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Perceptuomotor Function of Homeless Males in Alcohol Rehabilitation

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In a sample of 76 alcohol rehabilitation program (ARP) residents, homeless men demonstrated significantly poorer perceptuomotor function than nonhomeless men. This difference persisted despite similarities in several factors associated with neurobehavioral test scores including demographic characteristics; frequency, quantity, and duration of alcohol and other substance use; psychosocial factors, including motivation and social support; health, including history of head trauma; and neurotoxic occupational exposure.

Neurobehavioral tests have been employed to assess cognitive and motor impairment linked to chronic alcohol use too subtle for detection by standard medical examination (Eckardt et al., 1988; Goldman & Goldman, 1988; Sanders, Nixon, & Parsons, 1989; Tamkin & Dolenz, 1990; Tarbox, Connors, & McLaughlin, 1986). These same tests are sensitive to psychosocial characteristics attributed to chronic alcohol use such as depression, low motivation, and other psychosocial factors. Individuals among the homeless comprise a subgroup of chronic alcohol users who have been studied extensively. Yet few studies have examined whether there is a difference in neurobehavioral function between homeless and nonhomeless chronic alcohol users.

The research question draws from two different areas of study. One is the abundant literature on neurobehavioral function and the other is the increasing

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number of studies on homeless individuals. From the literature on neurobehavioral function, investigators suggest that chronic alcohol users remain abstinent for approximately a week or so to allow the more acute manifestations of alcohol withdrawal to dissipate before measuring motor and cognitive function (Goldman, 1986; McCrady & Smith, 1986; Tarter & Ryan, 1983). Then, after chronic alcohol users maintain an additional 6 to 31 days of abstinence, test scores indicate improved motor function (Eckardt, Parker, Noble, Feldman, & Gottschalk, 1978; Eckardt, Ryback, & Pautler, 1980; Long & McLachlan, 1974). This finding has been demonstrated in several studies using Finger Tapping and Purdue Pegboard tests to detect impairment in hand speed and dexterity, respectively (Adams, Grant, & Reed, 1980; Eckardt, Parker, Noble, Pautler, & Gottschalk, 1979; Eckardt et al., 1980; Goldstein, Shelly, Mascia, & Tarter, 1985). However, these findings have not been replicated in all studies (Adams et al., 1980; Eckardt et al., 1979).

Like motor performance tests, cognitive function tests particularly perceptuomotor tests, have been used to detect neurological impairments. Among the cognitive tests, perceptuomotor tests are among the most sensitive to alcohol-related impairment, possibly because they simultaneously measure multiple neurobehavioral functions, such as visual scanning, cognition, and motor speed (Hartman, 1988; Lezak, 1983). The perceptuomotor tests, Trail Making Test (Part A and B) and Digit symbol, have been used in many studies to measure neurobehavioral impairment in chronic alcohol users (Eckardt et al., 1988; Goldman, Williams, & Klisz, 1983; Kish, Hagen, Woody, & Harvey, 1980; Schaefer & Parsons, 1986).

Nevertheless, neurobehavioral motor function and cognitive tests are not without limitations. Age, history of head trauma, depression, low self-esteem, poor social support, low socioeconomic status, unemployment, low educational levels, and low verbal intelligence (measured by vocabulary) are associated with poorer neurobehavioral function (Eckardt & Martin, 1986; Fein, Bachman, Fisher, & Davenport, 1990; Öjehagen, Skajaerris, & Berglund, 1988; Spreen & Strauss, 1991). Motivation is another potentially confounding variable that rarely is measured for its effect on neurobehavioral performance. Because neurobehavioral measures are effort dependent, it has been assumed that motivation influences test scores (Bronisch & Hecht, 1987; Favazza & Thompson, 1984; Richards, Goldberg, Rodin, & Anderson, 1989; Steffenhagen & Steffenhagen, 1985). Yet, few studies have tested this assumption empirically.

Initially, this investigation was conducted to examine the influence of motivation, social support, and previous work history on neurobehavioral function for recovering chronic alcohol users; however, preliminary findings revealed that many respondents had experienced homeless episodes. This finding was not unexpected, because a recent compilation on alcohol problems among the homeless population found that prevalence rates of alcohol problems ranged between 41% and 58% (Fischer, 1991). Consequently, the purpose of this article is to examine whether there is a difference in baseline neurobehavioral function between homeless and nonhomeless alcohol users.

METHODS

Subjects

Data were collected from individuals enrolled in a 110-bed, residential, adult rehabilitation program (ARP) operated by the Salvation Army in Baltimore, Maryland (Zlotnick, 1992). ARP candidates were referred from area hospitals and detoxification centers. Only males, 25 or older, without diagnosed serious medical or psychological illnesses and capable of working 40 hours per week were eligible for admission into the ARP (and consequently, the study).

All new entrants whose primary substance abuse problem was alcohol were contacted by the researcher between the fourth and ninth day after admission. This lag time was incorporated to allow program participants to acclimate to their new surroundings and overcome the more severe symptoms of alcohol withdrawal. Of 79 entrants who were approached for study recruitment, two declined (97.5% participation). Informed consent including a certificate of confidentiality was obtained for the other 77 entrants.

Measures

The two-part testing session consisted of: (a) a pretest and interview component, and (b) a neurobehavioral function testing session. The pretest consisted of the 10-item Mini-Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) that was used to screen respondents. Respondents who obtained scores of 27 or below were judged as incapable of participating in the study.

The 60-minute interview included demographic information, psychosocial measures, substance use, and vocabulary test. The demographic information was comprised of questions selected from the Epidemiologic Catchment Area Survey Questionnaire (Eaton et al., 1984) on age, ethnicity, and social network; and questions from the Service Needs of the Homeless Survey (Breakey et al., 1989) on homelessness and informal work sector activities (untaxed, income-generating activities not reported to governmental agencies). Also included were questions on health (e.g., head trauma and diabetes) and work history, including occupational exposures to neurotoxic agents.

Five psychosocial measures of depression, self-esteem, social support, and motivation were obtained using standardized methods of administration and coding to avoid inconsistencies that may result from using isolated questions or anecdotal reports of psychosocial status (Bronisch & Hecht, 1987; Fagan & Mauss, 1986; Richards et al., 1989). To avoid problems due to differences in reading levels of study participants, all scales were read by the interviewer. The Achievement Motivation Test consisted of two scales. One measures desire to do well at a job and the other measures the desire to succeed in life (Costello, 1967). The Perceived Social Support Scale also contained two parts, one assessing social support from friends and the other from family (Procidano & Heller, 1983). Rosenberg's Self-Esteem Scale (Rosenberg, 1965) and Center for Epidemiological Studies-Depression Scale (CES-D; Radloff, 1977; Weissman, Sholomskas, Pot-

tenger, Prusoff, & Locke, 1977) have been used on chronic alcohol users (Charalampous, Ford, & Skinner, 1976; Nocks & Bradley, 1969; Weissman et al., 1977) and homeless individuals (Padgett & Struening, 1992; Padgett, Struening, & Andrews, 1990; Susser, Conover, & Struening, 1989).

The substance use scale elicited information on quantity, frequency, and duration of cigarette smoking, use of seven illicit drugs, and alcohol use for the past month, 3 months, and 1 year (Addiction Research Foundation, 1982). Based on this information, estimates were calculated of alcohol intake (cc) per day during the 12-month period prior to admission.

The vocabulary subscale of the Wechsler Adult Intelligence Scale–Revised (WAIS–R; Wechsler, 1981) was administered. Vocabulary skills are thought to be resistant to the effects of alcohol and other neurotoxins and are used as indicators of premorbid neurobehavioral function (Lezak, 1983).

Five neurobehavioral measures with established, standardized tests were chosen because of their utility and previous administration in studies measuring neurological impairment of chronic alcohol abusers (Eckardt et al., 1988; Goldman & Goldman, 1988; Lafferty & Kahn, 1986; Malloy, Noel, Rogers, Longabaugh, & Beattie, 1989). The same person, trained in administration of neurobehavioral function tests, used standardized protocols to conduct all tests.

1. *The Finger Tapping Test* (Reitan & Davidson, 1974) is a test of speed that enumerates lever depressions made by the index finger within 30 seconds. Two trials were conducted on each index finger. The final score was the sum of both trials for each finger.
2. *Purdue Pegboard* (Tiffin, 1968) includes three tests for hand speed and dexterity. The object of the first two tests is to place as many pegs as possible into vertically arranged holes within 30 seconds. Both hands are tested. In the third test, Assembly, a pre-established pattern of two washers, a collar, and a peg are replicated as fast as possible in 60 seconds. Two trials of each test were performed. The final score was the mean of those trials.
3. *Simple Visual Reaction Time* (SVRT; Wilkinson & Houghton, 1982) measures the elapsed time (in milliseconds) between a red light that illuminates and the participant response of pressing a white button. Thirty-two trials were obtained and the median of these trials was the final score.
4. *Digit Symbol* (Wechsler, 1981) is a paper-and-pencil test in which the participant fills in the symbol that corresponds with each number indicated on the key. The final score was the total number of correctly filled-in blanks in 90 seconds.
5. *Trail Making Tests, Part A and B* (Army Individual Test Battery, 1944) are two paper-and-pencil tests. In Part A, numbered dots are connected as fast as possible. In Part B, numbers and letters are connected alternately. Each test was scored by the number of seconds required to complete the test.

Homeless status was based on whether the respondent had lived in shelters, missions, or on the street for any period of time in the past year. Respondents

without this experience were categorized as not homeless. This classification scheme was used in another investigation studying participants in public alcohol treatment (Robertson, Zlotnick, & Westerfelt, 1993). A more commonly used method of classification bases homeless status on where the individual slept the previous night. However, this definition would be inappropriate when this study only enrolls participants who have started residential treatment following detoxification.

Procedure

Over the 14-month data collection period, 79 men were approached. Two men refused. A third scored below 27 on the MMSE and was excused. A fourth became emotionally distraught during the psychosocial questions and was unable to continue. A fifth individual was foreign-born and eliminated because the psychosocial questionnaires were standardized for English speakers. Thus, subsequent analyses were conducted on the remaining 74 respondents. Fifty-two were classified as homeless based on the sleeping places that they used during parts of the last year. The other 22 were classified as nonhomeless.

Statistical analysis was conducted using SAS®. Comparisons between groups were conducted with chi-square tests of independence for discrete variables and Student t tests for continuous variables. Least-squares regression models employing forward stepwise regression were used so that independent variables with p values equal or below .05 were added to regression equations and variables with p values over .10 removed. Residual analysis was conducted on all final models to ensure that least-squares assumptions were not violated.

RESULTS

Homeless and nonhomeless groups were comparable in race, age, education, WAIS–R vocabulary scores and employment history (see Table 1). Most respondents were 25 to 44 years old, had not received high school diplomas, and were unemployed prior to admission. Race was divided approximately equally between white and black. The only significant demographic difference was that more respondents in the homeless group had never been married than in the nonhomeless group. Similarly, no differences were found between homeless and nonhomeless respondents on the following psychosocial variables: depression, self-esteem, motivation scales, and social support from family or friends. In addition, no differences were found between homeless and nonhomeless respondents on hospitalizations, head trauma, diabetes, disability in the upper extremities, or neurological problems. Approximately 35.6% of the total sample reported head trauma (27.3% of the nonhomeless and 39.3% of the homeless group, $p = .33$). The association between reported head trauma and scores on the Digit Symbol Test (noted for sensitivity to head trauma) was examined, but none was found.

There were no differences in substance use history including frequency, quantity, or duration of use for illicit substances, cigarettes (pack-years), or alcohol (cc/year). Furthermore, there were no differences in duration of abstinence

Table 1. Demographic Characteristics Between Homeless and Nonhomeless Respondents

	Nonhomeless $n = 22$		Homeless $n = 52$	
	N	(%)	*N*	(%)
Age				
≤ 35	10	(45.5%)	21	(40.4%)
> 35	12	(54.6%)	31	(59.6%)
Race				
White	10	(45.5%)	26	(50.0%)
Black	12	(54.6%)	26	(50.0%)
Marital status				
Never married	16	(72.7%)	12	(25.0%)*
Grade level				
< 12th grade	11	(50.0%)	28	(53.9%)
Work history month prior to admission				
None	9	(40.9%)	32	(61.5%)

*$p < .001$.

prior to neurobehavioral tests between men in homeless and nonhomeless groups. Among neurobehavioral tests, no statistical differences between groups were found in vocabulary scores; right and left Finger Tapping; right, left, and assembly Purdue Pegboard; or Simple Visual Reaction Time. However, significant differences were discovered between homeless and nonhomeless groups on the perceptuomotor tests, Digit Symbol, and Trail Making tests (Part A and B; see Table 2). Because these findings may have been influenced by other known confounders, multiple regression models were constructed for each perceptuomotor test. Several independent variables, including age, history of head trauma, social support from friends, social support from family, both motivation scales, and depression, as well as the dichotomous variable of homeless or not homeless, were introduced into the model in a stepwise fashion. However, the association between homelessness and all three perceptuomotor tests remained. The variable of homeless was significantly associated with poorer perceptuomotor function in Trails Part A ($\beta = 9.79$, $p < .05$, $R^2 = .27$) and Trails Part B ($\beta = 25.44$, $p < .05$, $R^2 = .25$). Social support from family ($\beta = -0.56$, $p < .10$) and homelessness ($\beta = -7.90$, $p < .05$) were associated with performance on Digit Symbol ($R^2 = .32$).

This study examined whether homeless and nonhomeless chronic alcohol users demonstrated differences in neurobehavioral function. Despite overwhelming similarities in demographic characteristics (except marital status), psychosocial factors, health status, histories of head trauma, substance use, and occupational history, respondents in the homeless group demonstrated poorer perceptuomotor function compared to respondents in the not homeless group.

Perceptuomotor tests are complex neurobehavioral tests requiring integration of motor and cognitive skills, and therefore may be more sensitive in detecting

impairment (Lezak, 1983). These neurobehavioral differences may have existed prior to chronic alcohol use. However, no differences were found on the WAIS–R vocabulary test, a scale used to examine premorbid neurobehavioral function.

Marital status was the only other variable that differed between groups. Many surveys have discovered that homeless alcohol abusers are often unmarried or living in a single state (Fischer, Shapiro, Breakey, Anthony, & Kramer, 1986; Koegel & Burnam, 1985).

Yet, except for marital status, the homeless and not homeless groups in this study were similar. They possessed similar educational backgrounds, verbal intelligence (as measured by the WAIS vocabulary test), and levels of unemployment. They demonstrated similar levels of psychosocial function on social support, social networks, motivation, depression, and self-esteem. The lack of difference in these measures may indicate that the psychosocial instruments were too sensitive and nonspecific to detect group differences. Another possibility is that the sample size was too small to detect differences. It might also be that due to stringent admission criteria established by the Salvation Army Rehabilitation Program, respondents in both groups were very similar.

Several researchers have suggested that chronic alcohol abuse might increase the risk of becoming homeless (Drake, Wallach, & Hoffman, 1989; Fischer, 1991). If the course of homelessness for chronic alcohol abusers is pictured as a single continuum extending between homeless and nonhomeless states, then the two groups of homeless and nonhomeless adults in this sample were bordering

Table 2. Psychosocial and Neurobehavioral Test Scores of Homeless and Nonhomeless Respondents

	Nonhomeless $n = 22$[a]		Homeless $n = 52$[a]	
Variable	***M***	***SD***	***M***	***SD***
Self Esteem	2.9	1.60	2.9	1.60
Depression	24.1	12.57	23.8	13.83
Social support—Family	8.6	4.93	7.3	5.39
Social support—Friends	6.9	4.26	8.2	4.42
Motivation to do job well	3.9	1.04	4.0	1.15
Motivation to succeed in life	3.5	1.95	4.4	1.58
WAIS-R Vocabulary	36.8	14.04	33.3	14.72
Right Finger Tapping	51.2	6.24	47.3	8.75
Left Finger Tapping	47.7	5.77	45.4	7.50
Visual-reaction time	227.4	38.59	259.1	98.87
Right Handed Pegboard	28.2	4.17	26.1	4.19
Left Handed Pegboard	27.5	4.00	25.7	3.73
Pegboard assembly	64.8	16.11	57.5	14.64
Digit symbol	52.1	14.69	44.3	12.90*
Trail Making A	33.7	13.28	43.8	17.18*
Trail Making B	80.2	41.02	105.6	47.49*

[a]Sample sizes for some tests vary due to missing values for some respondents.

*$p < .05$

one another at the center of the continuum. If this is the case, it may be that men in the nonhomeless group were admitted to treatment prior to the point of becoming homeless.

Still, these results may not be generalizable to others admitted to residential alcohol treatment programs due to the idiosyncratic admission procedures of the ARP. Also, respondents who left prior to 4 days after admission were not eligible to enter the sample. Further, these data are cross-sectional and limited to describing associations. If there is a progression in which chronic alcohol abuse contributes to eventual homelessness, and homelessness is associated with neurobehavioral impairment, then there is an even greater need to intervene, reestablish societal ties, and initiate rehabilitation before chronic alcohol abusers deteriorate further and experience homelessness.

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