkenness			
None	59%	57%	58%
One	31%	21%	26%
More than one	10%	22%	16%
Arrests--drunken driving			
None	3%	18%	11%
One	10%	21%	16%
Two	35%	25%	30%
Three	28%	36%	32%
Four	10%	0%	5%
More than four	14%	0%	7%
Arrests--disturbing the peace			
None	93%	96%	95%
One	7%	0%	4%
Two	0%	4%	2%
Arrests--other			
None	86%	75%	81%
One	3%	18%	11%
Two	7%	4%	5%
Three or more	3%	4%	4%

TABLE 6 (Continued)

Variables	Cross-Sectional N = 29	Longitudinal N = 28	Total N = 57
Arrests--non-alcohol-related			
None	48%	61%	54%
One	28%	14%	21%
Two	17%	18%	18%
More than two	3%	4%	4%
Unavailable	3%	4%	4%

TABLE 7

EMPLOYMENT INFORMATION ON THE CROSS-SECTIONAL AND LONGITUDINAL GROUPS OF PROBLEM DRINKERS

Variable	Cross-Sectional N = 29	Longitudinal N = 28	Total N = 57
Occupational level			
Business managers--medium size businesses, lesser professionals	3%	0%	2%
Administrative personnel--small businesses, minor professionals	3%	4%	4%
Clerical and sales--Technicians--little businesses	21%	14%	18%
Skilled manual employees	28%	18%	23%
Machine operators and semi-skilled	14%	39%	26%
Unskilled	24%	21%	23%
Retired, disabled, student, or unemployed	7%	4%	5%
Employment status			
Full-time	73%	71%	72%
Part-time	10%	0%	5%
Unemployed	10%	25%	18%
Student, disabled, or retired	7%	4%	5%
Drinks on the job			
Yes	24%	36%	30%
No	72%	61%	67%
Unavailable	3%	4%	4%

	Mean	Range	Mean	Range	Mean	Range
Average times fired (alcohol-related)	0.4	0-5	1.1	0-20	0.8	0-20
Average missed workdays past year (alcohol-related)	2.6	0-20	5.8	0-90	4.3	0-90
Average longest time on one job (years)	7.1	1-25	5.1	0-29	6.1	0-29
Average total number of jobs	2.6	0-27	2.6	0-35	2.6	0-35
Average months employed past year	9.7	0-12	9.3	0-12	9.4	0-12

A rather detailed description of the past drinking history of these 57 problem drinkers is shown in Table 8. This group consumed alcoholic beverages on an average of about 5 days a week and on these occasions drank an average of 11.5 standard drinks (1 standard drink is the equivalent of 1-12-ounce beer, 1 ounce of hard liquor, or 4 ounces of wine). On an average of 110 days out of the 365 days before entering treatment, these drinkers consumed more than 8 ounces of hard liquor or the equivalent in beer or wine. The problem drinkers spent an average of $23.39 a week on alcohol and consumed an average of 91.7 standard drinks during the month prior to initial testing. Eighteen percent of these individuals felt that their only alcohol-related problem was a legal one and that alcohol did not cause problems in other areas of their lives. However, the majority of 63 percent admitted that alcohol caused problems for them in various aspects of their lives such as physical, familial, and vocational. For the most part (47 percent), these problem drinkers were weekend drinkers, meaning that they consumed the majority of their alcohol on the weekend. Approximately 30 percent of this group drank alone and at home, whereas the majority drank in social settings with friends. Over half of these problem drinkers reported having a relative with an alcohol problem. As many as 40 percent of this group had received no treatment for alcohol-related problems prior to entering treatment at Dede Wallace Center.

Health and drug-related data are reported in Table 9 for the 57 problem drinkers. Twenty-five percent of this group reported no past physical problems caused by alcohol, while 26 percent reported experiencing blackouts only, with 44 percent reporting a combination

TABLE 8

DRINKING HISTORY INFORMATION ON THE CROSS-SECTIONAL AND LONGITUDINAL GROUPS OF PROBLEM DRINKERS

Variables	Cross-Sectional N = 29 Mean	Cross-Sectional N = 29 Range	Longitudinal N = 28 Mean	Longitudinal N = 28 Range	Total N = 57 Mean	Total N = 57 Range
Mean high number of standard drinks consumed in 24-hour period	31.8	12-77	30.9	10-64	31.3	10-77
Mean high number of consecutive days abstinent--past year	46.4	1-210	49.4	2-349	47.9	1-349
Mean high number of consecutive days abstinent--past 3 years	106.5	2-365	143.8	3-999	125.2	2-999
Average number of days drinking/week	5.3	1-7	5.1	1-7	5.2	1-7
Average amount consumed each day of drinking (in standard drinks)	10.3	2-32	12.6	2-40	11.5	2-40
Average number of days consumption greater than 1/2 pint hard liquor or equivalent past year	98.7	2-330	122.5	1-300	110.2	1-330
Average money spent per week on alcohol	$21.11	3-60	$25.67	6-75	$23.39	3-75
Average alcohol consumed month prior to testing (standard drinks)	83.5	0-412	100.1	0-418	91.7	0-418
Problem areas caused by alcohol	Percentage		Percentage		Percentage	
Legal only	17%		18%		18%	
Physical only	0%		4%		2%	
Familial only	3%		7%		5%	
Vocational only	3%		0%		2%	
Combination of above	66%		61%		63%	
Other/unavailable	10%		11%		11%	

TABLE 8 (Continued)

Variables	Cross-Sectional N = 29 Mean	Range	Longitudinal N = 28 Mean	Range	Total N = 57 Mean	Range
	Percentage		Percentage		Percentage	
Drinking pattern past month						
Abstinent	41%		7%		25%	
Weekend	38%		57%		47%	
Random	10%		14%		12%	
Binge	3%		4%		4%	
Continuous	7%		18%		12%	
Drinking location						
Home	28%		32%		30%	
Bar	10%		29%		19%	
Car	7%		4%		5%	
Friend's home	7%		0%		4%	
Combination	41%		36%		39%	
Other/unavailable	7%		0%		4%	
Drinking partners						
Alone	31%		29%		30%	
With friends	45%		54%		49%	
Combination	24%		18%		21%	
Relative with alcohol problem						
Yes	41%		64%		53%	
No	59%		36%		47%	
Other treatment for alcohol problems						
Yes	72%		46%		60%	
No	28%		54%		40%	

TABLE 9

HEALTH AND DRUG-RELATED INFORMATION ON THE CROSS-SECTIONAL AND LONGITUDINAL GROUPS OF PROBLEM DRINKERS

Variables	Cross-Sectional N = 29 Percentage	Longitudinal N = 28 Percentage	Total N = 57 Percentage
Past physical alcohol-related symptoms			
None	24%	25%	25%
Shakes only	7%	4%	5%
Blackouts only	35%	18%	26%
Combination of symptoms (or other)	35%	54%	44%
Past liver problems			
Yes	10%	7%	9%
No	90%	86%	88%
Unavailable	0%	7%	4%
Hospitalizations--Alcohol-related			
None	66%	82%	74%
One	21%	11%	16%
Two	7%	7%	7%
Unavailable	7%	0%	4%
Hospitalizations--Mental			
None	83%	89%	86%
One	14%	11%	12%
Two	3%	0%	2%
Past treatment for drug abuse			
Yes	10%	11%	11%
No	79%	86%	83%
Unavailable	10%	4%	7%
Drug use--previous six months			
None	24%	32%	28%
Mood-altering drugs	52%	50%	51%
Non-mood-altering drugs	24%	18%	21%

	Mean	Range	Mean	Range	Mean	Range
Average number of cigarette packs per day	1.1	0-3	1.6	0-4	1.3	0-4
Average number of cups coffee per day	3.3	0-9	2.7	0-14	3.0	0-14

of physical symptoms related to alcohol consumption. Only 9 percent of the 57 problem drinkers reported past liver problems. Information concerning the use of drugs during the six months prior to testing and up to testing was collected. Results indicated that approximately one-half of the participants used some form of a mood-altering drug at some time during the previous six months but not necessarily at the time of test administration. At the time of testing, subjects were asked if they were currently (the day of testing as well as a few days before) taking any kind of prescribed or non-prescribed medication. It was estimated that on 55 percent of all test administrations no drugs were taken, and on 19 percent of the test administrations non-mood-altering drugs were consumed. On 26 percent of the testings individuals had taken a mood-altering drug sometime during the week prior to and/or up to the test day. For a classification of mood-altering and non-mood-altering drugs see Appendix D (Table 19). The problem drinkers smoked an average of 1.3 packs of cigarettes each day and at the same time consumed an average of three cups of coffee per day. Only 11 percent reported past treatment for drug abuse.

It is apparent from looking at Tables 5 through 9 that certain differences exist between the cross-sectional and longitudinal groups. This would be expected since due to time considerations and the necessity of obtaining subjects as they entered into the treatment program, no attempt was made at matching the two groups. The longitudinal group is somewhat younger and has had a problem with drinking for a shorter length of time than the cross-sectional group. Some of

the differences, however, are probably due to the fact that one group had been in treatment for several months while the other was just entering into treatment.

The Extent of Neuropsychological Impairment

Results indicate no significant differences between the cross-sectional and the longitudinal groups on any of the subtests of the Halstead Neuropsychological Battery including the Impairment Index. However, for both groups (N = 57) a rather substantial number of participants showed signs of neuropsychological impairment. Table 10 shows the performance of the 57 problem drinkers on the Halstead Battery. A total of approximately 51 percent of all subjects tested demonstrated an Impairment Index in the same range above 0.50 where patients with known brain damage score. According to Reitan (1955a) the Halstead Impairment Index is probably the most sensitive neuropsychological indicator of brain damage currently available. The group means for the Category Test, Tactual Performance Test for Time, Localization, and Speech-sounds Perception Test are all well into the brain-damaged range. Brain-damaged cut-off scores (e.g., Table 2, p. 13, $\geq$ 50) are based upon Halstead's work (1947) which established criterion scores as being the best distinguishing factor between those with known brain damage and normal control subjects. A detailed breakdown of the problem drinkers' performance on the Halstead measures and Trail Making Test appears in Appendix E (Table 20).

Table 11 compares the 57 problem drinkers with a normative control group of 191. This normative group was compiled from a total

TABLE 10

PERFORMANCE OF 57 PROBLEM DRINKERS ON THE HALSTEAD NEUROPSYCHOLOGICAL TESTS

Neuropsychological Measure	Mean	Standard Deviation	Range	Brain-damaged Range	Percent Impaired
Category	53.04	23.08	15-113	>50	56.1
Tactual Performance Test-Time	17.52	7.07	6.8-45.0	≥15.7	57.9
Tactual Performance Test-Memory	7.14	1.33	4-10	< 6	14.0
Tactual Performance Test-Localization	3.81	2.10	0-8	< 5	66.7
Speech	11.14	5.07	4-24	> 7	73.7
Rhythm	25.56	3.52	15-30	<26	38.6
Finger Oscillation	51.89	5.53	39.4-66.2	<51	33.3
Impairment Index	0.46	0.26	0.00-0.86	≥ 0.50	50.9
Trail Making A	26.88	7.95	13-50	>40	3.5
Trail Making B	76.35	28.89	39-146	>92	24.6

TABLE 11

SIGNIFICANT DIFFERENCES ON HALSTEAD NEUROPSYCHOLOGICAL MEASURES BETWEEN PROBLEM DRINKERS AND A COMPARISON GROUP OF 191

Neuropsychological Measure	Non-alcoholic Comparison Group Mean (N=191)	Problem Drinker Group Mean	Standard Deviation	N	t	Alpha two-tailed
Category	45.92	53.04	23.08	57	2.33	.05
Tactual Performance Test-Time	15.73	17.52	7.07	57	1.91	.10
Tactual Performance Test-Memory	7.16	7.14	1.33	57	- .1136	N.S.
Tactual Performance Test-Localization	4.12	3.81	2.10	57	-1.125	N.S.
Speech	8.83	11.14	5.07	56	3.417	.002
Rhythm	23.97	25.56	3.52	57	3.412	.002*
Tapping	46.85	51.89	5.53	57	6.87	.002*
Impairment Index	0.38	0.46	0.26	57	2.340	.05

*Problem drinkers performed better than the comparison group.

of five validation studies (Klove, 1974), each of which used a group of non-brain-damaged control subjects. Available ages and educational levels of these subjects are comparable to those of the problem drinkers.

Table 11 shows that the problem drinkers performed significantly worse than the control subjects on the Category Test, the Tactual Performance Test for Time, the Speech-sounds Perception Test, and the Halstead Impairment Index. Significant two-tailed differences also showed up on the Seashore Rhythm Test and the Finger Oscillation Test, however, here the problem drinkers performed better than the comparison group. A possible explanation for such a finding is that the mean scores for the comparison group on these two tests was in the brain-damaged range. The reason for the control group's poor performance on the two tests was most likely due to the fact that some of the comparison subjects used were hospitalized neurological patients who had no evidence of brain damage, but did have other neurological problems. Such a selection of control subjects tends to make the comparison between the two groups rather conservative and underscores the significant differences between the two groups on the Category Test, TPT-Time, Speech-sounds Perception Test, and the Impairment Index. Normative data for the Trail Making Test Parts A and B were not available, but compared to the criterion scores the group as a whole scored well within the normal range as indicated on Table 10.

The Nature of Neuropsychological Impairment

The second hypothesis deals with the nature of the neuropsychological deficits encountered in the group of problem drinkers. It was hypothesized that the neuropsychological deficits found to occur in problem drinkers would be of a similar nature to those already found to occur in the chronic alcoholic population. In order to examine this notion in more detail, a summary table of six research projects investigating neuropsychological deficits in alcoholics was prepared and appears as Table 12. In each of these studies alcoholics were administered the Halstead Neuropsychological Test Battery and were compared with either a non-alcoholic control group or some other non-alcoholic normative group. Table 12 shows the tests upon which deficits were observed for each of the six studies. These are tests of the Halstead Battery for which performance was significantly poorer in the group of alcoholics than in the comparison group of non-alcoholics.

In order to get an idea of which tests showed up in past research as exhibiting a significantly poorer performance among alcoholics than among non-alcoholics, the Halstead tests were ranked according to the number of times a particular alcoholic group's test performance was significantly poorer than a non-alcoholic comparison group's for that particular test. These rankings appear in Table 13. The Halstead test which showed alcoholics to perform significantly poorer than a non-alcoholic comparison group in the greatest proportion of studies appears first followed by the next highest proportion and so on until the last test appears for which significant differences were not found between the alcoholic and comparison groups in any of the six studies.

TABLE 12

SUMMARY OF SIX STUDIES ADMINISTERING THE HALSTEAD NEUROPSYCHOLOGICAL TEST BATTERY TO ALCOHOLIC PATIENTS

Group	Observed Test Deficits	N	Mean Age	Mean Education	Mean Drinking Duration	Hospitalized	Control Group
Fitzhugh et al.(1960)	Category, TPT-Time, Imp. Index	17	44.4	10.8	N.A.	Yes	Non-alcoholic
Fitzhugh et al.(1965)	Category, Speech TPT-Time, Localization Imp. Index, Trails A & B	35	40.6	11.0	19.8	Yes	Non-alcoholic
Goldstein and Shelly (1971)	Category, TPT-Time Localization, Speech Rhythm, Trails A & B	50	45.3	11.7	20.0	Yes	Used local normative group
Smith et al. (1973)	Category, TPT-Time Speech, Imp. Index	26	45.3	13.8	N.A.	Yes Private Hospital	Used other control group
Schau and O'Leary (1977)	Category, TPT-Time Trails B	38	49.6	12.7	N.A.	Yes	Non-alcoholic
Blusewicz et al. (1977)	Category, TPT-Time Memory, Localization Trails B, Imp. Index	20	33.0	12.2	13.3	Inpatient and Outpatient	Non-alcoholic
Present Study Bainum (1979)	Category, TPT-Time Speech, Imp. Index	57	33.3	11.2	5.9	Outpatient Only	Used normative group

TABLE 13

THE RANK ORDERING OF THE HALSTEAD NEUROPSYCHOLOGICAL MEASURES BASED UPON THE CONSISTENCY OF POOR PERFORMANCE BY ALCOHOLICS WHEN COMPARED TO NON-ALCOHOLIC CONTROL SUBJECTS

Neuropsychological Measure	Poor Performance in:
1. Category	6 of 6 studies
2. Tactual Performance Test-Time	6 of 6 studies
3. Impairment Index	4 of 4 studies
4. Speech Perception	3 of 4 studies
5. Trail Making Part B	4 of 6 studies
6. Tactual Performance Test-Localization	3 of 6 studies
7. Trail Making Part A	2 of 6 studies
8. Seashore Rhythm Test	1 of 5 studies
9. Tactual Performance Test-Memory	0 of 6 studies
10. Finger Oscillation Test	0 of 6 studies

In other words, the Halstead tests that alcoholics have been shown to perform poorly on, most consistently in the literature, appear first in order of decreasing consistency.

Recall from Table 11 (p. 52) that in the present study the four Halstead measures which problem drinkers performed significantly worse on than the normative group were the Category Test, the Tactual Performance Test for Time, the Impairment Index, and the Speech-sounds Perception Test. These four neuropsychological measures are the same four measures that have been most consistently shown in the literature to detect deficits in alcoholics when compared to non-alcoholics.

The above evidence supports the notion that these problem drinkers perform poorly on the same Halstead measures that alcoholics have been shown to perform poorly on when compared to non-alcoholic comparison groups, despite being much younger (33.3 compared with an average age of 43.9 for the alcoholics in the six studies cited). It is also important to notice that almost all of the alcoholics used in the six studies were hospitalized for the treatment of alcoholism, usually in a V.A. hospital, whereas the individuals in the present investigation were all outpatients, 40 percent of which had never before received any type of treatment for alcohol-related problems. Duration of drinking and the drinking problem were not always reported, but based upon available information, the problem drinkers in the present study appeared to have had a problem drinking for fewer number of years than those in the other studies.

The Halstead Impairment Index and the Category Test are considered by Reitan (1955a) to be the two most sensitive measures

of brain damage available today. The Category Test deficits shown by problem drinkers in this study indicate difficulty with abstract reasoning and the ability to shift from one concept to another. The poor performance on the Tactual Performance Test for Time suggests a deficit in the problem drinker's ability to coordinate tactile and kinesthetic cues. Poor performance on this test also indicates below normal motor ability as well as problems with abstraction ability. The poor performance on the Speech-sounds Perception Test indicates difficulty with verbal perception.

The Recovery of Neuropsychological Impairment

Two to three months following the initial administration of the Halstead Battery the 20 participants in the longitudinal group were retested using the same testing procedure. At this time information concerning their drinking behavior since entering treatment was also gathered.

The problem drinkers showed significant improvement on several of the Halstead measures. Table 14 shows significant two-tailed pre-post differences obtained using the Wilcoxon Matched-Pairs Signed Ranks test. Significant improvement occurred on the Category Test, the Tactual Performance Test for Time, the Tactual Performance Test-Localization, the Speech-sounds Perception Test, and the Impairment Index. It is interesting to note that not all tests showed improvement even though there was some room for improvement. For example, the TPT-Memory showed no improvement while the TPT-Localization showed significant improvement. This is particularly interesting since both

TABLE 14

THE COMPARISON OF 20 PROBLEM DRINKERS BEFORE AND AFTER TREATMENT ON 10 NEUROPSYCHOLOGICAL MEASURES

Neuropsychological Measure	Pre-test Mean	Pre-test Standard Deviation	Post-test Mean	Post-test Standard Deviation	Brain-damaged Range	Direction of change	Wilcoxon Significance Test (two-tailed)
Category	51.05	22.19	36.55	20.27	>50	+	.001
Tactual Performance Test-Time	16.75	4.89	13.71	4.54	≥15.7	+	.002
Tactual Performance Test-Memory	7.30	1.38	7.40	1.50	< 6	+	.859
Tactual Performance Test-Localization	3.90	2.02	5.35	2.08	< 5	+	.019
Speech	11.10	4.94	8.68	3.58	> 7	+	.031
Rhythm	25.25	4.12	25.60	3.82	<26	+	.796
Tapping	50.13	4.60	50.39	6.50	<51	+	.936
Trails A	26.05	9.45	25.60	6.25	>40	+	.709
Trails B	72.75	26.19	74.35	24.15	>92	-	.809
Impairment Index	0.468	0.268	0.363	0.246	≥ 0.50	+	.004

of these tests are so closely related to one another. A total of five out of the ten neuropsychological measures used in this study showed significant improvement. The post-test means for the Speech-sounds Perception Test, the Seashore Rhythm Test, and the Finger Oscillation (Tapping) Test all fell just into the brain-damaged range for those tests, however, all other post-test means were in the normal range.

Corresponding with this improvement was a significant reduction in alcohol consumption. In order to compare pre-post drinking practices, four different variables were employed. These are: (a) the number of standard drinks consumed during the month prior to each testing, (b) the average number of days per week when any alcoholic beverage was consumed, (c) the average number of standard drinks usually consumed on each of those days when alcohol was consumed, and (d) the average amount of money spent per week on alcohol. This information was collected for both the time period before entering treatment and then again for the period of time spent in treatment up to the second test administration. Table 15 compares these pre-post treatment differences in the four drinking reduction variables. A highly significant reduction was found using a t test on all four reduction variables for both the cross-sectional and the longitudinal groups, the exception being the variable standard drinks for the cross-sectional group, since the number of pre-treatment standard drinks was not available for this group. It is also evident from Table 15 that significant differences occurred between the post-treatment drinking of the cross-sectional group and that of the longitudinal group. After each group had been in treatment for a

TABLE 15

INDICATORS OF DRINKING REDUCTION FROM PRE-TREATMENT TO POST-TREATMENT
IN BOTH GROUPS OF PROBLEM DRINKERS

Drinking Reduction Variable	Cross-sectional (N=29)		Longitudinal (N=20)		Significance*		
	I. Pre-treatment	II. Post-treatment	III. Pre-treatment	IV. Post-treatment	I and II	III and IV	II and IV
Standard Drinks Consumed Past Month	N.A.	83.52	104.60	35.35	N.A.	.014	.048
Days Per Week of Alcohol Consumption	5.31	3.48	5.25	1.95	.002	.002	.030
Standard Drinks Consumed on Consumption Days	10.29	6.48	14.30	4.70	.016	.002	.230
Money Spent Per Week on Alcohol	21.11	13.69	26.68	4.79	.022	.002	.012

*Two-tailed t test

period of some months the cross-sectional group drank an average of 84 standard drinks for the month prior to testing, while the longitudinal group drank an average of only 36 standard drinks for the comparable period of time. The longitudinal group also drank on fewer number of days per week and spent less money on alcohol when compared with the cross-sectional group at the post-treatment testing. The greater amount of alcohol consumed by the cross-sectional group could partially explain why there were no differences between the two groups on the neuropsychological measures when the cross-sectional group was compared with the pre-test of the longitudinal group.

The Effect of Abstinence Versus Reduced Consumption on the Recovery of Neuropsychological Functioning

Initially an analysis of variance was used to look at improvement on the Halstead Impairment Index using age and amount of drinking during treatment as factors. This analysis did not support the notion that problem drinkers who chose to abstain performed better on the neuropsychological measures than the problem drinkers who reduced their alcohol consumption but continued to drink. However, it should be noted that the sample size was extremely small resulting in a substantial loss of statistical power.

In order to investigate this question further, some partial correlations were performed between the four drinking reduction variables and the amount of improvement on the neuropsychological measures from pre-treatment to post-treatment. Age was controlled for since age is known to be correlated with performance on these

neuropsychological measures as well as with amount of alcohol consumed. These correlations for the most part were not significant, again suggesting a lack of evidence for greater or less improvement among those who drank more alcohol but still in a greatly reduced manner.

Improvement on the Trail Making Test Part A was positively correlated with the number of standard drinks for the previous month and improvement on the TPT-Localization test was positively correlated with the number of days per week when alcohol was consumed. However, improvement in both tapping and the Trail Making Test Part B showed a significant negative correlation with the amount consumed on a given day of the week since entering treatment. Improvement on the Seashore Rhythm test was also negatively correlated with the amount of money spent on alcohol per week since entering treatment.

At this point it should be noted that change scores, which in the present situation represent the amount of improvement on the neuropsychological measures, have been shown by Cronbach and Furby (1970) to pose a threat to the validity of such a design. The problems with change scores will be dealt with in more detail in the next chapter.

Although there does not seem to be any evidence indicating that abstainers improved on the neuropsychological measures more than the problem drinkers who continued drinking, it should be pointed out that almost all of the 20 participants reduced their alcohol consumption substantially. Only 3 out of the 20 problem drinkers consumed more than 60 standard drinks the month before final testing. Information about these three add no further support to an improvement-amount

consumed relationship. One out of these three problem drinkers had an Impairment Index indicative of brain damage at both test administrations. The other two had pre- and post-Impairment Indexes in the normal range. One of these three showed no change in the Impairment Index after reducing alcohol consumption from 300 standard drinks to 110 standard drinks, however, this subject's Impairment Index was well into the normal range. Another of these three subjects reduced alcohol consumption from 267 standard drinks to 216 standard drinks and showed a corresponding change in Impairment Index from .71 to .57. However, both of these Impairment Indexes are in the brain-damaged range. The third subject who consumed more than 60 standard drinks during the month prior to the second testing actually increased alcohol consumption from 26 standard drinks to 89 standard drinks. This could be in part due to the fact that this individual was not tested until some time had passed from initial intake into the program. The pre- and post-Impairment Indexes for this individual were in the non-brain-damaged range each time. These three cases who were drinking somewhat more than the others during treatment tended to improve slightly but remained either in the normal or the brain-damaged range on the Impairment Index from the pre-testing to the post-testing. The mean consumption of the longitudinal group (N = 20) was only 36 standard drinks for the month prior to final testing compared to 105 standard drinks for the month prior to the initial testing. Some problem drinkers were abstinent during treatment while others drank in a reduced manner. It may be difficult to find differences in the extent of improvement on the neuropsychological measures when both

groups greatly reduced consumption and were not extremely different on the amount of alcohol they each were consuming.

A Model for Predicting Neuropsychological Impairment

In order to investigate the relationship between drinking history, vocational, demographic, health, and neuropsychological variables, a complete correlational matrix is presented below as Table 16. The correlational matrix serves as an adjunct to the regression procedure which was used to further investigate the relationship of the numerous demographic, vocational, drug and drinking history variables with neuropsychological impairment. The multiple regression analysis was used to predict the Halstead Impairment Index from a total of 26 variables. The analysis was performed on the 57 problem drinkers, however missing data reduced the N to 38. Using a forward, backward, and stepwise procedure the same variables tended to surface. The best five-variable regression model found to predict the Halstead Impairment Index in problem drinkers is shown in Table 17. To obtain the best five-variable model a regression technique known as maximum $\underline{R}^2$ improvement (Barr, Goodnight, Sall, Blair, and Chilko, 1979) was used. This method begins by finding the best one-variable model producing the highest $\underline{R}^2$ then adds the variable that yields the greatest increase in $\underline{R}^2$. Once this two-variable model is formed, each of the variables in the model is compared to each of the variables not in the model. For each comparison this procedure determines if removing one variable and replacing it with the other variable would increase $\underline{R}^2$. After comparing all possible switches the one which produces the largest

TABLE 16

A PEARSON PRODUCT-MOMENT CORRELATION MATRIX FOR 36 DEMOGRAPHIC, DRINKING HISTORY, AND NEUROPSYCHOLOGICAL VARIABLES*

Category	TPT Time	Memory	Localization	Speech	Rhythm	Tapping	Trail Making A	Trail Making B	Impairment Index	Standard Drinks	Days Drunk	Alcohol Consumed	Abstinent-3 Years	Abstinent-1 Year	Age	Problem Length	Education	Hospital-Alcohol	Hospital-Mental	Arrests-Drunkenness	Arrests-Drunk Driving	Arrests-Non-Alcohol Related	Average/Week	Amount Consumed	Times 1/2 Pint	Money Spent	Number of Jobs	Months Employed	Years One Job	Number of Times Fired	Missed Work Days	Number of Marriages	Length of Current Marriage	Cigarettes/Day	Coffee/Day	
	44	-58	-52	26	-45	-33	31	60	72	29	09	04	19	08	13	-03	-22	08	-11	08	-13	15	27	21	33	-06	-17	-34	-02	06	08	04	-13	18	18	Category
		-37	-43	10	-16	-29	40	38	49	-11	-05	21	13	-08	14	10	-06	19	22	03	-08	-03	-06	18	13	-10	-16	26	18	-08	-03	12	-23	03	TPT Time
			43	-06	12	23	-16	-46	-53	-41	04	-08	-08	02	-10	02	27	00	-01	-17	12	-21	-11	-27	-14	13	05	35	01	-28	-16	-07	18	-25	-02	Memory
				13	29	21	-46	-44	-65	02	-07	-01	-14	-10	-18	-15	-07	01	00	21	40	-13	00	20	-32	-05	-07	27	-13	-04	-12	05	01	-10	-12	Localization
					-36	-22	22	46	28	12	33	15	01	05	11	12	-21	18	-10	38	24	-08	16	12	-21	-04	-07	-16	-07	-11	-02	-10	-17	-08	00	Speech
						41	-18	-45	-62	01	-18	14	-29	-32	-27	-10	13	-04	-09	13	31	09	-03	17	17	27	15	22	-14	28	19	-11	-01	-09	-23	Rhythm
							-27	-34	-58	02	03	-05	-02	07	-15	-10	26	-13	17	-06	08	-08	-09	00	03	23	10	38	-09	05	-03	02	04	-11	01	Tapping
								67	49	-22	-14	17	32	29	49	34	-11	35	02	15	04	-16	12	19	-05	06	-25	-05	26	15	-03	-09	-02	-07	19	Trail Making A
									68	-04	04	04	35	34	45	39	-37	43	-15	20	-18	-11	11	20	-12	-06	-28	-33	-05	10	-05	13	-09	11	27	Trail Making B
										00	12	08	22	11	44	32	-22	21	-07	06	-20	09	14	19	13	-14	-19	-42	22	04	05	16	06	01	20	Impairment Index
											17	34	-09	-11	-35	-33	-09	-24	-10	-08	-18	51	37	36	26	15	01	-09	-18	10	53	-02	-16	48	-23	Standard Drinks
												02	-10	-07	-20	-01	00	-14	-12	04	-20	13	21	02	12	43	-02	-29	-12	01	21	-18	-10	04	04	Days Drunk
													14	06	-17	-01	-19	02	14	-02	-01	34	36	43	27	26	05	11	-06	03	43	14	16	12	06	Alcohol Consumed
														80	33	18	-19	46	18	-11	-17	21	03	04	-19	-04	-27	-29	-13	23	12	32	05	20	34	Abstinent-3 Years
															31	15	-04	24	12	-10	-26	10	13	01	-14	03	-23	-20	-13	-04	11	26	-08	03	21	Abstinent-1 Year
																58	-07	39	-08	33	08	-19	-13	00	-37	-24	37	-21	56	00	-14	34	11	-11	35	Age
																	-20	62	-13	07	-09	-18	04	-05	-20	-07	-13	-38	10	15	-13	29	22	-18	11	Problem Length
																		-32	05	-13	-11	-07	-21	17	04	-02	-03	18	07	-29	01	-44	-05	-34	-07	Education
																			-12	16	-06	-17	07	-02	-13	07	-17	-19	-15	27	-08	20	18	06	10	Hospital-Alcohol
																				-03	04	19	-36	-05	-19	-17	05	06	09	03	-04	21	00	05	-02	Hospital-Mental
																					48	00	-10	12	-18	-06	09	07	17	10	08	00	07	05	13	Arrests-Drunkenness
																						00	-23	-12	-27	-20	06	23	18	16	-14	-06	-07	-08	-01	Arrests-Drunk Driving
																							05	35	12	17	18	-13	-13	25	86	20	-08	52	-21	Arrests-Non-Alcohol Related
																								20	57	43	-08	01	-16	08	20	03	19	01	-07	Average/Week
																									27	18	-06	-02	-03	20	54	-10	04	09	-25	Amount Consumed
																										41	24	04	-14	01	22	02	01	-13	-30	Times 1/2 Pint
																											-04	17	-23	09	41	-18	-01	07	-11	Money Spent
																												19	-23	-09	13	-14	-12	12	-21	Number of Jobs
																													12	-03	02	-17	23	-04	06	Months Employed
																														-05	-08	05	04	-14	17	Years One Job
																															20	20	34	12	-17	Number of Times Fired
																																10	-12	45	-20	Missed Work Days
																																	23	01	02	Number of Marriages
																																		-13	09	Length of Current Marriage
																																			23	Cigarettes/Day
																																				Coffee/Day

*Note: Decimals have been omitted; N = 38 for all correlations; correlations greater than .26 are significant at the .05 level (one-tailed); correlations greater than .35 are significant at the .01 level (one-tailed).

TABLE 17

THE BEST FIVE VARIABLE MODEL FOUND USING MULTIPLE REGRESSION TO PREDICT THE HALSTEAD IMPAIRMENT INDEX (N=38)

Variable	Beta Value	Cumulative R^2	F	Probability F
Age	.009	.1917	7.06	.01
Months Employed	-.024	.3017	6.64	.01
Days Greater than 1/2 Pint	.001	.3944	4.64	.04
Cups Coffee Per Day	.019	.4200	2.01	.17
Average Amount Consumed on a Drinking Day	.005	.4396	1.12	.30

increase in $\underline{R}^2$ is made, resulting in the best two-variable model the technique could find. This process then repeats itself by adding another variable to find the best three-variable model and so on. Age was thesingle best predictor accounting for 19 percent of the variance. This supports earlier research (Reed and Reitan, 1963) which has demonstrated such a relationship between age and neuropsychological impairment. The best two-variable model found was age and the number of months the problem drinker was employed during the 12 months prior to entering treatment. The correlation is a negative one indicating that the longer the period of employment, the lower the Impairment Index. In addition to age and months employed, the best three-variable model included the number of days during the year prior to treatment upon which the problem drinker consumed more than a half pint of hard liquor or its equivalent in beer or wine. Here the correlation was a positive one suggesting a higher Impairment Index as the number of days that a half pint of hard liquor is consumed increases. These three variables alone account for almost 40 percent of the variance needed to predict the Impairment Index. The amount of coffee consumed per day that the problem drinker drank and the amount of alcohol consumed per day that the problem drinker drank are the next two most significant variables added to the equation. Although the amount of variance they account for is only about 4 percent, they both show a positive relationship with the Halstead Impairment Index. A greater amount of coffee consumed per day and a greater amount of alcohol consumed on a drinking day help predict a higher Impairment Index. Altogether, these five variables, age, months employed, days when

consumption was greater than a half pint of hard liquor, amount of coffee per day and the amount of alcohol consumed on a drinking day, account for nearly 44 percent of the variance.

In view of the above regression model it would be expected that the variables, months employed and the number of days when consumption was greater than a half pint of hard liquor, would be correlated with not only the Impairment Index but other neuropsychological indices as well. Table 18 shows the partial correlation coefficients for both the number of months employed and the number of days when consumption was greater than a half pint when correlated with four sensitive neuropsychological measures while age and education are being controlled. Significant correlations occurred between the number of days of high alcohol consumption and the Impairment Index, the Category Test, and the TPT-Localization. The correlation was negative for TPT-Localization since a lower score indicates a poorer performance on this test unlike the other three. Months employed was significantly correlated in a negative direction with the Impairment Index (0.076), the Category Test, and the Trail Making Test Part B.

Summary

Approximately 50 percent of the 57 problem drinkers tested had Halstead Impairment Indexes which fell in the brain-damaged range of 0.50-1.00. The cross-sectional group of 29 did not differ significantly from the longitudinal group (N = 20) on any of these measures. As a group the 57 participants performed significantly worse than a group of 191 non-problem-drinker control subjects on the Category Test,

TABLE 18

PARTIAL CORRELATIONS OF FOUR SENSITIVE NEUROPSYCHOLOGICAL INDICES WITH TWO PREDICTOR VARIABLES WHILE CONTROLLING FOR AGE AND EDUCATION*

Neuropsychological Measure	Months Employed	Times > 1/2 Pint
Impairment Index	-0.2015 p<.076	0.2700 p<.026
Category Test	-0.2315 p<.049	0.3362 p<.007
Tactual Performance Test-Localization	0.1004 p<.239	-0.3373 p<.007
Trail Making Part B	-0.3031 p<.014	0.0966 p<.248

*A one-tailed test of significance was applied to these correlations.

Tactual Performance Test-Time, Speech-sounds Perception Test, and the Halstead Impairment Index. These same four neuropsychological measures are the Halstead measures which most consistently have shown deficits among alcoholics when compared to non-alcoholics in past research.

The 20 participants in the longitudinal group who were available for retesting after two to three months of reduced alcohol consumption showed significant improvement on 5 out of the 10 neuropsychological measures obtained, including the Halstead Impairment Index. During the period of time in treatment both the longitudinal group and the cross-sectional group reduced their alcohol consumption significantly. Whether a problem drinker chose to abstain or to reduce alcohol consumption without abstaining did not appear to have an effect on the extent of improvement. Finally, certain demographic and drinking history variables were found to be significant predictors of the Halstead Impairment Index when using a regression model. These are age, the number of months employed during the past year, and the number of days during the past year when a half pint or more of hard liquor or its equivalent in beer and wine were consumed. The amount of coffee consumed as well as the amount of alcohol consumed per drinking day also accounted for a small amount of the variance.

CHAPTER IV

DISCUSSION

In view of the research reviewed in the introduction it does not seem surprising to find a substantial degree of neuropsychological impairment in a group of individuals known to abuse alcohol. However, it is somewhat surprising to find such a degree of neuropsychological impairment in this particular group of problem drinkers in view of the fact that they are younger, have had a problem drinking for an average of less than six years, and differ in other respects (as shown by their demographic information) from the older alcoholic that has usually been used in neuropsychological research. Heretofore little research has looked at the neuropsychological state of young problem drinkers. However, a few studies have suggested that perhaps younger abusers of alcohol might experience neuropsychological problems. Blusewicz, Dustman, Schenkenberg, and Beck (1977) found impairment in alcoholics whose average age was 33 but these alcoholics were different in certain respects. For example, they had been drinking an average of about 13 years and some were being hospitalized for the treatment of alcoholism.

Additionally, Epstein, Pisani, and Fawcett (1977) used computerized axial tomography to investigate cerebral atrophy in a group of alcoholics. Of those aged 39 or under, 7 of 14 showed mild to severe atrophy. This research team concluded that cerebral atrophy may be

more prevalent than previously suspected, especially among younger individuals. Tumarkin et al. (1955) also found psychometric and pneumoencephalographic evidence of neuropsychological and cerebral deficits in a group of 7 military men whose average age was 32.

The fact that approximately 50 percent of the problem drinkers in the present study exhibited definite signs of neuropsychological impairment suggests that such deficits do not occur exclusively in older chronic alcoholics.

The research reviewed in the introduction clearly demonstrates the occurrence of neuropsychological deficits in the chronic alcoholic population. This present study suggests that these same neuropsychological deficits can occur in younger problem drinkers who are not considered to be alcoholics. The question arises as to whether or not this is an artificial distinction between problem drinkers and alcoholics. After all, are not they both really the same thing whether you call them problem drinkers or alcoholics? The Third Special Report to Congress on Alcohol and Health[7] did not imply so, nor did the World Health Organization's report on Alcohol Related Disabilities (Edwards, Gross, Keller, Moser, and Room, 1977). Both of these reports made a clear distinction between problem drinkers and alcoholics. The WHO report suggested that problem drinking is not necessarily even a first step toward alcoholism since if all problem drinkers became alcoholics we would have by some estimates about nine times as many alcoholics as we presently have. Most problem drinkers do not fit Jellinek's classical description of alcoholism which proposed a coherent entity

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[7] Ibid., pp. 1-14.

marked by phases and symptoms which occurred in a rather regular and progressive order. Alcoholics supposedly exhibit "prodromal signs" at younger ages with the process climaxing sometime after age 30. The WHO report stated that drinking problems in the general population are more common at ages 21-24 than in middle age. Nevertheless, there are individuals who appear to follow the progression outlined by Jellinek, however, of all individuals experiencing alcohol problems these individuals are in the minority. Both of these reports indicate that there are many more problem drinkers than chronic alcoholics. Since the majority of individuals with alcohol-related disabilities are problem drinkers and not alcoholics, it is somewhat surprising that so much of the research has ignored problem drinkers and focused for the most part on the hospitalized chronic alcoholic. Such a lopsided difference in the types of populations investigated seems to be particularly applicable to the past neuropsychological research.

Cultural and geographic factors tend to raise the question of the validity of comparing sample data to normative data. However, it should be noted that the mean ages and educational levels for the normative group and the sample of problem drinkers were comparable. Additionally it was felt that such a comparison was a conservative one due to the fact that many of the control subjects used in the normative group were hospitalized neurological patients who did not have any evidence of brain damage. Their performance resulted in mean scores for some of the Halstead tests that were below the cutoff scores indicating poor performance. If the sample of problem drinkers can perform significantly worse than this "normative" group, then there must be real differences that exist.

The results have indicated that the neuropsychological test deficits found in problem drinkers are very similar to those already found to occur in chronic alcoholics. Deficits found in this study on the Category Test, Tactual Performance Test-Time, Impairment Index, and Speech-sounds Perception Test are the same four test deficits reported most consistently in the literature concerning older hospitalized alcoholics. The precise mechanism by which such deficits are brought about is not yet known. Whether the cause of these neuropsychological deficits be due to the direct toxic effects of ethyl alcohol, nutritional deficiencies, head injuries, or a combination of factors, the fact remains that these same deficits do appear in younger, non-hospitalized problem drinkers who have in the past consumed substantial amounts of alcohol. At what point in a problem drinker's (or a drinker's) history of alcohol consumption do these neuropsychological deficits first appear? Although this is an intriguing question, it is no doubt more complex than it may first appear. Most likely these deficits occur for a number of alcohol-related reasons. Future research could look at even younger populations of problem drinkers as well as non-problem social drinkers from young and old age groups.

Whenever a pre-post design is carried out the question of practice effect arises. The identical Halstead Battery was administered at intake or close to intake into treatment and again in two to three months. First of all, to remember details necessary for improved performance for such a period of time is certainly not out of the question. Perhaps an argument against the occurrence of practice

effect lies in the fact that five out of the ten measures taken and repeated did not improve even though there was room for improvement. For example, the Tactual Performance Test for Localization improved significantly even though performance on Memory Test did not improve. Such a difference in improvement is particularly striking when considering the dependency of these two scores upon each other. The subject is asked to draw a picture of the board he or she was working with, putting the blocks in the proper location, and remembering as many as possible. The localization score represented by the number of blocks placed in the proper location in relation to the other blocks improved significantly, whereas the total number of blocks remembered represented by the number of blocks correctly drawn did not improve even though both scores had room for improvement. However, the memory score was not as deviant as the localization score for the group of 20 problem drinkers, and consequently regression toward the mean should not be ruled out.

Information on the test-retest reliability of the Halstead Battery is sparse. Buros (1949) reports a test-retest reliability of about .72 for the Seashore Rhythm Test, but reliability coefficients for the other subtests of the Halstead Battery were not reported. Reitan (1979) feels that the question of test-retest reliability in the Halstead Battery is perhaps not relevant since so much of the battery involves an actual learning experience and is really a standardized experiment in the study of brain-behavior relationships rather than a psychometric tool. According to Reitan (1979) the interlude between test administrations of the Halstead Battery should

be about six months in order to minimize practice effects. He also stated that the more complex tasks such as the Category Test and the Tactual Performance Test were more susceptible to practice effects than the simpler tasks. Since the present investigation retested problem drinkers after two to three months, it is possible that some practice effect occurred, however, in this case it seems likely that other factors such as reduced alcohol consumption would have accounted for a certain amount of the pre-post improvement.

Whenever a test-retest design is used a problem with the reliability of the change measured exists. Cronbach and Furby (1970) point out the threats to validity of such a design. A certain amount of unknown error is inherent in any measurement. When a second measurement is taken some time later, a certain amount of unknown error also exists. The direction of this error is not known. A true score may be underestimated initially and overestimated upon retesting resulting in an unreliable change score. Unfortunately as the inter-correlation of the pre- and post-measures improves the reliability of the change scores decreases. To improve the reliability of the change scores the two measures must not be correlated highly, which means that they would be measuring two different things. The problem with change scores should be considered when interpreting the pre-post results.

Any investigation into brain-behavior relationships should acknowledge the problem posed by the ingestion of mood-altering drugs. It is difficult for obvious reasons to ask subjects who are taking mood-altering drugs to refrain from doing so. Also, it would be

highly impractical to exclude from a study those individuals who were taking a mood-altering substance since such a practice is so pervasive in today's society. On approximately 25 percent of the test administrations in this study the problem drinker being tested had taken a mood-altering drug sometime during the previous few days and/or on the day of testing. Generally speaking, a mood-altering substance would seem to result in poor performance on the neuropsychological measures, however, in some situations the ingestion of a mood-altering substance could conceivably enhance the individual's performance.

It is interesting to note the rather drastic reduction in drinking which occurred in a period of only two to three months' time in both the cross-sectional and longitudinal groups. However, for some unknown reason the cross-sectional group consumed a significantly greater amount of alcohol for the month prior to their single testing than the longitudinal group consumed for the comparable month prior to their retesting. Such a difference in amount of alcohol consumed could be a partial explanation for the finding that the cross-sectional group was as impaired as the longitudinal group at the initial testing. The group which had been in treatment for four months or longer would be expected to show less impairment than the group of problem drinkers just entering treatment, but this was not the case. Besides the fact that they consumed about two and a half times as much alcohol for the month prior to testing, the cross-sectional group was also slightly older, which could explain why there was no difference in performance.

Although improvement on the Tapping Test and the Trail Making Test Part B was negatively correlated with the amount of alcohol

consumed on a given day since entering treatment, and improvement on the Seashore Rhythm Test was negatively correlated with the amount of money spent on alcohol per week, the data do not for the most part support the notion that abstainers improved significantly more than the non-abstainers. It should be pointed out that those who continued drinking, reduced their alcohol consumption considerably and in many cases were not drinking much more than the abstainers. It may be that these two groups are simply not that much different on the amount of alcohol they are consuming relative to the significant reduction both abstainers and nonabstainers had already made. However, this study looked at improvement at one point in time after just two to three months of reduced drinking. It would be interesting to look at the improvement in abstainers and nonabstainers after a longer period of time to see if differences in improvement would be more pronounced. Future research investigating this question should have a larger sample size so that relevant factors such as age can be controlled for without sacrificing significant amounts of statistical power.

In light of the regression analysis as well as various correlations that were performed there is evidence that certain drinking history and demographic factors are correlated with and do predict neuropsychological impairment in the problem drinker. Age already has been shown to influence performance on the Halstead Battery (Reed and Reitan, 1963). However, the remaining four variables in the regression equation have not been previously reported as affecting the Halstead Impairment Index. One of these variables is the number of months employed in the year prior to treatment (months employed)

and the number of days during the past year on which at least a half pint of hard liquor or its equivalent in beer or wine was consumed (half pint). Although it is logical that the longer an individual has held a job the less likely he or sne is to have a high Impairment Index, it is difficult to understand the exact nature of this relationship. It seems much more likely that the Impairment Index would predict months employed rather than the other way around. The possibility of third variables should also be considered when interpreting such correlations. In this instance a negative partial correlation coefficient between months employed and the Impairment Index was significant at the .076 level (one-tailed) when age and education were controlled for, ruling out age and education as third variables, however, other variables could conceivably be affecting the correlation. In interpreting the correlations presented in this paper one should not necessarily assume a causal relationship. The questions of directionality and third variables should be considered. Another variable, half pint, an indicator of how much alcohol the individual had consumed, accounted for a significant amount of the variance in the model used to predict the Halstead Impairment Index. Although the measure half pint does not represent the number of years of heavy drinking, it is indicative of the amount of past alcohol consumption and is therefore somewhat supportive of past research (Tarter, 1971; Jones, 1971) which reported differences between long-term alcoholics and short-term alcoholics on various neuropsychological and intelligence measures.

The 57 problem drinkers used in this study represent a fairly homogeneous group of individuals in that they are of a similar socioeconomic status and all have had alcohol-related problems. The rather restricted range of the sample of problem drinkers may pose a problem in interpreting various statistics such as the correlation coefficients. The correlations reported in this research should be viewed with this caution in mind. It is possible that higher correlations would have resulted had the sample been of a more heterogeneous nature.

Neuropsychological impairment among such problem drinkers as were used in the present study may hold important implications for the rehabilitation of these individuals. For example, Berglund et al. (1977) report that alcoholics who improved their drinking habits were overall less psychometrically impaired at a pre-treatment examination than those whose drinking habits had not improved. It is logical that neuropsychologically impaired problem drinkers could have greater difficulty being rehabilitated than others with no impairment. However, it should not be concluded that neuropsychologically impaired problem drinkers cannot be helped, but rather that therapy or treatment of any kind could probably benefit from an awareness of the individual's neuropsychological state. If a problem drinker has difficulty with new ideas, abstract reasoning, or shifting from one concept to another perhaps a more concrete approach would be more helpful. An awareness that one's brain is not functioning at its potential and that a reduction in drinking can serve to reverse this state (at least partially) would be a piece of information that

could be of use to the problem drinker and additionally serve as an incentive during rehabilitation. An educational approach which makes the problem drinker aware of the deficits that result from excessive alcohol consumption and which explains the behavioral changes which come about could prove most useful. Problem drinkers should be educated to understand that they do not have to be considered a chronic alcoholic in order to experience detrimental changes in their neuropsychological state, and that such changes can seriously affect the manner in which they relate to their work situation, family, and friends. In more severe cases of impairment (which did not seem to be frequent in the group of problem drinkers) additional steps for rehabilitation could be employed including referral to a specialist.

Future research in this area would do well to focus on the younger problem drinker, particularly in light of the fact that there are more of them than there are chronic alcoholics. Studies investigating in more detail the relationship between amount, type, and duration of alcohol consumption with neuropsychological and neuroradiological information would prove most useful. Investigations of other populations not considered to be alcoholics or problem drinkers such as young and old social drinkers may also prove interesting. A more detailed description of what conditions bring about neuropsychological impairment in any individual who consumes alcohol will contribute significantly to a better understanding of this pervasive problem.

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APPENDICES

APPENDIX A

INFORMED CONSENT FORM

The following information is provided to inform you about this project and your participation in it. Please read this form carefully. Any questions that you may have about the procedures in this study will be answered. Please feel free to ask any questions you may have about this study and/or the information given below.

1. CONFIDENTIALITY

Any information we gather will be kept confidential, will not affect your treatment in any way, and you will not be identified by name. Confidentiality will be kept at all times in accord with the DHEW federal confidentiality guidelines for clients in alcohol and drug treatment programs. All information will be coded by number rather than by name. This information will be seen only by the people directly involved in the conduct of this study. A master code sheet will be kept under lock and key until the study is completed at which time this code sheet will be destroyed. Any information used in our scientific reports will be based on groups of people so that a particular individual cannot be identified.

2. PURPOSE

The purpose of this study is to investigate the neuropsychological state of those individuals who have a drinking problem and to investigate the extent to which any neuropsychological impairment that may have occurred is reversed following a given period of time spent in treatment.

3. METHODS

The information required for this project will be gathered by two different methods. First of all information concerning the effect alcohol has had on various aspects of your life such as work, family, health and so on will be obtained at the initial pre-treatment interview. This is information which is gathered from all clients with alcohol problems that seek treatment at Dede Wallace Center. In order to assess each individuals neuropsychological functioning the Halstead-Reitan Neuropsychological Test Battery will be administered to all individuals deciding to participate in this project. This test takes approximately two hours to administer and will give us information regarding the functioning of your brain. The test consists of various tasks, some of which require the use of your hands to manipulate various objects and others which require the use of paper and pencil. Some of you will be asked to take this test battery upon entering treatment and again three months later while some of you will only be asked to take it once approximately 5 to 8 months after entering treatment. At the time of testing information concerning your drinking behavior since entering treatment will also be obtained. This is so we can establish a reduction in your drinking since you entered treatment. You will also be asked to take a breath-test just before taking the

Halstead-Reitan Battery. This is to assure that there is no alcohol in your bloodstream since this could affect your performance on the test.

4. POSSIBLE DISCOMFORTS AND RISKS

The main risk involved in this study involves the fact that knowledge pertaining to your neuropsychological state and other facts about your life will be made known to the researcher. We will, however, take all possible precautions to protect your privacy and confidentiality as outlined above. You are free to withdraw from participation in this project without prejudice to you at any time.

5. BENEFITS TO SCIENCE AND TO YOURSELF

For participating in this study you will receive upon request a brief summary of your performance on these tests. In the event that negative results do occur it will be recommended to you that this information be passed on to a specialist whom you should then consult. In the event of negative findings your test results would also be given to your therapist here at Dede Wallace Center. All participants will receive a compensation for their time of either $6.00 or $10.00 depending on the amount of time spent on this project. A clinical psychologist may charge about $200.00 to $300.00 for administering and interpreting the complete Halstead-Reitan Battery. You will be given eight of these tests and will receive a brief summary of your results free of charge if you request one. Information gathered in this study will serve to shed light on the neuropsychological state of the problem drinker and will help us understand the extent that impaired functions are recovered following a given period of treatment. This information in turn may have significant implications for treating the problem drinker.

NOTE: YOU ARE FREE TO WITHDRAW THIS CONSENT AND TO DISCONTINUE PARTICIPATION IN THIS PROJECT AT ANY TIME.

STATEMENT BY PERSON AGREEING TO PARTICIPATE IN THIS PROJECT:

☐ (a) I have read this Consent Form. All my questions have been answered, and I freely and voluntarily choose to participate. I understand that I may withdraw at any time. I agree to participate as a volunteer in this program.

☐ (b) The material contained in this Consent Form has been explained to me orally. All my questions have been answered and I freely and voluntarily choose to participate. I agree to participate as a volunteer in this program.

_____ _____
Date Signature of Volunteer

_____ _____
Date Signature of Witness

Bruce Bainum
Project Director

Department of Psychology
University of Tennessee
Knoxville, TN 37916
Telephone: 974-2531

APPENDIX B

DEDE WALLACE CENTER

dede wallace center

CLIENT ADMISSION/INFORMATION FORM

1. Date: ___/___/___
mo. day year

2. Name: _____ 3. Date of Birth: _____

4. Sex: _____ 5. Race: _____ 6. Social Security No.: _____

7. Address: _____
Street City State Zip County

8. Person disclosing information and relationship: _____

9. Home Phone: _____ Work Phone: _____
Work Phone (Wife, Mo., Guard) _____ Work Phone (Husband, Fa., Guard) _____

10. Referred by:
Person_____ Relationship to Client_____
Agency _____ Agency Phone No: _____ Agency Worker_____

11. Previous Mental Health Care:
1._____ 2. _____
Name or Place DATES Name or Place DATES
3._____ 3. _____
Name or Place DATES Name or Place DATES

12. Have you or any member of your family ever been a client of Dede Wallace Before:
Yes_____ No _____
If yes, complete the following:

Name Date Relationship

13.

	NAME	BIRTHDATE	OCCUPATION	LIVING WITH CLIENT
Spouse:	Last First Middle			Yes or No
Mother:	Last First Middle			Yes or No
Father:	Last First Middle			Yes or No

List names of Children (living & dead). If client is a child, list brothers and sisters.

	NAME	AGE	SCHOOL GRADE OR OCCUPATION	LIVING WITH CLIENT	FORMER CLIENT?
1.				Yes or No	Yes or No
2.				Yes or No	Yes or No
3.				Yes or No	Yes or No
4.				Yes or No	Yes or No

14. Highest Grade Completed:_____ 15. Name of School (if currently enrolled)_____

16. Your average grades (circle one) Good Average Poor

17. Usual Occupation _____ 18. Present Employer & Address:_____
_____ 19. Number of dependents: _____

Continue on Back

20. Working hours _____ 21. Other sources of income: _____

22. Amount of monthly income _____ 23. What is the longest period of time you have held a job? _____ 24. How many jobs have you had in the last 5 years? _____

25. If unemployed, how long have you been without a job? _____

26. Name of Insurance Comapny _____

Medicaid Number _____ Medicare Number _____

---

27. Military Branch _____ Date Entered _____ Discharged _____

28. Rank When Discharged _____ Type of Discharge _____

29. Do you have a service connected disability? Yes _____ No _____

30. With whom are you now living (list people) _____

---

31. Do you live in a house, hotel, room, apartment, boarding house or other (please circle one)

32. Marital Status: (circle one) never married widowed married remarried separated divorced

a. If currently married, please answer the following:
   1. How long have you been married? _____ 2. Your husband/wife's age _____
   3. How many times have you been married? _____
b. If currently divorced, separated, widowed, please answer the following:
   1. How long have you been separated, divorced or widowed? _____
   2. How many times have you been married? _____

33. Were you brought up by your natural parents? Yes ____ No ____

34. Have you ever been arrested or convicted of a crime? Yes _____ No _____

35. Do you have any current charges? Yes ____ No ____

36. Please list other agencies you are currently involved with:

1. _____ 3. _____
2. _____ 4. _____

---

37. What is the problem or problems for which you are seeking help?

_____

_____

38. Why did you seek help at this time? _____

_____

39. Client accompanied on admission by: _____
Name Address

Phone No.: _____ Relationship to Client: _____

40. I HEREBY APPLY FOR THE SERVICES OF DEDE WALLACE CENTER FOR MYSELF AS A CLIENT OR FOR THE ABOVE NAMED CLIENT WHOM I AM LEGALLY AUTHORIZED TO REPRESENT AND TO ACT IN HIS BEHALF.

_____ _____
Signature of Client Date

_____ _____
Signature of Authorized Person Date

---

41. Intake Interview: Date: _____ Time: _____ Therapist: _____
Appointment Kept? _____ Follow-Up Contact: _____
Rescheduled: _____

42. Referral made: When and Where: _____
Reason for Referral _____

43. Client informed about DWC fee policy & told to bring in medication and papers on guardianship: Yes ____

44. Branch _____ Code _____ Modality _____ Code _____
Readmission: Yes ____ No ____ Admitting Diagnosis _____
Code: Census Tract _____ Payor Code _____ Fee Multipler _____
or Pint Fee _____
Check by: _____
Professional or Worker Office Manager Administrative Coordinator

ALCOHOL PROGRAMS - DEDE WALLACE CENTER

INITIAL INTAKE INTERVIEW AND HISTORY

Date of Intake:_____
Completed by:_____(#)_____
Breath Test (BAC):_____% Time_____am/pm
Blood Pressure:_____/_____ Time_____am/pm

We should like to have the following life history data systematically obtained and recorded at the first interview:

1. Patient's Name_____
(Last) (First) (Middle or Maiden)

2. What are the circumstances surrounding the client's referral to this program?

_____

_____

3. Would you say your referral to this program was
_____Voluntarily _____Elements of both
_____Through Coercion (courts, lawyer) _____Other_____

DRINKING HISTORY INFORMATION

1. When was the last time you had anything to drink (date, amount and length of this drinking episode)?_____

2. How many years has drinking been a problem for you (Note: if client indicates no problem, write such and why)?_____

_____

3. In the last three years what is the longest number of days in a row that you have been drunk (Note: let client define drunk and note what he/she means by that)?

_____

_____

What is the greatest amount of alcohol you have ever consumed in one day -- one 24 period?_____

4. In the last three years what is the longest period of time (months) that you have gone without drinking any alcohol -- totally abstinent (not including time spent in jail, hospital, or halfway house)?_____

5. In the last twelve months (365 days) what is the longest period of time that you have gone without drinking any alcohol (not in jail, hospital or halfway house?)_____

6. As a result of your drinking, have you ever had occasion to use any of the following treatment supports or programs (check each column)?

Program Type	No	Yes	When/Where
Alcoholics Anonymous (AA)	____	____	_____
Antabuse	____	____	_____
Outpatient clinic/program	____	____	_____
Salvation Army	____	____	_____
Halfway House program	____	____	_____
Samaritan House	____	____	_____
Marriage/family counseling	____	____	_____
Religious counseling (priest, minister, etc.)	____	____	_____
Private doctor (general MD)	____	____	_____
Private therapist	____	____	_____
Vocational Rehab. Program	____	____	_____
Other_____	____	____	_____

7. How many times have you ever been hospitalized for alcohol-related health problems at (Note: put a zero if never hospitalized)?

# of Times	Facility	Comments--when, how long
_____	Central State Hospital	_____
_____	Nashville VA Hospital	_____
_____	Murfreesboro VA	_____
_____	Madison A&D Hospital	_____
_____	Cumberland Heights	_____
_____	Other state hospital (List Names)	_____
		_____
_____	Other out of state detox facilities (List Names)	_____
		_____

8. Have you ever been hospitalized for mental or emotional problems not related to drinking? No_____ (Go to #9) Yes_____ (Ask A)

A. Where, when, # of times, how long, circumstances surrounding the hospitalization(s)

_____

_____

_____

9. How many total times in your life have you ever been arrested for each of the following alcohol-related offenses (put a zero if not arrested)?

_____ Drunk in public (public drunkenness)

_____ Drunk driving (list the BAC (%) and dates for each arrest; if unknown, write such)_____

_____

_____

_____ Disturbing the peace (alcohol-related)

_____ Other (describe)_____

_____ Non-alcohol-related arrests(describe)_____

_____

10. A. Do you have legal charges pending? Yes_____ No_____
    B. Are you currently on probation or parole? Yes_____ No_____
    If yes: to (a) or (b) describe further:_____

11. Has anyone in your family (aunts, uncles, cousins, mother, father, brothers, sisters) ever had a drinking-related problem? No_____ (Go to #12) Yes_____ (Ask A)

    A. Give relationship_____

12. Ecological drinking information:
    A. Where do you usually drink (environment)_____
    B. With whom do you usually do most of your drinking (alone, others)?_____
    C. On the average how many days per week do you drink or did you drink?_____
    D. About how much (beer/wine/hard liquor) would you or did you drink on a typical day?

Check one Column	Beer	Hard Liquor	Wine
_____	1-2 12 oz cans	1-2 oz (drinks)	1-2 glasses (4oz/each)
_____	3-6 12 oz cans (up to 1-6 pack)	3-6 oz (drinks)	3-6 glasses (up to 1 5th - 12%)
_____	7-12 12 oz beers (3 qts/2-6 packs)	7-12 oz (drinks) (½ pint plus)	7-12 glasses (up to 2 5ths)
_____	3-6 packs - 5 qts	13-16 oz (drinks)	2 fifths (12%)
_____	Case a beer plus (24 - 12 oz cans)	more than pt (16 oz) (fifth, quart)	3-4 fifths plus 12%

    F. Approximately how many times in the last year (365 days) did you drink more than 8-10 beers (12 oz), or ½ pint hard liquor, or a quart of wine? (List the # of days)? _____
    G. Approximately how much money do you or did you spend for alcohol per week?_____
    H. Do most of your friends drink alot?_____

13. In your own words, what are the main reasons you drink alcohol?_____

14. In what ways or areas of your life has your drinking caused you problems (legal, physical, familial, vocational, etc.)?_____

MEDICAL HISTORY

1. What types of medical problems or disabilities have you ever been treated for or are currently being treated for (i.e., head injury, hypertension, epilepsy, diabetes, ulcer, heart or kidney trouble, etc.)? (Note, if none write none) Describe specific nature and duration (dates) of the problem/disability and treatment:

2. Have you ever had any type of surgery (if yes, describe)?_____

_____

3. A. Date of last complete physical:_____
   B. Name & address of physician_____
   _____
   C. Reason(s) for the physical:_____
   D. Were any problems noted? No_____ Yes_____ (describe)_____
   _____
   _____

4. Drug use (non-alcohol):

   A. Currently taking medications or drugs? No_____ Yes_____ If yes, what type, length and reason for use, how frequently taken?_____

   _____

   B. Have you ever used dilantin? No_____ Yes_____ (describe)_____

   _____

   C. Have you ever used any type of anti-coagulants (e.g. Coumadin)?
   No_____ Yes_____ (describe)_____
   D. Have you ever used any other prescribed or non-prescribed drugs or medications for any length of time (1 month or more, i.e. antabuse, valium, other tranquilizers, uppers, downers, heroin, etc.)? No_____ (Go to # 5)
   Yes_____ (reason and length)_____

5. Have you ever been treated or hospitalized for drug abuse? No_____ Yes_____
   If yes, for what drugs, when, where, describe circumstances surrounding this situation?_____
   _____

6. Are you experiencing any physical problems now from drinking? No___(Go to #6) Yes____

   A. Describe the symptoms, (i.e. DT's, seizures, vomiting, psychomotor agitation, hallucinations, insomnia, anorexia, etc.)_____

   _____

   _____

7. Have you ever experienced any of the following physical problems when drinking?

Problem	No	Yes	If yes, when
Hallucinations (visual/auditory)	____	____	_____
DT's (delerium tremens)	____	____	_____
Seizures/convulsions (fits)	____	____	_____
Psychomotor Agitation (shakes)	____	____	_____
Blackouts	____	____	_____
Other (describe)_____	____	____	_____

8. Have you ever or do you currently have high blood pressure? No_____ Yes_____
If yes, describe_____

9. Have you ever had any type of hepatitis? No_____ Yes_____ If yes, describe the cause, dates, type of treatment and residual problems, if any?_____

10. Has anyone ever told you that you have or have had liver problems or cirrhosis of the liver? No_____ Yes_____ (Ask A)

A. Who told you this, and what did they base their findings on (i.e., liver tests biopsy, etc.)?_____

11. Have you gained or lost a lot of weight in the last 6 months? No_____ Yes_____
If yes, describe:_____

EDUCATIONAL AND VOCATIONAL HISTORY

1. Highest grade completed in school_____If less than 12th grade, why did client not complete high school?_____

2. What type of work are you trained to do (usual occupation)_____

3. At the present time do you have a:

_____Full time job (Ask A - B)
_____Part time job (Ask A - B)
_____Self-employed (Ask A - B)
_____Works at odd jobs (Ask A - B)
_____Not employed (Ask C - E)
_____Student (Go to Q# 4)
_____Disabled (Go to Q #4)
_____Retired (Go to Q #4)

If employed:
A. Current job title_____
B. How long employed there (months)_____

If unemployed:
C. How long since last permanent job (exclude temporary jobs)_____
D. Did you lose this job because of drinking?_____
E Do you have a job to return to_____

4. How many jobs have you had in the past twelve months (including present job)?_____

5. How many months were you employed during the past twelve months?_____

6. What is the longest time you have held a job (in years)?_____

7. Have you ever drank on the job? No_____ Yes_____

A. Number of total times fired or laid off from a job as a result of drinking?___
B. Approximately how many days have you missed work in the last twelve months (365 days) as a result of drinking?_____

8. Additional Educational and Vocational History: (stability, problems, etc.)

_____

_____

_____

_____

_____

_____

SOCIAL AND FAMILY NETWORK HISTORY

1. Now living with: _____ Relationship: _____

2. Current Marital Status:

(Check one)

_____ Married (Ask A - D)
_____ Divorced (Ask E - G)
_____ Separated (Ask E - G)
_____ Widowed (Ask E - G)
_____ Never Married (Go to #3)

If currently married:

A. How long have you currently been married? _____

B. How many total times have you been married? _____

C. Has your drinking ever affected your married life, and if so, in what ways?

_____

_____

D. Does your spouse drink? Yes ____ No ____

If currently divorced, separated or widowed:

E. How long (in years) have you been (widowed, divorced, separated)? _____

F. Have you ever been separated or divorced as a direct or indirect result of your drinking? No ____ Yes ____ (describe) _____

_____

G. How many total times have you been married? _____

3. Who has ever complained about your drinking or felt you drank too much (i.e. spouse, friends, employer, etc.: if no one, write none): _____

4. Who are the people you usually spend time with? _____

_____

Additional Social and Family History (con't):_____

_____

_____

_____

_____

_____

_____

_____

INTERVIEWER'S ASSESSMENT OF CLIENT:

1. Statements of patient are considered: _____Largely reliable _____Unreliable _____Doubtful _____No possible judgment

2. Information on this form was obtained largely from:
   _____Patient
   _____Relative (who)_____
   _____Other (who)_____

3. Diagnostic Statement:_____ DSM-II Code:_____

4. Initial Treatment Recommendations:

   _____

   _____

   _____

   _____

5. Additional Comments:_____

   _____

   _____

   _____

   _____

   _____

_____ _____

Signature of Intake Interviewer Date

DRUG USE PROFILE-DRUG HISTOI

CLIENT IDENTIFICATION

Name: _____

Case #: _____ DOB: _____

1. What medications (includes prescribed as well as nonprescribed drugs) are you taking now and what have you taken over the past six months for physical and/or mental health problems?

Medication	Dosage	Frequency of Use	Prescribed for What Condition	Prescription Drug No Yes By Whom (check one)			Side Effects* No Yes* (check one)		Presently Taking Medication Yes No (check one)		If No, reasons fc discontinuing
1.											
2.											
3.											
4.											
5.											
6.											

*Side Effects (describe the effects for each drug): _____

_____

2. Are you allergic to any drugs and/or foods? ___No ___Yes (describe) _____

3. Have you ever used dilantin? ___No ___Yes (describe) _____

4. How many packs of cigarettes do you smoke per day? _____ 5. How many cups of coffee do you drink per day? _____

6. Has anyone in your immediate family (parents, grandparents, aunt/uncle, sisters/brothers) ever been treated for depression and/or psychiatric problems? ___No ___Yes, If yes, please address the following: (A) Who is the relative (relationship, not name)? (B) Types of treatment (inpatient, outpatient, etc.) and duration; and (C) Type of medication prescribed and the relative's response to it if known.

_____

_____

_____

dede wallace center

Completed by: _____ Date: _____

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APPENDIX C

Subject Number _____ ☐ Initial Testing ☐ Retesting ☐ Single Testing

CODING CATEGORIES (Standard drinks = SD)

4 = 1-4 SD
8 = 5-8 SD
12 = 9-12 SD
16 = 13-16 SD
20 = 17-20 SD
24 = 21-24 SD
25 = -25 SD

Standard drink = 1 oz. whiskey
= 3-4 oz. wine (not fortified)
= 12 oz. beer

Other than Drinking Categories

S = Sober (No Alcohol)
JA = Jail, Alcohol Reason
JN = Jail, Non-alcohol
HA = Hospital, Alcohol Reason
HN = Hospital, Non-alcohol
RR = Residential, Halfway House

MARCH						
S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

APRIL						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

MAY						
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

JUNE						
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

JULY						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				26

AUGUST						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
27	28	29	30	31		

DRINKING BEHAVIOR QUESTIONS

Subject Number _____ ☐ Retesting ☐ Single Testing

1. Since entering treatment at Dede Wallace Center, on the average how many days per week do you drink? _____

2. About how much (beer/wine/hard liquor) would you drink on a typical day?

Check on Column	Beer	Hard Liquor	Wine
_____	1-2 12 oz cans	1-2 oz (drinks)	1-2 glasses (4oz/each)
_____	3-6 12 oz cans (up to 1-6 packs)	3-6 oz (drinks)	3-6 glasses (up to 1 5th-12
_____	7-12 12 oz beers (3 qts/2-6 packs)	7-12 oz (drinks) (½ pint plus)	7-12 glasses (up to 2 5ths)
_____	3-6 packs - 5 qts	13-16 oz (drinks)	2 fifths (12')
_____	Case of beer plus (24 - 12 oz cans)	more than pt (16 oz) (fifth, quart)	3-4 fifths plus

3. About how much money do you spend for alcohol per week?

_____

APPENDIX D

TABLE 19

DRUGS CLASSIFIED ARBITRARILY AS MOOD-ALTERING OR NON-MOOD-ALTERING USED BY PROBLEM DRINKERS DURING THE SIX MONTHS PRIOR TO ENTERING TREATMENT AND/OR UP TO THE TIME OF TEST ADMINISTRATION

Mood-Altering	Non-mood-altering
Drug	Drug
Vistaril	Disulfiram
Tofranil	Aspirin
Elavil	Dymelor
Atarax	Synthroid
Imipramine	Acetaminophen
Mysoline	Xylocaine
Tranxene	Diazide
Valium	Inderal
Marijuana	
Emprazil-C	Drug Group
Percodan	
Mellaril	Antihistamines *
Parafon Forte	Vitamins
Demerol	Antibiotics
Seconal	Diuretics
Norpramine	Nitrates
Ritalin	
Meprobamate	
Drug Group	
Amphetamines	

*With the exception of one subject all individuals taking this drug did not appear to have done so on the day of testing.

APPENDIX E

TABLE 20

THE BREAKDOWN BY PERCENTAGES OF PERFORMANCE ON THE HALSTEAD NEUROPSYCHOLOGICAL MEASURES AND THE TRAIL MAKING TEST FOR THE CROSS-SECTIONAL AND LONGITUDINAL GROUPS OF PROBLEM DRINKERS

Neuropsychological Measure	Cross-Sectional N = 29	Longitudinal N = 28	Total N = 57
Category Test (errors)			
0-20	10%	7%	9%
21-40	21%	28%	25%
41-60	31%	25%	28%
61-80	24%	28%	26%
81-100	10%	11%	11%
101-120	3%	0%	2%
Tactual Performance Test Time (minutes)			
0-10.0	14%	7%	11%
10.1-15.0	28%	36%	32%
15.1-20.0	28%	25%	26%
20.1-25.0	17%	18%	18%
25.1-30.0	3%	14%	9%
30.1-35.0	7%	0%	4%
Above 35.1	3%	0%	2%
Tactual Performance Test Memory (number correct)			
4	3%	0%	2%
5	10%	14%	12%
6	17%	11%	14%
7	24%	39%	32%
8	31%	18%	25%
9	14%	14%	14%
10	0%	4%	2%

TABLE 20 (continued)

Neuropsychological Measure	Cross-Sectional N = 29	Longitudinal N = 28	Total N = 57
Tactual Performance Test Localization (number correct)			
0	3%	4%	4%
1	10%	14%	12%
2	17%	4%	11%
3	31%	18%	25%
4	7%	25%	16%
5	0%	11%	5%
6	14%	18%	16%
7	10%	7%	9%
8	7%	0%	4%
Speech-sounds Perception Test (errors)			
0-5	7%	7%	7%
6-10	45%	43%	44%
11-15	21%	39%	30%
16-20	14%	7%	11%
21-25	10%	4%	7%
Unavailable	3%	0%	2%
Seashore Rhythm Test (number correct)			
15-18	0%	4%	2%
19-22	24%	21%	23%
23-26	24%	21%	23%
27-30	52%	54%	53%
Finger Oscillation Test (number of taps)			
39-41	3%	7%	5%
42-44	7%	0%	4%
45-47	10%	18%	14%
48-50	14%	18%	16%
51-53	24%	36%	30%
54-56	21%	18%	19%
57-59	7%	4%	5%
60-62	7%	0%	4%
63-65	3%	0%	2%
66-68	3%	0%	2%

TABLE 20 (continued)

Neuropsychological Measure	Cross-Sectional N = 29	Longitudinal N = 28	Total N = 57
Trail Making Test Part A (seconds)			
11-15	0%	7%	4%
16-20	7%	21%	14%
21-25	35%	36%	35%
26-30	28%	11%	19%
31-35	17%	7%	12%
36-40	7%	11%	9%
41-45	3%	4%	4%
46-50	3%	4%	4%
Trail Making Test Part B (seconds)			
31-50	24%	14%	19%
51-70	28%	36%	32%
71-90	14%	32%	23%
91-110	17%	7%	12%
111-130	10%	4%	7%
131-150	7%	7%	7%
Impairment Index			
0.00-0.10	14%	7%	11%
0.11-0.20	10%	14%	12%
0.21-0.30	14%	7%	11%
0.31-0.40	3%	0%	2%
0.41-0.50	10%	25%	18%
0.51-0.60	10%	21%	16%
0.61-0.70	10%	0%	5%
0.71-0.80	17%	14%	16%
0.81-0.90	10%	11%	11%
0.91-1.00	0%	0%	0%

VITA

Bruce David Bainum was born on May 25, 1953 in Takoma Park, Maryland. There he attended John Nevins Andrews Elementary School and then Takoma Academy which awarded him his high school diploma in 1971. Three of his next four years were spent at Pacific Union College in Angwin, California where, in 1975, he received the Bachelor of Arts degree with a major in Psychology. During one of these four years the author was engaged in study of the French language near Geneva, Switzerland for which he received the Diplôme de Langue de l'Alliance Française. In December of 1979 he received the Doctor of Philosophy degree with a major in Psychology from the University of Tennessee in Knoxville.