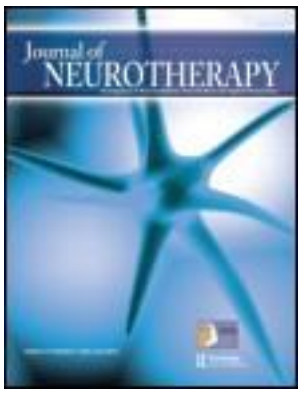

Journal of Neurotherapy: Investigations in Neuromodulation, Neurofeedback and Applied Neuroscience

"Native Americans, Neurofeedback, and Substance Abuse Theory". Three Year Outcome of Alpha/theta Neurofeedback Training in the Treatment of Problem Drinking among Dine' (Navajo) People

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Published online: 20 Oct 2008.

To cite this article: Matthew J. Kelley Ph.D. (1997) "Native Americans, Neurofeedback, and Substance Abuse Theory". Three Year Outcome of Alpha/theta Neurofeedback Training in the Treatment of Problem Drinking among Dine' (Navajo) People, Journal of Neurotherapy: Investigations in Neuromodulation, Neurofeedback and Applied Neuroscience, 2:3, 24-60, DOI: 10.1300/J184v02n03_03

To link to this article: http://dx.doi.org/10.1300/J184v02n03_03

"Native Americans, Neurofeedback, and Substance Abuse Theory"
Three Year Outcome of Alpha/theta Neurofeedback Training in the Treatment of Problem Drinking among Dine' (Navajo) People

Matthew J. Kelley Ph.D.

This three year follow-up study presents the treatment outcomes of 19 Dine' (Navajo) clients who completed a culturally sensitive, alpha/theta neurofeedback training program. In an attempt to both replicate the earlier positive studies of Peniston (1989) and to determine if neurofeedback skills would significantly decrease both alcohol consumption and other behavioral indicators of substance abuse, these participants received an average of 40 culturally modified neurofeedback training sessions. This training was adjunctive to their normal 33 day residential treatment.

According to DSM-IV criteria for substance abuse, 4 (21%) participants now meet criteria for "sustained full remission", 12 (63%) for "sustained partial remission", and 3 (16%) still remain "dependent" (American Psychiatric Association, 1994). The majority of participants also showed a significant increase in "level of functioning" as measured by the DSM-IV Axis V GAF.

Subjective reports from participants indicated that their original neurofeedback training had been both enjoyable and self-empowering; an experience generally different from their usual treatment routine of talk-therapy and education. This internal training also appeared to naturally stimulate significant, but subtle, spiritual experiences and to be naturally compatible with traditional Navajo cultural and medicine-ways. At the three-year follow-up interview, participants typically voiced that these experiences, and their corresponding insights, had been helpful both in their ability to cope and in their sobriety. From an outside perspective, experienced nurses also reported unexpected behavioral improvements during the participant's initial training. Additionally, administrators and physicians generally found the objective feedback and verification quality of neurofeedback protocols compatible with their own beliefs.

An attempt has also been made to conceptualize the outcome analysis of this study within both a culturally specific and universal socio/bio/ environmental context.

This three year follow-up study presents the treatment outcomes of 19 Dine' (Navajo) clients who completed a culturally sensitive, alpha/theta neurofeedback training program. Their initial training, provided in addition to their 33 day inpatient substance abuse treatment program, was an attempt to reduce the chronic stress patterns commonly found in people who have alcohol-related problems. Stress (and its emergent neurological matrix) is considered by some to be one of the significant (and most neglected) factors contributing to problem drinking (Johnson & Pandina, 1993; Peniston & Kulkosky, 1989). With this in mind, participants were thoroughly trained in relaxation-based neurofeedback skills and other self-regulation techniques in an attempt to allow them to "make their own medicine."

In an attempt to tie this study into the construction of an applied neurotherapy theory and its application in substance abuse treatment, an unusually broad literature discussion is included. In addition, many complex cultural context factors are involved in understanding this project and its outcome, It is inherently difficult, for example, to accurately appreciate the outcome of any type

of treatment program, and especially this one. Treatment outcomes can only be evaluated against the background of clearly understood predictive variables such as the client's social stability, severity of dependence, psychopathology, stressors, physiology, and environmental support (Lettieri, 1992).

Outcome analysis is even further complicated because the scientific and the public understanding of the spectrum of "alcohol-use-disorders" (and their corresponding causality) is often imprecise and confusing (U.S. Department of Heath and Human Services, 1990). In addition, because cultural norms strongly influence the etiology, dynamics, and the various problems inherent in alcohol consumption, a meaningful understanding of the dynamics and outcome of neurofeedback training within this specific rural Navajo context is even more complex (Westermeyer & Canino, 1994).

Although this study involves Navajo participants, its outcome potentially has a much wider application. If the outcome shows positive results within these challenging and culturally powerful contexts, many of the same self-empowerment and stress reducing components of the protocol could also be applicable to other populations, including the dominant U.S., non-native culture.

To illustrate the research context, the drinking dynamics of both the non-native and the Navajo population must also be briefly described. This includes the current theories of the etiology of excessive drinking, the relationship of stress to problem drinking, and the application of alpha/theta neurofeedback training to treatment. A discription of the study's purpose, the assessment methods used, the outcome results with their inherent limitations, and a discussion will follow.

The Definition of Problem-Drinking

Because of the widely varying meanings of the word "alcoholic" and "alcoholism", the *Diagnostic and Statistical Manual of Mental Disorders (DSM)* (American Psychiatric Association, 1994) (including the *DSM III-R, DSM-IV*) and the *ICD-10*, in an attempt to better present the dimensional nature of alcohol-use problems, distinguish between "alcohol abuse" and "alcohol dependence." These three manuals also recognized that individual patterns within these two categories can be quite varied. Alcohol abuse is roughly defined (in all three manuals) as at least a one month pattern of alcohol usage which causes psychological or physical harm to the user. However, within different social or cultural contexts, this criterion itself may vary (Westermeyer & Canino, 1994). The *DSM-IV* defines alcohol dependence as a persistent pattern of alcohol usage (for at least one month) involving at least three of the following symptoms: (a) a subjective sense of having a compulsion to drink; (b) a difficulty in controlling intake; (c) using alcohol to relieve or avoid withdrawal symptoms; (d) the experience of a physiological withdrawal state; (e) an increased tolerance to alcohol; (f) making drinking a priority over important activities; (g) continued use of alcohol even after experiencing physical or psychological complications; (f) an increase in time spent drinking or the interference of drinking (or withdrawal) with other important activities.

In an attempt to acknowledge this wide spectrum of problem-causing drinking behavior (ranging from infrequent but problematic binge-drinking, to full-blown alcohol dependence) the terms "alcohol dependence or abuse", "alcohol-use disorders", "alcohol-use problems", "problem-drinking", and "excessive-drinking" will be used instead of the term "alcoholism."

Literature Review

The Problem of Assessing Treatment Outcomes

Because of the vast range of physiological, psychological, sociological, and cultural differences among populations, and even between people within a racially and culturally homogeneous population, understanding of the dynamics of excessive

drinking remains both complex and controversial. In addition, because of the necessarily multifaceted nature of treatment programs, and due to the inherent difficulty in both the definition of successful treatment and in the non-invasive assessment of treatment outcome, the meaningful evaluation of treatment efficacy is difficult. Understanding these dynamics in the various Native American societies is even more challenging due to the strong persistence of inaccurate cultural generalizations, the inherent difficulties of accurate cross-cultural investigations, as well as the frequent biases, polarizations, and prejudices common within many treatment, administrative, and scientific communities (Heath, 1983).

To understand the impact of treatment upon a problem drinker's experience it is first important to understand both the reliability of outcome data, and then the etiological context in which the drinking problems occur. Thombs (1994) and the Institute of Medicine (1990) both pointed out that, in spite of considerable effort, there has been remarkably little success in assessing the outcome of alcohol treatment. They stated that, in most cases, the relapse rates of treatment facilities are significantly higher than what is publicly presented. This public over-statement is often due to the lack of research resources, the inevitable variation of treatment quality from group to group, weak research methods, and the facility's both unconscious and conscious vested-interest in presenting positive results.

Several other researchers suggested that outcome investigation is as complex as both the phenomenon of alcohol-use disorders and the individuals involved (Sanchez-Craig, 1986). Thombs (1994) also maintained that relapse rates should be only analyzed by taking into account specific client characteristics such as individual pathology, amount of aftercare support, motivation, and the clients' original drinking characteristics. The National Institute of Alcohol Abuse and Alcoholism stated that outcome data cannot be functionally understood unless there is a full understanding of the client's original predictive variables (Lettieri, 1992). Others suggested that the analysis of specific relapse rates is too simplistic and does not place the problem in an appropriate perspective (Moos, Finney, & Cronkhite, 1990). Furthermore, these authors suggest that "treatment" is only one of the many factors that contribute to successful outcome. For example, it is possible to identify environments so suppressive they would eventually encourage even a normally happy, highly productive, and neurologically "resilient" person into a pattern of excessive drinking. The criteria for success must always be relative to the individual's problem and conflict (IOM, 1990).

Patterson, Sobell, & Sobell (1977) suggested that the most appropriate evaluative question to ask when assessing treatment success might be "what kinds of individuals, with what kind of alcohol problems, are likely to respond to what kinds of treatments, by achieving what kinds of goals, when delivered by which kinds of practitioners" (p.143).

Some of the other challenges of accurate treatment evaluation are the desire to respect the client's private world and the frequent, non-reliability of the client's self-report. One study concluded, after attempting to verify self-reports with collateral interviews and blood and urine testing, that only 65% of those people reporting total abstinence were truthful about their drinking habits (Fuller, Lee, & Gordis, 1988). In another study using collateral information to cross-check the client's self-report, about 50% of the cross-verifications did not correspond to self-report (Watson, Tilleskjor, Hoodecheck-Schow, Pucel, & Jacobs, 1984).

To make such analysis even more complex, success is defined in different ways by various facilities. Some treatment facilities describe "abstinence" as "no drinking at all" while other facilities expand the definition of abstinence to include clients who might have

had major slips but who stayed relatively healthy and out of trouble (IOM, 1990).

Relapse statistics can also be skewed by other variables. Many studies wrongly eliminated clients who were difficult to contact, or clients who have what they called "unstable" situations such as being unmarried, or those who are non-compliant (Wallace, 1990).

The wide variation of outcome results reported in the literature reflect the complex range of assessment standards, assessment protocols, treatment qualities, population differences, etc., which continue to frustrate researchers. Most of these studies make little mention of either their assessment protocol or their relapse criteria. For example, even the *DSM-IV* stated that 65% of all "highly functioning" treatment participants become abstinent for at least one year (American Psychiatric Association, 1994, p.202). Definitions of "highly functioning" and "abstinent" were not offered.

In an important note, the *DSM-IV* concluded that an estimated 20% or more people with alcohol dependence will eventually establish their own long-term sobriety even without treatment. The successful self-treatment rate (spontaneous abstinence or spontaneous controlled drinking) seems to vary according to the age of the person (Fillmore, Hartka, Johnson, Speiglman, & Temple, 1988). These researchers found that young men from 17-30 years who are chronic problem-drinkers have a 50-60% chance of self-induced sobriety, women from 17-30 years have a 70% chance, men from 30-60 years have a 30-40% chance, women from 30-60 years have a 30% chance, men from 60-80 years have a 60-80% chance, and finally, women from 60-80 years have a 50-60% chance. Regarding Navajo people specifically, Kunitz and Levy (1994), in a 25 year study, found that 80% of their original chronic use disorder population eventually stopped drinking when they reached the ages of 40-60 years. (Six percent of this original population, however, died of alcohol-related problems). Based on this experience they claimed that the currently popular theory that alcohol dependence and abuse is a genetically dependent, progressive disease has not been observed within this population.

Surprisingly, the Institute of Medicine study (1990) also concluded that treatment can actually encourage some types of people to drink more. They also reported that a significant number (more than 25%) of people stop (or modify) their drinking without formal treatment. These researchers also suggested that there are no clear predictors to identify which people will respond, and which will not. After studying over 250 outcome studies (60 included random assignment), they summarized the findings: (a) no single treatment is effective for all people; (b) a specific and appropriate treatment modality for a certain person can significantly improve outcome; (c) brief interventions can sometimes be very effective; (d) treatment of other life problems besides drinking is essential; (e) the quality of available therapeutic skill can influence outcomes; (f) outcomes are influenced by an assortment of individual, treatment, and post-treatment factors; (g) successful outcomes are relative for different people and different situations.

Designing Useful Outcome Assessment

The Institute of Medicine's (1990) report on the assessment of alcohol treatment programs suggested that randomized controlled comparisons, although usually preferred, are not always essential (or practical) for useful data collection. They stated that quasi-experimental designs, and even individual case studies, have proven helpful. They also suggested that, in spite of their previously mentioned shortcoming, self-report assessments are viable methods if done correctly. They, along with other researchers, believe that self-reports are neither inherently valid or invalid and that the circumstances where such reports are given can either increase or decrease their validity (Lettieri, O'Farrell & Maisto, 1987; 1992, Skinner, 1984;

Sobell et al., 1987). In his report to the National Institute on Alcohol Abuse and Alcoholism, Lettieri also stated that validity actually depends on the methodological sophistication of the person gathering the data, the personal characteristics of the respondent, and the quality of rapport between the interviewer and respondent.

In order to increase the validity of a verbal self-report these authors recommended that: (a) the client is free of alcohol at assessment; (b) the client is medically stable with no major health symptoms; (c) the interview is structured and carefully developed; (d) the client suspects that his or her statements will be cross verified; (e) there is good rapport between client and interviewer; (f) the client has followed the aftercare suggestions; (g) the client has no obvious motivation in distorting facts; (h) the client is assured that all comments will be confidential; (i) the interviewer, and related staff, appear neutral and nonpunitive; (j) two or more assessment instruments are used.

In addition, Sobell, Sobell, Leo, & Cancilla (1988) suggested that the use of a graphic time-line chart, where the client fills in the periods and quantities of his or her drinking/life-problem pattern, has been shown to be both an expressive way to gather data and appears reliable over time.

Problem-Drinking Within All Populations

The causes of excessive-drinking have been hotly debated throughout history. Alcohol related disorders have been looked at as a character weakness, a disease, a maladaptive behavior pattern, and a coping mechanism. While each theory has its advantages and disadvantages, in this study, problem-drinking is viewed as complex and variable phenomenon of inter-dynamic pharmacological, biological, psychological, social, and environmental factors (Thombs, 1994).

The disease theory of alcohol-use disorders remains the most popular model within both the treatment and the medical community (Milam & Ketcham, 1983). Critics, such as Fingarette (1988), Peele (1988), and Alexander (1988), believe that the disease model best serves the economic and social interests of those involved in spite of having little scientific support. Others (Institute of Medicine's Study of Alcohol Abuse and Alcoholism, 1990) suggested that there are different types and combinations of pre-disposing causes; Some drinkers are sensitive to genetic

factors; some drinkers are sensitive to environmental conditions; some drinkers have personality disorders; some drinkers have psychobiological traits such as impulsivity and an affinity for risk-taking.

Because the genetic pre-disposition theory is becoming socially popular and is often over-emphasized, Tombs (1994) pointed out that the findings of the Goodwin, Schulsinger, Hermansen, Guze, & Winokur (1973) study commonly used to support it has been greatly exaggerated over time (Goodwin, 1988). In that study, only 18% percent of the sons of parents who suffered from alcohol-use disorders actually developed drinking problems. In the control group, 5% of the sons of parents without a history of alcohol-use disorders developed drinking problems. Several reviewers have suggested this study offers no statistically significant evidence on the genetic predisposition of alcohol-use disorders, and has even less clinical applicability (Lester, 1988; Murray, Clifford, & Gurling, 1983). Tombs also pointed out that the frequently cited twin studies (Health, Jardine, & Martin, 1989; Kaigi, 1960; Kaprio et al., 1987; Kendler, Health, Neale, Kessler, & Eaves, 1992; McGue, Picken, & Svikis, 1992) actually illustrated a complex inter-related "loading" relationship between genetics, environment, age, sex, and social factors, the exact nature of which remains unclear. Other researchers believe that they have actually located a "tendency" gene (DRD2 A) which appears to be ethnically loaded (Blum, 1991). At the very least, because behavioral traits are usually influenced by

more than one gene and are usually integrated with environmental factors, the clinical applications of this evidence remains limited.

Tombs (1994) also reviewed several studies which suggested that people suffering from alcohol dependence (and their relatives) tend to metabolize alcohol in a more-pathological way (Fringarette, 1988). People suffering from problem-drinking often appeared to have higher levels of acetaldehyde (the metabolized by-product of alcohol) than others. This was thought to correspond with an increased tolerance for alcohol and may be what stimulates physical dependency (Schuckit, 1984). Others believe that this research is inconclusive due to the difficulties in accurately measuring acetaldehyde and in establishing a casual or consequential relationship (Institute of Medicine, 1987; Lester, 1988).

Other physiological differences have been noted. Tombs stated that the reduced amplitude P3 brain wave deficit seen by Begleiter, Porjesz, Bihari, & Kissin (1985) in the non-drinking sons of alcoholics was not seen by Polich and Bloom's (1988) matching study. Even if this slow cortical response "signature" eventually becomes established, just what significance it might have in a clinical or applied situation remains unknown. (It is assumed here that by using the word "alcoholic" the authors mean someone suffering from alcohol dependence.)

Other researchers have shown that alcohol-dependent persons (as well as the non-drinking sons of alcohol-dependent persons) generally have a lower level of brain wave synchrony and a lower level of overall alpha brain wave amplitude than non-alcohol dependent persons (Volavka, Pollock, Gabrielli, & Mednick, 1985). (These authors use the word "alcoholic" as determined by unspecified Dutch standards.) Although often slight, this abnormal neurological signature may contribute to a feeling of depression, emptiness, and internal mental restlessness (Walters, 1992). It is also relevant that alcohol temporarily stimulates a rise in both alpha brain wave coherence and EEG amplitudes (part of the subjective warmth and neurological-quieting felt during intoxication)(Pollock, Volavka, Goodwin, Mednick, Gabrielli, Knop, & Schulsinger, 1983). In this model, drinking often becomes a sort of self-normalization, or self-medication, for a person who wants to disengage from uncomfortable thoughts.

When scrutinized, many other established assumptions also begin to weaken. For example, Tombs (1994) criticized the popular notion that alcohol biologically or chemically "short-circuits" the problem drinker's ability to control his or her consumption after the first drink. Although this apparent "loss of control" is a common experience among many abusers, more than 60 laboratory experiments have shown that problem drinkers can control their intake if the perceived costs and benefits of controlled drinking are sufficient (Pattison, Sobell, & Sobell, 1977). It now appears that the frequency and quantity of drinking among problem drinkers is not determined solely by endogenous mechanisms. This does not deny, however, that many drinkers find alcohol neurologically intense, addictive, and overwhelming.

Although individuals naturally differ in their metabolic dispositions, the negative grip of alcohol can also be complicated by diabetes, poor nutrition, head injury, stress levels, health factors, and expectations. These conditions, themselves, can stimulate the cravings for both calories and liquid. For example, stress-triggered, blood-based Beta endorphins often stimulate the desire for calories (Baile, McLaughlin, Della-Fera, 1986; Naber, Bullinger, Aahn, 1981; Riley, Zellner, Duncan, 1986). In turn, the physiological craving for calories is often linked with the desire to drink alcohol (Kulkosky, 1985).

Blum's (1991) Reward Deficiency Syndrome model (RDS) emphasizes the complex integration between neurophysiology/psychology/ environment/and genetic design. He suggests that drinking is largely an effort to medicate the neurologically based "Feel Good Response" (FGR).

Tombs (1994) also pointed out that the concept of alcohol dependence as an inevitably progressive and chronically persistent disease is not supported by the empirical data. Although such progressive destruction does frequently happen, a larger population of problem drinkers are able to drink excessively and chronically with few physical problems. These "more fortunate" drinkers never report for treatment and often "mature out" of these behaviors on their own (Fillmore & Midanik, 1984; Fillmore, 1987a; Fillmore 1987b; Peele, 1985).

Other assumptions are challenged by the research. Controlled drinking, for example, can become a naturally comfortable position for many once-problematic drinkers (Heather & Robertson, 1981; Marion & Coleman, 1990; Miller, 1982; Kunitz & Levy, 1994). To better illustrate this point, Sobell & Sobell (1976) presented evidence, much to the dismay of many people in the treatment field, that controlled drinking may produce better outcome results that abstinence-oriented treatments for a large percentage of people.

In summary, problem drinking involves a complex continuum of biological, behavioral, social, and environmental forces (Institute of Medicine, 1990). Some of the possible, interacting and contributing factors of excessive-drinking include: (a) high levels of unemployment; (b) low levels of education and career opportunity; (c) repressive economic conditions; (d) the self-treatment of depression, hopelessness, frustration, feeling of inadequacy, and low self-esteem; (e) an escape function; (f) cultural and social pressure or modeling, sharing, reward, social status, risk-taking and daring; (g) high stress levels or a lack of energy; (h) poor nutrition; (i) metabolic, hormonal, and neurological factors; (j) enjoyment, entertainment, and taste appreciation; (k) lack of awareness of a problem; (l) dependence upon external loci of control; (m) little perceived vested interest in the outcome of drinking; (n) time-out, or reward taking; (o) punishing others or self-punishment (Institute of Medicine, 1987).

In addition, several researchers have pointed out that most substance abusers are seeking better moods, thoughts, and behaviors by pursuing an "altered state of consciousness" typical of their preference; they want to feel better (or different), if even for a short time (McPeake, Kennedy, & Gordon, 1991). This apparent internal drive for the neurophysiological and mood changes was well expressed by Weil (1972). He theorized that many people have a natural and originally healthy urge to occasionally modify or shift their consciousess; e.g., when a child intentionally spins until dizzy or when a singer or "devotee" sings, chants, or prays until entering an altered state. This neuropsychological urge is also often interpeted as a "spiritual" craving. These researchers believe that the use of mood altering substances is often an attempt to fulfil this inherient and significant need.

R. Daw (personal communication, June 14, 1995), the Director of Na'Nizhoozhi (a "safe-place" detox center in Gallup, New Mexico which accepts an average of 1,800 intoxicated people per month), summarizes what he sees as the cause of repeated relapse; "Most of the "chronics" see no other option at the moment but to get drunk."

The psycho/social/physiological benefits of alcohol

On a more positive side, alcohol been described as a sometimes beneficial medicine to both individuals and society (Horton, 1943). Other authors have proposed that drinking is a form of taking "time-out" from a culture's behavioral expectations and can actually serve as an important stabilizing factor for both individuals and communities (MacAndrew &

Edgerton, 1969). One Navajo client, for example, after surviving intense childhood trauma, foreign war, and numerious family crises, stated that alcohol had kept his soul intact over the years. When questioned about his developing liver disease and long arrest record, he shrugged, "It's better than the bullet." In his case, although admittedly destructive, he felt that alcohol allowed him to continue functioning within the society, at least on some level. ("It's better to have a bottle in front of me that to have a frontal lobotomy.") In many social situations, the use of alcohol is also an important, culturally-accepted form of bonding, relaxation, and reward.

Several researchers (Blum & Tractenberg, 1988) have identified brain receptor sites which may respond to potential metabolic products of alcohol. They believe that the "craving" which excessive drinkers often develop may be related to a deficiency of naturally-occurring opiate-like neurotransmitters . This neurological deficiency may be caused by a combination of genetic and chronic stress conditions (the RDS model). This deficiency may, of course, become exacerbated by the extended use.

Alcohol also temporarily stimulates alpha brain wave coherence (Pollock, Volavka, Goodwin, Mednick, Gabrielli, Knop, & Schulsinger 1983), improves peripheral blood flow, decreases respiration rates, and relaxes muscles tension. This pleasant and reinforcing experience is common to a large (but not all) percentage of consumers.

Accordingly, the widespread popular notion that alcohol is a depressant is often misunderstood. Although alcohol is indeed a CNS depressant, many problem and non-problem drinkers paradoxically feel highly stimulated, more social, and even energized when drinking. In many mildly intoxicated individuals, hand-eye coordination, reflex time, and certain abilities may even temporarily increase especially if such performance had been previously limited by mental inhibition or a physical stressor such a tension or pain. From another point-of-view, Cowan (1994) suggested that alcohol does not actually make people feel good, but produces a "negative euphoria" which tends to make drinkers forget that
they feel bad. To both the casual drinker and the problem drinker, alcohol can initially act as an effective, stress reducing, mood-enhancing medicine (stimulating the FGR).

The Relationship Between Stress and Problem-drinking

"Stress" refers any complex of stimulus that disturbs or interferes with the normal physiological (or pychophysiological) equilibrium of an organism (Schwartz, 1987). Ninety-three percent of a group of 2,300 people suffering from problem-drinking stated that they drank in order to relax or to avoid feeling "stressed" (Stockwell, 1985). The majority of non-problem social drinkers expressed the same motivation, including a desire to escape anxiety, depression, frustration, fear, and several other negative emotional states (Brown, 1985; Conger, 1956; Masserman, Jacques, & Nicholson, 1945; Wanberg, 1969). Although this stress-related factor is almost universally acknowledged by drinkers, Tombs (1992) pointed out that the medical community is largely resistant to the idea that people drink in an attempt to relieve stress. Apparently the simplistic "tension reduction hypothesis" (TRH) does not fit the commonly held medical disease model. Several more recent researchers have concluded that the most careful empirical studies support the TRH model (Cappell & Greeley, 1987; Langenbucher & Nathan, 1990; Powers & Kutash, 1985). This statement is usually qualified with the addition that alcohol's effect upon stress relief is complex; it can depend upon the user's expectations, the dosage used, the individual's metabolism, behavior, values, and perception of their own life-stressors. Blum's (1994) integrated theory of the Reward Deficiency Syndrome (RDS) and Feel Good Response (FGR) presents a more neurologically-oriented model of this stress-integrated complex. In

Blum's theory, drinking becomes an attempt to self-medicate an uncomfortable neurological deficit caused by the interaction of genetic/cultural/ environmental factors.

Ironically, high amounts of alcohol can actually exacerbate both short term and long term physiological stress in spite of the drinker's intention, subjective experience, or belief. It is also worthy to note that, although stress provides a common motivation to drink, many people cope just as well, or better, without drinking. This implies that stress alone, although significant, is only one of the components of excessive-drinking (Johnson & Pandina, 1993).

Mail (1992) also stated that alcohol eventually exacerbates both a physiological and emotional stress condition, especially when used excessively. Mail went on to say that when alcohol is consumed under stressful conditions, its euphoric properties tend to become reinforced. Eventually larger quantities can be consumed with less obvious intoxication. Excessive use, in spite of the drinker's belief and experience that alcohol makes him or her feel momentarily better, actually raises stress-related blood cortisols, contributes to immuneosupression, raises blood pressure and heart rate, and increases the risk of heart, cancer, and liver failure (Gibbons, 1992; Peris & Cunningham, 1986).

In spite of this paradox, stress is the most frequently cited cause of relapse (Brown, Vik, Peter, McQuaid, Patterson, Irwin, & Grant, 1990; Hunter & Salmone, 1986; Milkman, Weiner, & Sunderwith, 1984; Marlatt & Gordon, 1979). Tombs (1992) categorized stress-related relapse into four types: (a)intrapersonal negative emotional states (37%); (b) social pressure (24%); (c) interpersonal conflict (15%); (d) other reasons for drinking (24%). Some of the stress-related problems are, in themselves, directly related to the consequences of excessive-drinking. These same authors concluded that relapsers tend to evaluate negative life situations as being harsher, as well as appearing to have a lower tolerance threshold or a higher sensitivity, than do non-drinkers.

Stress Reduction as Treatment Technique

The value of a significant stress reduction program within a treatment regime has been controversial. In this review, a stress reduction technique must necessarily and significantly increase the parasympathetic activity of the autonomic nervous system. In other words, it must cause measurable, restful, healthy, and enjoyable changes in both physiology and neurology (Andreassi, 1989).

A major problem when evaluating the efficacy of stress reduction on sobriety is the difficulty in first assessing the quality and impact of the learned stress-relieving skills. In other words, to what degree did the relaxation, or stress management training, actually produce relaxation or physiological value, and how often was it maintained? Shellenberger and Green (1986) point out that many such self-regulation-type studies have often failed because researchers commonly attempt to use complex learning skills as if they were a form of external medical treatment, rather than skills which must be internally mastered before producing significant results. When the desired outcome does not appear, these researchers question the "medication's effect" rather than questioning whether the skill was actually learned and applied to a specifically recognized level (e.g., trained to a measurable criteron). A related challenge involves the effective "dosage" of any stress technique. Unlike an inoculation or surgical procedure, any form of stress or self-regulation practice training will, at best, only improve the probability of resilience and recovery. For example, a 20 minute practice of relaxation may significantly impact one person but may have little effect on another person who tries to cope within a more extreme environment; or may not effect one whose psychophysiological makeup does not respond to the offered technique for various reasons.

In several outcome studies researchers have found that stress reducing techniques are effective in promoting sobriety (Miller & Hesster, 1986; Rohsenow, Smith, & Johnson, 1985; Rosenberg, 1979). In other cases, relaxation training had little overall effect on sobriety (Miller & Tayor, 1980; Miller, Taylor, & West, 1980; Sisson, 1981). Two studies, however, showed a correlation between the practice of TM meditation and a reduction of general substance abuse (Aron & Aron, 1980, 1983). The EEG modifying correlates of such meditation techniques have been extensively studied Murphy & Donovan (1988).

In an attempt to address the relationship between stress and drinking problems of specific groups worldwide, McKirman and Peterson (1988) proposed a "stress vulnerability theory." They suggested that a general pattern of sociocultural stressors can induce substance abuse problems among people who: (a) are discriminated against socially and economically; (b) are experiencing chronic employment difficulties; (c) fear verbal or behavioral harassment; (d) develop a complex of mild depression, low-self-esteem, alienation, and trait anxiety. Again, these ideas are compatible with the RDS and the FGR model (Blum, 1994).

Peniston's Alpha/Theta Neurofeedback Training as an New Component

In Peniston's (1989) controlled, neurofeedback study, ten clients who were suffering from chronic alcohol dependence and chronic treatment relapses were trained in alpha/theta neurofeedback. These participants were taught to intentionally increase the amplitude and coherence of their transient alpha/theta brainwaves in their occipital lobes with the use of a a specially designed EEG feedback devise. Eight of these remained generally abstinent at least three years after treatment. The specific criteria used in this "abstinent" classification is unknown. Each of the clients experienced approximately 40 30-minute alpha/theta brain wave training sessions. These clients had all failed previous VA hospital residential treatment programs, were of low and middle economic backgrounds, and were of European, Hispanic, and Afro-American decent. Peniston reported that these participants showed significant improvement from pre-training to post-training MMPI personality scales (including hypochondriasis, depression, hysterical, psychopathic deviate, paranoia, and pasychasthenia). They also experienced a decrease in stress-related, blood-based Beta endorphins. In several cases, these clients did attempt a few drinking bouts without success. Quite significantly, when they did drink, they reported a "more appropriate" physiological reaction to excessive alcohol, complaining of low tolerance, unusual hangovers and even an allergic-like reaction. Apparently, these "experimenters" eventually stopped trying to drink. A three year follow-up indicated that these results remained stable. This data was independently corroborated with a second series of participant interviews by the Menninger Foundation (Walters, 1992).

In a similar study completed by the University of North Texas, 16 clients with chemical dependence were trained in a similar neurofeedback protocol against a controlled and matched group. Twenty-four months later, 77% were reported near-abstinent and 23% were reported to have significantly improved their behavior patterns (Bodenhamer-Davis & deBeus, 1995). The controlled groups showed no significant improvement. In another recent experiment, this time within the Kansas state prison system, 39 chemically dependent felons, who were trained in neurofeedback, showed significant improvement after an extended period of freedom over a matched "state-of-the-art" traditional treatment group (Fahrion, 1995).

Several researchers (Ochs, 1992; Peniston, 1994; Walters, 1990) suggested that the most active (and apparently transformational) properties of neurofeedback training may involve teaching the participants to intentionally increase the amplitude and coherent interaction of both their alpha and

theta brain wave frequencies in either the occipital or the central brain locations. Fahrion (1995) also stated that this apparent neurological "normalization" is responsible for shifting the trained client into a physical state of comfortable sobriety. Fahrion suggested that when chemically dependent persons are sober they often have a neurologically-based inability to experience pleasant feelings from simple stimulation. Blum (1995) concurred with these ideas and suggested that neurofeedback training may be triggering a neurological-normalizing shift, as explained by his RDS model of the endless quest for neurotransmitter balance.

With a different but not necessarily contradictory emphasis, Cowan (1993) suggested that the apparent effectiveness of such training may be due more to the enhanced imprinting of positive sobriety suggestions and the feeling of inner empowerment which the alpha/theta state seems to encourage. McPeake, Kennedy, and Gordon (1991) suggested that self-induced altered-states such as those found in various forms of meditation can sometimes replace the self-destructive pursuit of alcohol induced "highs."

In another opinion, Rosenfield (1992) questioned whether there would be any difference between Peniston's neurofeedback protocol, general relaxation, and hypnotic suggestion. Others suggest that the same results can be accomplished with meditation procedures alone (Taub, Steiner, Smith, Weingarten, & Walton, 1994).

In an article reviewing Penniston's (1991) neurofeedback study, Erickson (1989) suggested that effective treatment for substance abuse will always require a combined physiological and psychological approach. He criticized clinicians for frequently ignoring the more complex, underlying, physiological and environmental mechanisms. For example, few treatment programs address the neurophysiological issues of addiction (such as depression and neurometabolism) except on a superficial level. He suggested that, without improving an addict's neurophysiology, treatment is often fruitless or incomplete. This criticism is easily illustrated by the highly motivated addict who is left with a "white knuckle" version of sobriety often involving depression and tension. Many clients, for example, leave treatment facilities with higher measurable stress levels than their pre-treatment condition (IOM, 1990, Peniston & Kulkosky, 1989) yet few treatment programs effectively address this stressor-neurological complex. Those which do, seldom have time for more than a few, relatively insignificant mental or physical exercises.

Problem-Drinking Among the Navajo People

Although this study specifically involves Navajo people, problem-drinking is a human problem which crosses many cultural and all racial boundaries. Special care must be taken to avoid assuming that the drinking dynamics of the Navajo people are necessarily different from, or the same as, the general U.S. population or other Native American tribes. Rebach (1988) warned that the literature on substance abuse among minorities is often limited, imprecise, and incorrectly generalized. It is also important to realize that there are significant environmental, social, and cultural differences among tribes, and that there is no standard Native American response to alcohol (Watts & Lewis, 1988).

Within the Navajo Nation, problem-drinking, and the alcohol related problems of increased disease, poor nutrition, violence, and automobile accidents, is the leading cause of mortality (May, 1992). Alcohol-related deaths among <u>all</u> U.S. tribes nationally account for a disproportionate 16.7% of <u>all</u> Native American deaths. This can be compared with 7.7% alcohol-related deaths in the overall U.S. population. In spite of this statistic, however, May (1992) pointed out that fewer Navajos actually drink (52%) than do members of the general U.S. population (67%). (Note: this is a Navajo specific statistic and may, or may not, be typical of other tribes.) Of six studies in the

literature, May also cited three studies which indicated that the average Native American consumer drinks less than the average U.S. non-native consumer. He found one study which showed that Native Americans consume the same amount of alcohol as non-natives, and two studies which found that Native Americans have a slightly higher drinking level. May did not make a distinction between tribal groups in this assessment. It is also important to recognize that the majority of Native American drinkers, like most non-native people, enjoy alcohol socially without problems (Mail, 1992). Gregory (1992) also stated that although alcohol-related problems are indeed serious, the prevalence of Native American drinking is commonly exaggerated. Mail also reported that many Native American communities have reduced this trend significantly. As an illustration, unlike at most popular U.S. events, the majority of Navajo meetings, ceremonies, dances, rodeos, and public events are alcohol free. In towns within the Navajo Nation there is little evidence of public intoxication (personal observation). At the Gallup National Indian Pow Wow in 1991, of several thousand celebrating Navajo people, the only people publicly drinking were German tourists. This does not mean that excessive-drinking does not occur privately, but does illustrate the recent change in public values.

In spite of this improvement, a disproportionate percentage of Native Americans who do consume alcohol still experience drinking related problems. Although statistics are often skewed by the extremely high rates of some smaller, urban-surrounded tribes, May believed the Southwest Native American population experiences a 18.4% mortality from alcohol-related deaths. This can be compared to a 7.7% of the overall U.S. population. He attributed the higher mortality ratios (in spite of the apparently near-similar drinking prevalence percentage) to a combination of social and cultural factors magnified by the environmental situation of extreme poverty, poor nutrition, and the long distance and low availability of medical attention. For example, a large percentage of alcohol related deaths in the Navajo environment are due to cold weather exposure. In comparison, for example, several rural, non-native counties in the Southwest have almost identical alcohol-related death/injury statistics (May, 1992).

May (1992) also pointed out that Native American substance abuse, magnified by the limited economic and environmental-logistical context, places a disproportionate strain on the already limited reservation-based medical, social, and criminal systems. For example, a mildly injured Navajo problem-drinker is more likely to become a mortality statistic because his or her accident occurred many hours from a hospital. Additionally, if this person does manage to get treatment, the hospital may be ill-equipped and understaffed.

Navajo-specific causes of problem-drinking

It is a common idea among both non-Native American and Native American people that "Indians" have both a genetic metabolism and cultural heritage which pre-disposes them to substance-use-disorders (Levy, 1992; May, 1992). Milam & Ketcham (1983), for example, stated that a significant percentage of Native Americans lack the metabolic, hormonal, and neurological factors which permits the smooth metabolization of alcohol. In strong objection, however, May (1992) and others (Beauvais, 1992; Dorpat, 1992; Fleming, 1992; Gregory, 1992; Heath, 1992; Peters, 1992; Wolf, 1992) argued that, although there are some unique and specific differences, in general, Native Americans react to alcohol much like other people.

In an attempt to lessen the importance of racial predisposition towards alcohol abuse, May listed five studies which show that Native Americans metabolize alcohol as (or even more) rapidly than non-native people (Bennion & Li, 1976; Farris & Jones, 1978; Reed, Kalant, Griffins, Kapur, & Rankin, 1976; Schaefer, 1981; Zeiner, Perrez, & Cowden, 1976). Additionally, two biopsy studies concluded that

the livers of Native Americans and Western Europeans were similar in both structure and phenotype (Bennion & Li, 1976; Rex, Bosion, Smialek & Li, 1985). May and others (Bennion & Li, 1976; Leiber, 1972) found only one study which indicted that Native Americans might have a slower alcohol-processing metabolism but they all believed this study was significantly flawed (Fenna, Mix, Schaefer, & Gilbert, 1971).

It is true, however, that certain racial groups, such as the Japanese and some specific Native American groups, sometimes experience an unpleasant "flushing" sensation when drinking alcohol, an experience that is uncommon among Western Europeans. Some researchers speculated that this sensation is caused by the slower metabolic processing of ethanol due to an enzyme deficiency (Okada & Mizoi, 1982). Although, Japan now consumes more alcohol per capita than any other nation (and much of it during excessive-drinking "bouts"), the relationship between this flushing phenomenon and excessive-drinking remains unclear (Gibbons, 1992). This correlation became even more confused when Japanese researchers reported that their alcohol dependence rate is less than 3%. Western observers believe, however, that the actual hidden prevalence of Japanese drinking problems is much higher. Some researchers are predicting that problems in Japan will become more apparent as time goes on (Saitoh, Steinglass, & Schuckit, 1989).

Wolf (1992) observed that Alaskan Natives are much more likely to experience "black-out" periods of unconsciousness during periods of heavy drinking than the average U.S. non-native population. May (1992) maintained, however, that the ethnic differences between people are not as significant as the differences of individual metabolism, diet, body weight, drinking history, state of health, speed of consumption, intention, context, and history of head trauma. Because many Alaskan Natives suffer disporportionally from these conditions, the relationship between blackouts and genetics again remains unclear.

Mail (1989) suggested that American Natives, along with many other suppressed peoples, suffer disproportionately from both "acculturation" and "deculturation" stresses (e.g., the combined demands to integrate with the dominant culture and the loss and devaluation of their own historical traditions and economic standing). In such cases, alcohol appears to help cope with feelings of inadequacy during periods of rapid personal, cultural or social trauma (Rotman, 1969; Savard, 1968; Topper, 1974). Other researchers stated that 200-500 years of physical suppression, domination, depopulation, and relocation of Native American populations have produced a generalized cultural trauma which would naturally lead many into excessive-drinking (Ackerman, 1971; Berreman, 1964). This situation then becomes magnified by environmental stresses such as limited resources, barren land, and harsh weather. These stressors can tumble even further out of control when additionally fanned by the resulting negative-feedback cycle of anger, rebellion, family breakdown, hopelessness, and substance abuse (Norick, 1970). It is very likely that this chronic trauma eventually will impact the neurotransmitters (as postulated in the RDS model).

May (1992) and Reed (1985) both warned that although alcohol consumption, metabolism, and the negative consequences of alcohol dependence and alcohol abuse can differ among ethnic (tribal), social, and environmental groups, there is often a great variation within the same group. May, and others, concluded that the etiological complex which contributes the most to substance abuse lies within the social, culture, and environmental realm (including subcultures) of their communities, and the social structures of the surrounding regions (Bach & Borstein, 1981; Bennion & Li, 1976; Dozier, 1966; Kunitz & Levy, 1994).

A historical perspective is also helpful. The heavy use of alcohol among Southwest tribes was often encouraged and manipulated by the U.S. Army, was intentionally perpetuated by many missionaries and traders, and is still actively and aggressively encouraged by the liquor industry (Levy & Kunitz, 1975). As an example, several New Mexico legislators implied that they would not vote for an increase in liquor tax (which would have been applied to better treatment programs), or vote for restrictions on liquor advertisements, because the liquor industry was their primary source of election contributions and represented a substantial part of the state's economy (personal communication). The alcohol industry is a significant and integral part of today's U.S. society, especially in reservation border-towns.

Additionally, the majority of non-native government leaders still believe that drinking problems are triggered more by character weakness than by social factors. They continue to believe that a solution simply demands more self-responsibility, discipline, and education; and that it's solution does not require legislative protection (personal observation).

Differences in Drinking Dynamics

Some behavioral aspects of average Navajo consumers differ from those of average non-native drinkers. For example, many Navajo problem-drinkers tend to "binge drink" (or drink rapidly) in contrast to the more typical urban problem-drinker's tendency to drink steadily throughout the day (Heath, 1983). Binge drinking is common among social groups who are temporarily removed from more stable, domestic situations. The rapid, excessive-drinking habits of some college students and young soldiers commonly illustrate this phenomenon.

It was also found that the EEG baselines of most Navajo's suffering from drinking problems were not alpha deficient, contrary to the literature suggesting a predisposing EEG signature for alcohol dependency (Kelley, 1992). It is unknown whether the mean EEG baselines of non-drinking Navajo people tend to be different from the non-native U.S. population norms.

The Cultural Components of Excessive-drinking

The often traumatic dissonance between the Navajo cultural and the dominant, non-native U.S. culture significantly contributes to the disproportionate ratio of drinking problems to the amount of alcohol actually consumed, to the low number of Navajo problem-drinkers who seek treatment, and to the lack of treatment success among those Navajo people who do enter treatment (Christmas, 1978). Anthropologists have identified some social and cultural factors which may pre-dispose the Navajo society to this pattern. MacAndre and Edgerton (1969) suggested that societies often "get" the type of behavior which they allow. Some of these identified, possibly pre-disposing, Navajo social characteristics are as follows: (a) a nomadic-warrior individuality placed within a now-sedentary matrilineal society which increases male-role frustration and the quest for personal independence (Waddel & Everette, 1975); (b) a history of psychoactive plant usage (peyote and other herbs) to induce spiritual power, dreaming, visions, and spiritual contact; (c) the lack of recent historical self-determination, and externally imposed control (Hurlburt, Gade, & Fuqua, 1983); (d) peer conditioning from childhood to consume both rapidly, excessively, and extensively when drinking; (e) aberrant role models from early, non-native contact; (f) higher rates of tough-mindedness, introversion, and emotionality than non-native U.S norms as scored on the Eysenck Personality Inventory corrected for cultural differences (Hurlburt, Gade, & Fuqua); (g) little, or no, "stake" in either the dominant society or the outcome of their drinking problems (Levy & Kunitz, 1975).

The Success of Navajo Specific Treatment

Because most treatment programs for Native Americans are largely based upon the values and strategies of the dominant urban culture, both the rates of treatment

participation and successful treatment outcomes for Native Americans are even lower than the reported rates for non-Native Americans (Kivlahan, 1985). The current Navajo treatment programs typically involve "disease model" education, general behavioral and employment counseling, psychotherapy, the Christian-oriented twelve-step-program, limited medial attention, and various forms of family support. The current rate of success among Navajo-oriented treatment centers is currently considered to be low (personal discussions with Navajo Nation Department of Behavioral Health and RHCH-BHS, 1991 - 1995).

Improving the Effectiveness of a Navajo-Oriented Treatment Program

In designing a more effective treatment for Navajo people, several anthropologists suggested that programs must utilize traditional Navajo cultural techniques, traditional settings, and traditional self-empowerment programs (French, 1989; Kavlahan, 1985; Westermeyer, 1988). Besides addressing the client's specific environmental and psychological concerns in a culturally appropriate way, it is very likely that many traditional Navajo medicine and Native American Church procedures (such as sweat lodge, "blessing-way", herb-usage, and a wide range of often intense ceremonies) will produce significant psychophysiological, neurophysiologiocal, stress-relieving benefits. Currently, active participation in the Native American Church is considered to be more effective than the standard 12-step treatment or medical treatment protocol (Hill, 1990; Pascarosa, 1976). Christian support, for Christian-oriented Navajos, has also proven significant.

The Primary Research Question

In this study, the following question was investigated: Have the 19 participants trained in alpha/theta neurofeedback applied adjunctively within their residential substance abuse treatment program, shown a significant decrease in both their alcohol drinking habits and in related behavioral variables three years later?

Methods

Participants

Nineteen clients (16 men and 3 women) with a history of alcohol abuse or dependence were trained in alpha/theta neurofeedback during a nine month period ending January 1992 (Kelley, 1992). The intensity of their alcohol-related problems varied, ranging from occasional binge-drinking to childhood alcohol dependence. In spite of this range, 74% (14) of these participants met the *DSM-IV* criteria for alcohol dependence and the additional 26% (5) met the criteria for alcohol abuse. Fifteen of the participants were ordered into treatment by a court judgment. Clients ranged from 20 to 56 years old during their initial training and came from low income backgrounds. Only a few were educated beyond a high school level.

The study participants were chosen by the facility nurses. Although the selection process was originally intended to be randomized, as the program evolved, the nurses reported favoring and selecting those clients who they felt needed the most help. One participant was selected, for example, because he began to express excessive anger and threaten the group. Instead of sending him back to jail, the nurses assigned him to the neurofeedback trial. Although this realistically unavoidable selection bias may have skewed the project towards a lower success, it also increased its immediate value to both the treatment facility and the clients. This type of a compromised field design is often ethically essential in clinical settings.

Of the 28 clients who were approached, 2 declined participation, 1 dropped out because of a conflicting schedule, 1 quit after a few sessions, and 1 left the residential facility against medical advice. Four of these clients were not treated but were kept as fully assessed neurological baseline controls, e.g. their EEG baselines were recorded but they were not trained in neurofeedback. These clients were not contacted in this follow-up.

Initial Training Apparatus

During the initial neurofeedback

training period, thoracic and diaphragmatic breath patterns, heart rate and cardiac-respiratory sinus arrhythmia patterns, hand temperature, muscle tension, electrodermal skin responses, and end-tidal CO2 breath gas were frequently monitored. EEG baseline levels were also taken from 19 head sites for both pre and post treatment measures. A computerized J&J I-330 biofeedback module and a Lexicor Neurosearch-24 EEG was used.

Semi-structured interviews and Beck's Depression Inventory were also given as pre and post measures.

Culturally Sensitive Procedures

All biofeedback and neurofeedback techniques were adapted into the Navajo cultural perspective. For example, in order to begin the project in a culturally congruent manner, the written proposal was reviewed and sanctioned by a "blessing" procedure conducted by a recognized Navajo "singer" medicine man. The tribal health committee also arranged for a demonstration of the biofeedback equipment at several Navajo health fairs to observe the public and religious-leader response. The project proposal eventually received formal approval from all of the required tribal agencies including the U.S. Indian Health Service.

Navajo terminology, metaphors, imagery, and music were used to supplement instruction. For example, the Navajo image of breath (nilche') contains subtle concepts of vitality, health, and "holy spirit." By using this image, with its traditional connotations, end-tidal CO2
breath gas balance-training became easy to

instruct. Although breath balance-training is an important component of neurofeedback, it usually requires a long practice and instruction. Other concepts such as self-esteem and self-appreciation were presented by using Navajo metaphors such as eagles and flute eagle-like recordings. On occasion as needed during the sessions, a Navajo therapist, who was also a recognized "singer" medicine man, provided encouragement, blessings, purification, and interpretive guidance. In several cases, for example, clients believed their drinking problems were influenced by a witchcraft-like curse. Although some had unsuccessfully received traditional purification ceremonies before coming to the treatment center, having their neurofeedback sessions sanctioned and blessed with a brief traditional feather and sage smoke ceremony gave them added assurance. Because many of the clients were also Christian-oriented, Christian terminology would sometimes compliment these therapeutic ideas. For example, the imagined image of Christ inside the client's body was used to exemplify both personal power, health, and a safe environment. Such tools were adjunctively utilized to maximize communication, develop rapport, establish a safe environment, and to encourage physiologically-verified shifts. Although these techniques were frequently employed, they were not over-emphasized or exaggerated.

A modest attempt was also made with room decor to suggest a healing environment, e.g., dim lights, protection feathers, a warm blanket, the scent of sage smoke, Navajo spiritual posters, and wall-hangings. Soft Native American music was often played as a quieting-background for those who wanted it.

Initially there was concern that a non-native therapist of European decent, such as the researcher, would be inherently handicapped as an instructor. This seemed not to be the case. Many clients commented that although they usually felt more comfortable with Navajo people, they felt safer talking about private and sometimes culturally taboo or awkward subjects (including witchcraft) with the researcher than with a fellow clan member. Other factors such as an emphatic "foreign authority" were probably also present.

Neurofeedback Training Protocol

All neurofeedback training was

adjunctive to the participant's normal residential treatment regime. The non-neurofeedback program consisted of educational talks about chemical abuse, rest, recreation, bible study and spiritual discussions, group therapy, individual counseling, AA attendance, and weekly participation in a "talking circle" and sweat lodge. Those with diabetes and, or, physical problems received a limited amount of medical attention.

The neurofeedback program was designed, implemented, and completed by the researcher within the Rehobeth-Mckinley Christian Treatment Center - Behavioral Health Services (RMCH-BHS) in Gallup, New Mexico. The initial program funding came from the Navajo Nation Department of Behavioral Health, Window Rock, Arizona. Although RMCH-BHS is an private facility, it is the primary treatment facility for the Navajo Nation.

Participants attended two, 1-hour training sessions per day, five days per week, in addition to their regular residential treatment schedule. Within their 33 day residency, participants experienced an average of 40 neurofeedback training sessions.

After the initial evaluation and an educational overview of self-regulation techniques, participants were trained to raise their hand temperature to 96 degrees Fahrenheit. A finger temperature of 96 degrees usually requires significant parasympathetic relaxation. It is more common for a person's hand temperature to range from 75-92 degrees Fahrenheit depending upon their level of CNS activity (Andreassi, 1989). Because breath gas ratios directly influence brain waves and states of consciousness, deep diaphragmatic breath patterning combined with EMG muscle relaxation was also taught (Fried, 1987).

The neurofeedback procedures used in this project generally followed the Peniston protocol (1989) (see literature review) with the addition of several initial sessions of guided imagery-inductions using Navajo oriented symbols appropriate to the participant. More biofeedback, guided imagery and therapeutic suggestion were incorporated than the standard Peniston approach. The active EEG feedback sensor was place on the head at the CZ location (top-center) in a monopolar configuration with linked ground sensors attached to each ear. Two feedback tones, one representing alpha and the other theta, were fed to the participant through enclosed headphones. The researcher's voice was also routed through the headphones. Quality headphone produces a significantly more engaging experience. Both feedback activating thresholds were set at 66% of the participant's highest resting-baseline alpha/theta amplitude. This means that the participant would generally hear the feedback tones at least 33% of the time. Because a theta dominant state is subjectively deeper than an alpha dominate state, theta awareness (theta tones) were emphasized. A computer video monitor recorded and displayed the EEG data to both client and therapist. After closing their eyes, the participant would initially listen to a 10 minute induction involving "full-body" breath patterns, sobriety, empowerment, and self-healing concepts. Once a significant increase in the alpha/theta EEG frequencies was observed, the therapist's verbal instructions were gradually supplanted by the feedback tones. Before the therapist's voice faded out completely, participants were given a variety of additional instructions such as: (a) "Increase the power of your healing tones by following the sounds deeper inside"; (b) "As you sink deeper into your personal power, the tones will increase. As the tones increase, they purify and cleanse your heart and mind." Scripts were varied according to the preference of each individual.

Each 30 minute period of internal, private neurofeedback practice was followed by a five minute verbally-guided "coming-back" period to shift the client into their normal outwardly-directed awareness. During this

time further sobriety and empowerment images were suggested. An additional 10-15 minutes were spent debriefing the client and cleaning the EEG sensor cream from both the client's hair and the equipment. To prevent disorientation (or any lingering spaciness), time was always taken to mentally engage the client before they left the office.

The majority of participants reported that they experienced deep meditative-like states during their sessions. This was usually verifiable by significant periods of theta dominance on the computer screen. A conscious, inwardly-alert level of awareness was usually maintained. although clients commonly reported losing awareness of the room and even the feedback tones. In a theta dominated meditative state, although the loss of awareness-to-the-outside is typical, a sense of "inner awareness" is maintained. This state can also be characterized by the faint awareness of drifting spontaneous images which are more similar to vivid or disassociated dreams than they are to active thoughts. Drowsiness, or sleep, (although it can occur) is not neurofeedback therapy and can be easily distinguished with EEG and breath pattern analysis. It was not uncommon, however, for some sessions to be subjectively more relaxed than others as verified by both the degree of enjoyable imagery and the level of theta EEG coherence. Most participants reported periods of positive visual subconscious imagery, pleasant sensations, and a feeling of freshness and clarity after each session.

Abreactions such as unpleasant imagery of past traumas, quiet crying or tearing, spontaneous regression, and subconscious movements did occur as typical of deep release altered states of consciousness (Spiegel & Spiegel, 1978) Special attention was given to creating a positive, pleasant, even sensuous, experience for the participant. It is important to realize that even if negative abreactions do occur, the theta-dominant participant tends to experience his or her thoughts a being subtly disassociated from their pleasantly quiet foundation of base-consciousness or self-idenity. It is important to realize that clients is such a meditative state usually feel protected and distanced from the abreacted event. The majority of small physical movements (such as foot jerks) and tears are more frequently due to pleasant or neutral sensations, or even emotional appreciation. In tis study, the vast majority of abreactions were allowed to self-process through to a pleasant outcome. When necessary, this outcome was encouraged with verbal positive imagery or assurance by the therapist, such a telling the client that their brain is just re-organizing as well as reminding the client that they are safe and protected both in their chair and under the white, warm blanket. There was no attempt to analyze, or to facilitate therapeutic regression or the resulting images. In all cases, clients reported feeling safe, comfortable, and protected. Each session concluded by showing the client their session's trend-over-time EEG graph.

During the last few sessions the majority of participants were given brief meditative and self-hypnosis training instructions to use in home practice. Two customized, self-hypnosis empowerment audio tapes were given as home-gifts to each participant. An attempt was made to put individualized and relevant information on the audio tape such as their own name, favorite themes, and children's names. After training, the released participants were encouraged to establish a regular home practice and to attend all other regularly recommended supportive functions (such as traditional healings, sweat lodge, church, and AA meeting).

Semi-Structured Interview

The interview protocol consisted of a simplified, verbally administered, hybrid of six outcome assessment tools in addition to a simplified *DSM-IV* Multiaxial Assessment (American Psychiatric Association, 1994). Emphasis was placed on life-style outcome variables which may influence excessive-drinking (Table 1, p. 45).

For this population, under these often awkward field circumstances, a semi-structured, informal, friendly, slow-moving interview was believed to produce a higher reliability than a more formalized, structured checklist. An attempt was made to make each interview relatively consistent while still sensitive to logistical context, rapport, and Navajo cultural issues. Special efforts were taken to establish an honest and non-judgmental dialogue in an attempt to minimize the self-management of the participant's report. This appeared to be largely successful.

Participants were questioned about the degree and comfort of their sobriety and their freedom from both alcohol and drugs. General questions were also asked concerning their post-treatment life quality, their mood, the amount of support they have been receiving, and their reflections on their past treatment.

The interview schedule (See Appendix A) contained items condensed from the following: (a) Quality-Frequency-Variability Index (Cahalan, Cisin, & Crossely, 1976); (b) National Alcohol Program Information System, ATC Client Progress and Follow-up Form (NIAAA, 1979); (c) Michigan Alcoholism Screening Test (Selzer, 1971); (d) FIDD Six-month Follow-up Questionnaire (Skoloda, Alterman, Cornelison, & Gottheil, 1975); (f) Time-Line Follow-Back Assessment Method (Sobell, Maisto, Sobell, & Cooper, 1979); (g) Addiction Severity Index (McLellan, Luborsky, O'Brien, and Woody, 1980). The interview also contains a modified version of the *DSM-IV* Multiaxial Assessment.

Because of the wide range of variables affecting each participant, the significant, cost-effective value of this program cannot be determined by a simple analysis of the rate of long-term sobriety (IOM, 1990). The categories of outcome illustrated in Table 1 represent the general areas thought to be indicative of improvement in the substance abuse arena (Lettieri, 1992).

Results

Data Collection and Reliability

Because of the transient lifestyle of many of these participants, their lack of established residences, their lack of employment locations, the lack of home telephones, the large size of the four-corners Navajo Nation, and the justified aversion to outside "authorities," this three year outcome assessment was challenging. Of the initial 21 participants, 8 were interviewed face-to face by the author; 5 were personally interviewed over the telephone; the status of another 6 were confidently established by relatives, friends, and counselors; and 2 could not be located (Both were eventually located as doing relatively well 1 year after the study concluded). In most cases, a significant degree of collaboration was established by visiting each location's aftercare specialists, checking their client files when available, checking the regional crises-center database, and talking to local sources such as police, post offices, markets, and neighbors. Each contact was recorded in written notes.

The level of confidence in this information for 9 of these participants is rated "excellent"; enough personal contact was established to fully trust the participant's response. For 8 of these participants, the information confidence was rated as "good"; it is highly likely that the information is accurate even though some of the information comes from other's opinions. For 2 participants the confidence rating was considered to be "fair"; it is likely to be accurate but there is not enough collaborative information to be certain due to minimal contact. Of the 2 participants who could not be located at all, one man was away in school and another had moved without leaving an address. On the average, eight hours of field investigation were required for each participant contact. This involved physically finding the client's home or relatives, asking questions with relatives or friends, physically visiting local behavioral health centers and authorities, and numerous phone calls. Over 2,700 miles of driving were

eventually required.

In the majority of both phone and personal contacts, a small gift exchange was made as is appropriate within Navajo culture. This might involve buying the client lunch, sending them a new audio-relaxation tape, a therapeutic exchange, or offering administrative assistance. Such remuneration has been shown to increase the validity of the interview results by increasing rapport and by defusing the often distorting threat of interrogation and authority (Lettieri, 1992). An extensive number of therapeutic telephone calls occurred with one participant who is in prison. In another case, several free therapeutic sessions have been given to a participant who just left prison. Both have been categorized as alcohol dependent.

Changes in Drinking Status

In an attempt to better understand the dimensional continuum of drinking changes found in these 19 participants three year after their training, two types of category scales were used.The left cluster in Figure 1 shows that of the 19 participants, 12 (63%) can be classified within the *DSM-IV* criteria of "sustained partial remission." These participants have had a few occasional binges (or slips) throughout the three years period but do not drink regularly and did not get into any significant problems. As the worst case in this category, one of these clients did have a series of drinking binges shortly after treatment which landed him an 18 month prison term He has been non-problematic since his release more than a year ago so still fits within this *DSM-IV* category. Four (21%) of the other participants can be classified as "sustained full remission" which signifies that they may have had few minor slips during the past three years but have not binged and do not experience any drinking related problems. Three (16%) of the participants can still be classified as alcohol "dependent" according to the *DSM IV* criteria; they have continuing significant problems associated with excessive-drinking bouts. One of these clients is in prison for a DUI parole violation and another was recently was released for the same violation. Three years earlier, before neurofeedback training, 14 participants were categorized as alcohol dependent and five were categorized as alcohol abusers.

The right hand cluser in Figure 1 is a further break down of the specific changes in the three year post-training history. On this scale of my own design, 2 client's (11%) still have serious problems with dependence. One this "non *DSM-IV*" scale, one client (5%) was classified as a chronic "abuser" rather than "dependent" because he appeared to lack the usual physical dependence characteristics of the *DSM-IV* scale but still had significant drinking-related problems. Eleven (53%) of these participants had occasional experiences with alcohol but all managed to avoid problems. These eleven includes nine (47%) clients who have had infrequent binges but without problems, one (5%) client who was classified a social drinker who consumes regularly (almost daily) but
seldom excessively, and another (5%) who had a drink about once a week. Five (27%) of the participants have had little or no experience with alcohol during the past three years. Although the same people are involved, the differences between the *DSM-IV* scale cluster and the Drinking Dynamic Scale cluster illustrates a difference between classification criteria.

Changes in Life Conditions

The significant psychobehavioral improvement between the pre and post training measures in both Figure 2 and Table 2 demand both a complex and cautious interpretation. Figure 2 represents my subjective estimate of the client's functioning according to the *DSM-IV* "Global Assessment of Functioning Scale" (GAF). Data to rate original status was extracted from both the pre-training interview and from the initial clinical intake file. This information was then compared with my ratings from the three-year outcome interview.

Table 1

Outcome Variables

Changes in alcohol abuse or dependence

DSM IV Substance Abuse Scale
- Dependence - 3 or more symptoms relatively constant/year
- Abuse - 1-2 symptoms relatively constant/year
- Sustained Partial Remission - 1-2 symptoms/year, but not constant
- Sustained Full Remission - no symptoms/year

Drinking Dynamics Scale
- Dependence - same as *DSM IV* criteria
- Abuse - same as *DSM IV* criteria
- Infrequent Binger without problems - Some excessive periods but infrequent
- Social Drinker without problems - Seldom in excess but regular consumption
- Light Drinker - Drinks occasionally, less than six drinks/month
- Infrequent drinker - drinks on rare occasions
- Abstainer - never drinks

Psycho/social/behavioral Scales
- *DSM IV* Global Assessment of Functionality

DSM IV, Axis IV Psychosocial/Environmental Factors

Significant problems with:
- Family
- Social
- Educational
- Occupational
- Financial
- Housing
- Health care
- Legal/Criminal
- Cultural Dissonance (addition)

Amount of aftercare contact

General mood (Beck's depression scale and subjective assessment by interviewer.)

Only one client experienced no apparent change. The two other clients who are still classified as alcohol dependent, reported slight improvements in their lives, even though both were in prison (one was recently released). Although such changes are graphically impressive and statistically significant ($\underline{M}1 = 44$, $\underline{SD} = 9.5$; $\underline{M}2 = 69$, $\underline{SD} = 9.5$; $\underline{t} = 9.55$, $p<.0005$), it is also important to note that the participants present status is still indicative of

people living under tremendous stress who have a relatively modest degree of functioning - certainly not a healthy living situation and certainly one not free from the high risk of relapse.

Table 2 reflects the *DSM-IV*, Axis IV, "Psychosocial/Environmental Factors Scale". On this scale, participants are only rated if they have significant problems in these categories. In these cases for example, a significant problem with the job, money, or house category means that the client has no job, little money, and no real residence. There was no significant improvement apparent in any of the social, educational, job, money, health care, or legal arenas. This finding was not unexpected because these social variables are unusually difficult to change within this economically suppressed location. Significantly, however, 4 of the 11 participants who originally reported serious family problems did improve their family relationships. Also significantly, 4 of the original 13 who reported no available housing situation three years ago were able to find a modest but permanent residence.

The category called "cultural dissonance" was added to the Axis V scale in an effort to acknowledge the significance of this stressor for these clients. In this case, cultural dissonance was rated when a client reported feeling emotionally (and even physically) troubled by living within two often-conflicting cultures. A rating in this category also involves a significant and frequent experience of discrimination or inequality.

Again, the high and persistent level of these participant's psychosocial/ environmental problems keeps them in a chronic "high risk of relapse" condition.

Changes in Depression

There was also a substantial improvement between the client's pre-training Beck's Depression Inventory (BDI) scores when compared to their final post-training scores. The mean pre-training BDI score was 25 (SD = 9) and the mean post-training BDI score was 4 (SD = 4.6). Because one participant's test was invalid, only 18 of the 19 participants were scored on the BDI. Six of the 18 participants scored their post-training BDI as zero, a possible indication of testing problems. Four matched, non-neurofeedback controls also completed pre-treatment and post-treatment BDIs. Their mean pre-treatment BDI score was 24 (SD = 11) while their mean post-treatment BDI score was 10 (SD = 9.3). Although this small number of control participants is not large enough to present a significant control group, it also indicates a significant drop in depression, although at a lesser rate. Because of the time/resource limits and the sensitive cultural field nature of this follow-up interview, a BDI was not given at the 3 year interview. Several questions during the outcome interview, however, involved the self-report of the client's overall experience with depression during the past three years. Because a significant amount of depression was reported, and because there is a correlation between depression and the Axis IV and Axis V scales, periods of depression are still significant within this population. Several of these participants may even meet the criteria for a major depressive disorder. It is my belief that at least six of the 19 participants would currently score within the 10 - 28 (moderately to medium depressed) as indicated by both their self-report and Axis IV and V scores. At least two participants would probably score considerably higher.

Although there seems to be correlation between periods of depression and the participant's relapse-dynamics, within this study's participants this relationship is not always apparent. For example, of the three participants rated still in dependence, one participant does not appear to suffer from significant depression. Two other participants, who are both rated in sustained partial remission but who still occasionally binge drink without obvious problems, usually only drink during happy, social events.

Aftercare Maintenance and Home Practices

Only one participant had been involved in significant aftercare (including two additional residential treatment programs) and AA meetings. This individual, who was scored as in sustained partial remission, was regularly involved in both AA and in traditional practices such as numerous sun dances, Native American Church ceremonies, and vision quests. He attributed his drinking episodes to times when he was depressed or confused about his sexuality. He also reported PTSD symptoms due to childhood sexual trauma.

For the majority of participants with families, their primary support appeared to be family oriented. About half of the participants had also participated in at least one traditional Navajo practice. When asked to elaborate on what had been most helpful in establishing their sobriety, participants commonly cited "spiritual" explanations, often integrated with the nature-oriented images developed during their neurofeedback training. Most of these comments were simple statements such as "I need to be closer to nature", or references to "my higher self", "my inner spirit" and "harmony." At least six clients reflected back to very specific imagery events which occurred in the original neurofeedback training sessions. For example, one woman said that she frequently saw herself (even now, three years after the initial vision) flying above a group of hogans, children, and horses at sunrise. This was obviously an important and stabilizing image to her. Five participants also reported having gone through a family sponsored medicine (blessing or enemy-way) ceremony during these years. There were other reports of attendance in sweat lodge ceremonies, Native American Church (NAC) ceremonies, and Christian practices. The majority of respondents reported a desire to attend more traditional Navajo medicine-way therapies but were unable to afford or arrange it. In at least two cases, relatives implied that negative, witchcraft-like influences were partly to blame for the participant's relapse periods. In one case, a relative reported that the participant was sober and healthy because he had moved into the positive influence of his girlfriend's family. Several members within this new family were well known Native American Church "road men" (spiritual escort-guides during ceremonies). Because of the private, subtle, and cultural nature of such experiences most participants were unwilling to elaborate in more specific detail. Of the 12 participants interviewed in person, or over the phone, at least 9 implied that their neurofeedback/ biofeedback experience had had some sort of spiritual impact.

Although none of the participants reported that they were regularly doing the suggested home practices (such as daily meditation, breathing exercises, and hand warming), many reflected that listening to their guided audio-tapes had been useful over the years. Several talked about remembering to breathe diaphragmatically and fully during times of stress. Most alluded to now knowing how to remain more relaxed than before. They were not specific about how they did this. Many commented (when asked directly) that their hands were now warmer; a partial indication of a relaxed physiology. New relaxation/ motivational tapes were requested by six participants during the interviews[8]

All clients who were personally contacted volunteered that they felt bad about their relapses. Fifty percent of these clients also reported that their hangovers and physical response to alcohol were now different.

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[8]Over the three year period, five participants called requesting new tapes. Numerous additional tape requests also came from Navajo therapists, friends, and relatives. Because customized tape making and shipping is both expensive and time consuming, I found myself attempting to downplay, or avoid, questions about relaxation tapes. Over 200 customized audio relaxation tapes were made on this project.

Anecdotal Observations of the Initial Training Phase

During the initial training phase which occurred three years earlier, experienced nurses reported unexpected behavioral improvements in several of the more "challenging" neurofeedback participants. These positive observations encouraged them to sometimes route their more "difficult" clients into neurofeedback training.

It also appeared that the objective and computerized nature of neurofeedback training, along with constant tracking of EEG data, was psychologically supportive to observing therapists, physicians, and administrators. Additionally, many of these interested observers, after trying an experiential session themselves, reported experiences of relaxation and therapeutic insight not unlike those experienced daily by the study participants.

Discussion

Limitations

Although significant information and experience was obtained, this study has, of course, many limitations.

As a pilot study, control was severely limited by both the lack of staff and funding, as well as the challenge of conducting research under the dynamic and ethical conditions of a desperately-serious real-life situation. The positive outcome of this study, while encouraging further investigation into this protocol, still presents a complex mix of both active, complementary, and passive variables. Due to a historical consensus that substance abuse treatment usually has limited efficacy in this population, and due to the limited funding and exploratory nature of this design, there was no attempt to identify the active variables.

As a qualification, the inclusion of other components (such as the Navajo cultural framework, autogenic training, hypnotherapeutic-like suggestions, and general biofeedback training) necessarily complicates the empirical identification of the essential variables of this trial.

As an important but also complicating caution, several biofeedback researchers have warned of the potential distortion, and even inappropriateness, of trying to isolate variables to better fit experimental criteria and design (Shellenberger & Green, 1986). Furthermore, the self-regulation techniques found in neurotherapy and biofeedback (applied psychophysiology) are necessarily multifaceted, interactive, and emergent in their active variables (Shellenberger & Green, 1989). Effective self-regulation training necessarily involves large amounts of personalized, special attention and high-tech equipment which potentially and often deliberately encourages both Hawthorne and other placebo effects. The very nature of a trained psychophysiological response implies the intentional triggering of the body's natural, largely non-conscious, self-regulating systems. Such a response, by itself, could be considered a placebo except that it is deliberately trained and consciously appreciated (Green & Green, 1977).

Additionally, the unique challenges of the current Navajo biocultural and environmental context, and the general consensus by the Navajo Nation Department of Behavioral Health that their contracted treatment programs are not very effective, made the establishment of a formal control group seem premature.

Other complicating factors which confuse meaningful outcome comparisons between research projects include the lack of standardization of pretreatment assessment, training methodology, outcome criteria, and outcome data collection (Sobell & Sobell, 1976). With this in mind, great care must be taken to keep the presentation of these results within their original context.

In addition, establishing significant inter-rater reliability during the data collection and analysis would have required two field investigators instead of one. Such thoroughness

is not practical and may have even distorted the sensitive nature of the interview situation unless rapport between these interviewers and the participants had been established from the beginning. Finally, a definitive outcome analysis is only possible with an invasive program of random urine and breath tests (which is, in itself, is possibly data-skewing practice).

In another qualifying note, most of these participants could be, or were, dual diagnosed with other psychiatric and medical disorders in addition to excessive alcohol-usage. For example, post traumatic stress disorder, diabetes, closed head injury, depressive disorders, and attention deficit disorders commonly co-occurred. Because of the lack of a thorough medical examination, the majority of these symptoms and diagnosis were not recorded on the intake records. Because of time/resource limitations, these special conditions remained largely untreated. Such undocumented conditions also complicates an evaluation of efficacy.

The "treatment" versus "person" variable was again difficult to isolate. Good neuro and biofeedback training requires as much empathy and personal influence as do all forms of good therapy, education, and medicine. It is important to also note, however, that "person" and "rapport" quality within the standard RMCH residential treatment facility was also high in spite of the usually discouraging outcome.

Natural maturation-learning additionally complicates the isolation of active variables in long-term outcome studies. Knitz & Levy's (1994) 25 year study which observed that 80% of Navajo men commonly stop, or taper, their drinking after 50 years of age does indicate that some aspect of the remission forund in this study may be due to increasing maturity. On the other hand, because the mean age of this participant group is currently 38 years old, the influence of three years of additional aging is probably slight. The maturity factor as a confounding variable, of course, is always present in all outcome studies.

Overall Evaluation

With these limitations acknowledged, it appears that significant long-term changes have occurred and that the original study question has been answered positively. Drinking has become a less significant and less damaging component in the majority (81%) of these participant's lives. The general overall life-skill functioning of these clients has improved significantly, even if not yet to ideal levels. Although the majority of the participants voiced appreciation for their neurofeedback experience and its impact on their lives, it is not yet possible to isolate this variable alone as the primary cause.

I found the encouraging, albeit modest, outcome results in this harsh environment a pleasant surprise. None of my colleagues were optimistic about any of these clients. With one exception, none of the participants appeared to experience drinking problems during the several months of unannounced and randomly conducted interview contacts. The researcher was also surprised by the apparent frankness of the clients responses. Participants appeared open and interested in re-establishing contact. Although descriptions of relapse were understandably linked with embarrassment and hesitation, there did not appear to be much impression-management or an attempt to manufacture socially pleasing answers. Questions about the participant's drinking dynamics were always asked after a degree of confidence and friendship had been re-established.

With only a one exception, all participants are still living within persistently high-risk conditions. Because of the limited available resources within the rural Navajo Nation area, as well as the increasing social/economic recession of the dominate society, these conditions are unlikely to get better. Without exception, these participants are intelligent, caring people trying their best

under very difficult and persistent situations.

Subjectively, at the end of their initial neurofeedback training period three years earlier, clients generally reported finding the training experience interesting, enjoyable, self-empowering, and refreshingly different from their previous treatment experiences. The protocol emphasized techniques which worked immediately and could be felt physically, an unusual experience for clients more familiar with talk and educational therapy. The protocol also appeared to significantly address most of the participants desire for spiritual experiences. Most also voiced that neurofeedback training had been successfully modified, and was perhaps even strengthened, by both the Navajo cultural and traditional medicine-way context. Experienced facility nurses also reported significant and unexpected improvements in some of their most difficult clients (change which they attributed to neurofeedback). Additionally, the computerized objective feedback and verification value of the neuro-biofeedback instruments appeared encouraging to clients, therapists, administrators, and physicians.

Although no participant appeared to be regularly practicing biofeedback skills on a daily bases, all reported that these initial experiences were significant and helpful during their three-year post-training period. Even the three participants who are still abusing alcohol were adamant that the neurofeedback experience had been helpful in their basic survival.

Although not part of this outcome study, the majority of Navajo therapists (about 14), who had periodically observed the initial neurofeedback training sessions three years earlier, expressed similar opinions after their own personal experiential trial sessions.

These positive results are also consistent with two recent studies of Bodenhamer-Davis & deBeus (1995) and Fahrion (1995). Both of these new studies reported a significant improvement in both usage and behavior. Although these are different populations with different environmental conditions, these outcomes compliment this study.

It is important to again emphasize that alpha/theta neurofeedback training (and its related stress-reducing skills) are, at best, only complimentary and adjunctive tools. Neurofeedback training increases the probability that the participant will feel both physical and mentally more resilient during their life. When risk conditions become excessive, or if the client does not generalize these practices into their daily lives, this effort still may not be enough. The lack of traditional aftercare support, the lack of home practice, the absence of ongoing training, and lack of social support severely limits the continuing influence of such a program. My surprise at the relatively positive results of this study results from the majority of these participants doing relatively well in spite their non-supportive environments.

BDI scores. The dramatic reduction of mean BDI scores between pre and post training probably involved a wide range of other variables in addition to neurofeedback training such as the relief of completing residential treatment. Because six neurofeedback participants scored their post-training BDI as zero, and because there was also a significant decrease on the BDI in the four, non-neurofeedback controls, the BDI data itself may be of limited value. For example, there is no doubt that the 30 day residential stay in the pleasant environment of the RMCH treatment facility has a significant positive effect on depression.

The Peniston Effect

The researcher was unable to verify what is commonly referred to as the "Peniston effect." Peniston (1989) had reported that his group of neurofeedback trained problem-drinkers appeared to develop a physiological "allergy-like" response (the more common

response of excessive alcohol to most people but not as typical in heavy users). Although 50% of the interviewed participants did say that drinking alcohol now gives them more side effects, such a conclusion is complicated by both the guilt of their relapse and the accepted neurofeedback procedure of intentionally making a mild aversion-like suggestion repeatedly during the training sessions. Although harsh or strong aversion suggestions were not made, clients were humorously warned that they might not feel good if they drank again. All of the participants who reported this phenomenon did remember that physical aversion had been originally discussed. When asked if they resented this suggestion, all said "no." It maybe significant to note that in the only client situation where a serious relapse was treated, the observing nurses reported that they had to heavily medicate the neurofeedback-trained client during his detox period. This need for detox medication had not been previously necessary during this client's numerous pre-training detox periods; a clear indication that his response to alcohol was now different. Both the nurses and the participant voiced belief that this unusually harsh withdrawal/hangover was due to the neurofeedback training.

Clinical Implications

As previously outlined in the literature review, the essential ingredients of neurofeedback training have not been identified and remain controversial. The active ingredients in neurofeedback certainly involve a complex range of influences including: (a) induction of the relaxation response; (b) induction of a beneficial neurologically-based altered state of consciousness which produces both chemical balance and emotional satisfaction; (c) the benefits of both Hawthorne and placebo responses combined with the other essential psychological values of faith, expectation, belief, and hope; (d) the new experience of physiological/ psychological self-control in a situation where the client had previously felt helpless; (e) the apparent experience of what the participants commonly describe as a significant spiritual insight.

These components of neurofeedback training may someday become an essential modality within the ideal treatment package. The effective mechanism of neurofeedback appears to address the Reward Deficiency Syndrome and Feel Good Response model (Blum, 1991), The Altered-State Fulfillment model (McPeake, Kennedy, and Gordon, 1991), the Natural Mind model (Weils, 1972), and the Tension Reduction and Stress-related hypothesis. Neurofeedback also appears to compliment a wide range of cultural and religious traditions including, but not limited to, both Navajo and Christian faiths.

To increase cost-effectiveness, a more streamlined group approach to neurofeedback is absolutely essential. Additionally, although there are numerous benefits to using neurofeedback and biofeedback training and verification equipment, it is also possible that non-instrument based neuro-enhancement techniques (such as meditative or hypnotic-like procedures) may produce similar neurological/behavior results. Such alternatives, especially if still combined with the unique values of neurofeedback, may even have some advantages (such as better long-term home practice).

Wickramasekera's (1995) model of somatization/absorption/risk profiles, when applied to such use-disorder populations, may indicate that problem-drinkers have a higher than average degree of negative somatic response or sensitivity to the environment. Wickramasekera's model may also help predict which participants would respond best to high-tech neurofeedback, soft-tech meditative procedures, or more traditional cognitive skills training. In other psychophysiological applications, for example, Wickramasekera's model has accurately predicted which participants would respond best to a hypnotic-only approach versus the more time-consuming biofeedback-only approach. If participants were

found to score high on Wickramasekera's absorption scale it might be possible that they could achieve the same beneficial results as neurofeedback but by using self-hypnotic or meditative techniques. If this were the case, however, both the quantifying and emotionally exciting aspects of neurofeedback would still be occasionally warranted to both evaluate and affirm the participant's progress. Neurofeedback techniques are also more culturally/professionally acceptable to psychologists, administrators, physicians, and (very importantly) church leaders than are self-hypnotic and meditative techniques.

The major weakness of neurofeedback is the over-reliance upon expensive and time-consuming equipment. While the use of such equipment within treatment facilities has many unique benefits, few, if any, clients have access to this equipment at home. Rather than thinking of neurofeedback as a short-term treatment (or procedural treatment) for substance use disorders, neurofeedback training should actually become an introduction to the life-long practice of various influential psychophysiological self-regulation skills. Although such techniques are not for all clients (or needed by all), those clients who do value them should be taught more self-sufficient techniques which they enjoy practicing on a regular bases. To encourage daily maintenance-practice, these techniques should be also be deeply intertwined with the clients own religious, social, and professional systems.

Another problem of professional credibility also exists when neurotherapists teach their practices to relatively sophisticated spiritually-oriented clients. For example, although both the 12-step AA model and the majority of traditional therapists vocally encourage "spirituality", such encouragement rarely amounts to more than lip service. Professional resistance to the actual application of spiritual practice is actually common. Very few therapists practice daily relaxation/spiritual skills themselves making their effective instruction of these practices difficult and often incomplete. Although 58% of all Americans reported an interest in spiritual experience, few psychologists ever receive relevant spiritual training (Lukoff, 1995). Alfa-theta neurofeedback training commonly involves spiritual-like experiences.

The demand for self-sufficient psycho-physiological home practices places even greater demands upon the therapist than neurofeedback alone does. For example, unlike the more mechanical approach of neurofeedback training, meditation skills really need to be taught by an experienced teacher/practitioner and place within the context of the participants life. To make this training situation even more complex, because different techniques produce different results, and because each individual client has his or her own preferences and ability, such training often also needs to be individualized.

One final factor inhibits the wide-spread use of clinical neurofeedback training within substance abuse treatment facilities. Effective neurofeedback requires computer and equipment skills, the complications of hookup and cleanup, a wide range of psychophysiological training skills, and time consuming data analysis. Unfortunately, while rewarding to the therapist, and while appreciated by the client, this increased work load is often prohibitive with the contemporary tight budgets of most treatment centers.

Future Research

A quantitative comparison between the participant's pre and post training baseline EEG signatures and their relationship to the participant's post-treatment behavior should be made. Both the subjective-experiential reports of the participants and their EEG data should be compared with the substantial literature on meditative and altered-enhanced-state techniques.

Although it is probably important for this protocol to remain as multifaceted and

integrated as possible, it would be worthwhile to investigate the outcomes associated with fewer components.

Many of the reports of these participants, their therapists, and the nurses concerned the unusual, but subtle, self-empowering aspect of this protocol. This important experiential value might be better illustrated and appreciated with a rigorous phenomenological analysis rather than an quasi-experimental or experimental design.

Although the quality of information exchange during the interviews appeared good, there are inherent limitations in this process other the obvious concern over the integrity of the drinking self-report. The follow-up interview is a meeting between people who had been in an intense therapeutic relationship punctuated by a long period of separation. During the interview, both persons are trying to quickly reorganize and understand their new relationship. In most cases, this meeting was a surprise event occurring spontaneously under less than ideal conditions (e.g., standing outside in a strong wind, sitting in a car, inside a noisy restaurant, inside a small home with other people in the background). Neither party could be can be fully relaxed or reflective. With a list of more than 50 question-guidelines (which must be answered within a limited time frame) many important experiences and perceptions, no doubt, go unreported. For example, one of the participants kept telephoning after the interview to add information such as; "now I remember, I actually had a long period of sobriety before quitting that job." Questions such as "what factors were most important in establishing your sobriety" may be understandably answered in an incomplete manner. An ideal outcome study would involve a series of at least three interviews; an initial re-acquaintance meeting in the participant's home environment, a more detailed semi-structured interview meeting, and a final follow-up summary meeting. Information depth might also increase if the second meeting were held in a neutral, more formal place, and if the client were compensated in such a way that his or her full, undivided attention was both warranted and available. Ideally, the participant will be encouraged into a role of co-researcher, rather than remain a simple respondent.

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