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The Neurobehavioral Cognitive Status Exam (NCSE) with Geriatric Inpatients

Michael W. Wiederman, PhD
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ABSTRACT. The Neurobehavioral Cognitive Status Examination (NCSE; Northern California Neurobehavioral Group, Inc., 1988) has been proposed as a brief yet sensitive instrument to screen for cognitive impairment such as that occurring in dementia. In the current study we investigated the nature of the NCSE with a large sample of geropsychiatric inpatients ($N = 503$). The results of the current research suggest that the NCSE is a useful screening instrument sensitive to the differentiation of psychiatric illness versus organic cognitive impairment among geriatric inpatients. The Comprehension, Constructions, and Memory subtests each uniquely contributed to the statistical differentiation of depression from dementia. Scores on the subtests of the NCSE were generally inversely related to age and positively related to years of formal education, but these correlations were rather small in magnitude. Subtest intercorrelations were generally moderate in size and consistent among the scales suggesting that the subtests are relatively independent measures of different facets of cognitive functioning. Although further research is needed with different samples, the NCSE shows promise as a screening instrument

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for cognitive impairment among elderly adults. [Single or multiple copies of this article are available from The Haworth Document Delivery Service: 1-800-342-9678, 9:00 a.m. - 5:00 p.m. (EST).]

Dementia and depression are among the most commonly occurring mental health problems faced by the elderly. Approximately fifteen percent of people over 65 years of age have some form of dementia (Joynt & Shoulson, 1985; Kaszniak, 1986) and an even higher proportion of senior citizens will suffer from depression (Perlmutter & Hall, 1985; Roybal, 1988). For the clinician, distinguishing between the two diagnoses in individual clients can be problematic (see Benedict & Nacoste, 1990, for an overview of this issue). For example, in the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV*; American Psychiatric Association, 1994, p. 139) the differential diagnosis for dementia includes depression.

The Neurobehavioral Cognitive Status Examination (NCSE; Northern California Neurobehavioral Group, Inc., 1988) was developed as a brief screening instrument to assist the clinician in evaluating cognitive functioning (Kiernan, Mueller, Langston, & Van Dyke, 1987). The NCSE may be useful in differentiating the cognitive deficits that can occur with depression from those that accompany dementia, but this specific issue has received little research attention. The primary purpose of the current study was to explore the role of the NCSE in the differential diagnosis of dementia versus depression among geriatric inpatients.

The NCSE assesses multiple domains of cognitive functioning, yet, because it was designed as a screening tool, takes only ten to twenty minutes to administer (Kiernan, Mueller, Langston, & Van Dyke, 1987). Scores are generated on ten subscales designed to measure orientation, attention, and functioning within five major ability areas: language (comprehension, repetition, and naming), constructions, memory, calculations, and reasoning (similarities and judgment).

Orientation is evaluated with respect to person, place, day, date, and time, whereas attention is assessed through repetition of sequences of digits. Comprehension is assessed through performance of a series of verbal directives made by the clinician. In the repetition section of the NCSE, the client is asked to repeat sentences verbatim, and in the naming portion of the test, the client is

asked to name a series of familiar objects. Constructional ability is assessed in much the same way as in the Wechsler Adult Intelligence Scale-Revised (Wechsler, 1981) using red and white colored tiles to reproduce patterns presented by the clinician. Memory is measured by the client's recall of four words after an interval of approximately ten minutes. After clear indication of memorizing the words, the tests of language and constructional abilities serve as interference and recall is scored with regard to the type of prompting required. Calculation ability is assessed through arithmetic problems verbally presented to the client. Verbal reasoning abilities are measured through asking the client how two items are alike (similarities) and what she or he would do in a series of everyday predicaments (judgment).

The NCSE was normed on healthy adults of varying ages (Kieran, Mueller, Langston, & Van Dyke, 1987) but also has been validated with neurosurgical patients (Northern California Neurobehavioral Group, Inc., 1988). In clinical trials the NCSE has been shown to be more sensitive to detection of cognitive impairment when compared to the Mini-Mental State Examination (Fields, Fulop, Sachs, & Strain, 1992; Schwamm, Van Dyke, Kiernan, Merrin, & Mueller, 1987).

Recently Logue, Tupler, D'Amico, and Schmitt (1993) investigated the psychometric properties of the NCSE in a large sample of psychiatric inpatients aged 15 to 92 years. They found that the psychiatric patients consistently scored below the normative sample described in the test manual (Northern California Neurobehavioral Group, Inc., 1988, p. 11) and that scores on each subtest were negatively correlated with age. Logue et al. (1993) also investigated whether those subtests that are conceptually related demonstrated higher intersubscale correlations than did seemingly unrelated subtests. Their data revealed moderate correlations (.22-.48) among the subscales of the NCSE with no apparent clustering of certain subscales.

Given the potential utility of the NCSE for clinicians, the relative lack of empirical research on the instrument is disappointing. The current study was undertaken with data relevant to a common use of the NCSE—assessment of geropsychiatric inpatients. As such, there were several objectives of the current research:

1. The relationship of age to NCSE scores was further investigated. The negative correlations found by Logue et al. (1993) are not surprising given the wide range of ages in their sample. However, the question of whether age is related to performance on the NCSE among elderly adults remains unanswered.
2. The manual for the NCSE (Northern California Neurobehavioral Group, Inc., 1988) cautions that individuals with superior premorbid intelligence may still score in the average range despite substantial cognitive loss (p. 18). In the current study we explored the potential relationship between formal education and NCSE scores.
3. The NCSE includes three subscales meant to measure language abilities and two subtests meant to measure reasoning (Kiernan et al., 1987). The implication of this test structure is that some subscales are more highly interrelated than are others. The intercorrelations among subscales of the NCSE when administered to geriatric patients was also a focus of the current investigation.
4. The extent to which the NCSE is useful in the differential diagnosis of dementia versus depression in elderly patients was investigated, including exploration of which subtests are most useful in making such a distinction.
5. Last, the issue of how subpopulations of geropsychiatric patients perform on the NCSE was explored. For example, what are the NCSE score profiles for elderly individuals with psychiatric diagnoses other than depression, a documented cerebrovascular accident (CVA), multi-infarct dementia, or a long-standing history of alcohol abuse? These were issues explored in the current research.

METHOD

Subjects

Participants in the current study ($N = 503$) were 150 men and 353 women who were inpatients at a midsized general hospital at the time of testing (between 1987 and 1993). The vast majority were patients on a 30-bed, comprehensive geropsychiatric program designed to meet the mental health needs of patients ages 50 years

and older. Participants in the current study ranged in age from 50 to 93 years with a mean of 74.69 years ($SD = 8.06$).

Procedure

The data used in the current study were gathered in the process of providing formal consultations to physicians when those physicians suspected, or wished to rule out, the presence of a dementing illness in the case of a particular patient. Conducting the consult consisted of integrating information from the history and physical performed at time of admission, nursing staff observations since admission, the results of any lab work or brain imaging techniques, a diagnostic interview, and the results of the NCSE. All patients were interviewed and tested by one of several predoctoral clinical psychology interns or supervising clinical psychologists either in the patient's room or in a small testing room.

The data in the current study comprise those 503 inpatients with whom the above procedures were performed and who were given a primary diagnosis of dementia of the Alzheimer's type or dementia not otherwise specified ($n = 194$), major depression ($n = 163$), a psychiatric diagnosis other than major depression ($n = 100$), or cognitive impairment secondary to a documented CVA ($n = 16$), vascular dementia ($n = 11$), or alcohol-induced persisting dementia ($n = 19$). The psychiatric diagnoses included personality disorders, adjustment disorders, schizophrenia, delusional disorder, panic disorder, generalized anxiety disorder, post-traumatic stress disorder, or a psychotic or manic episode.

The current data were not collected for research purposes but rather accumulated in the process of providing clinical consultation. As such, the diagnoses were not made blind to NCSE scores. Despite the potential methodological limits of this approach, we believe that the current data represent a high degree of external validity and are indicative of the typical use of the NCSE in actual clinical practice.

RESULTS

Within the entire sample, the number of years of formal education ranged from two (second grade) to eighteen (Master's degree), with a mean of 10.98 years ($SD = 2.83$). Age and education were unrelated

($r = -.05$, $p < .27$) and the correlations between age and education and the ten subscales of the NCSE are presented in Table 1. Consistently, age was negatively related to performance on the NCSE, whereas in general formal education was positively related to NCSE scores. The intercorrelations among the subscales of the NCSE are presented in Table 2. The correlations ranged from .21 to .56 and were all statistically significant.

What about mean scores on the subscales of the NCSE as a function of diagnostic category? The mean scores are presented in Table 3 and illustrated in the subsequent figures. Figure 1 illustrates the mean profiles for the dementia and depression groups, and the overall difference is apparent. The mean profiles for the psychiatric, CVA, vascular dementia, and alcohol-induced persisting dementia groups are illustrated in Figures 2-5, respectively. Note that these profiles all appear remarkably similar.

The question of the predictive validity of the NCSE in determining depression from dementia remains. To address this issue a probit regression analysis was conducted using the ten subscales of the NCSE as predictors of diagnosis (depression vs. dementia) while

TABLE 1. Correlations Between Age and Education and Subscales of the NCSE ($N = 503$)

SUBSCALES	AGE	EDUCATION
ORIENTATION	-.19	.08
ATTENTION	-.05	.14
COMPREHENSION	-.18	.09
REPETITION	-.14	.09
NAMING	-.23	.19
CONSTRUCTIONS	-.22	.18
MEMORY	-.19	.09
CALCULATIONS	.02	.26
SIMILARITIES	-.11	.34
JUDGMENT	-.10	.19

Note: All correlations with absolute value greater than .15 are $p < .001$, correlations greater than .09 are $p < .05$.

TABLE 2. Correlations Among the Subscales of the NCSE (N = 503)

SUBSCALES	1	2	3	4	5	6	7	8	9
(1) ORIENTATION	—								
(2) ATTENTION	.30	—							
(3) COMPREHENSION	.56	.32	—						
(4) REPETITION	.43	.39	.50	—					
(5) NAMING	.48	.31	.48	.47	—				
(6) CONSTRUCTIONS	.43	.23	.44	.34	.45	—			
(7) MEMORY	.55	.21	.38	.32	.39	.38	—		
(8) CALCULATIONS	.37	.27	.43	.30	.42	.49	.33	—	
(9) SIMILARITIES	.45	.34	.48	.41	.50	.53	.34	.50	—
(10) JUDGMENT	.44	.23	.47	.38	.46	.39	.38	.45	.49

Note: All correlations are $p < .0001$.

TABLE 3. Mean Subscale Scores on the NCSE by Diagnostic Category

n =	ALL (503)	DEMENT (194)	DEP (163)	PSYCH (100)	CVA (16)	VDM (11)	ALCOH (19)
ORIENTATION	9.45	7.23	11.04	11.25	9.88	8.91	9.05
ATTENTION	6.52	5.85	7.09	6.97	6.13	6.45	6.47
COMPREHENSION	5.13	4.23	5.63	5.64	5.13	5.27	5.16
REPETITION	11.01	10.22	11.64	11.66	10.81	9.54	11.11
NAMING	6.61	5.82	7.20	7.40	6.25	5.73	6.32
CONSTRUCTIONS	2.24	0.99	3.25	3.46	1.25	1.45	1.63
MEMORY	7.00	4.45	9.10	8.75	7.38	6.18	5.89
CALCULATIONS	2.95	2.27	3.42	3.56	2.94	2.54	2.84
SIMILARITIES	4.09	2.72	5.23	5.22	4.06	2.73	3.32
JUDGMENT	4.30	3.49	4.94	4.88	3.81	4.09	4.63

Note: ALL = Total Sample, DEMENT = Dementia of the Alzheimer's type or dementia not otherwise specified, DEP = major depression, PSYCH = psychiatric diagnosis other than major depression, CVA = cerebrovascular accident, VDM = vascular dementia, ALCOH = alcohol-induced persisting dementia.

FIGURE 1. Mean NCSE Profiles for the Dementia ($n = 194$) and Major Depression ($n = 163$) Groups

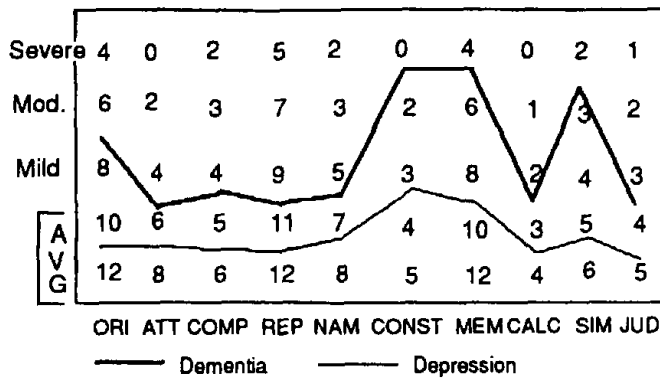
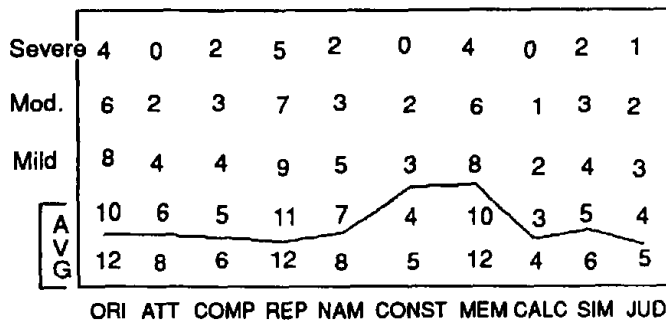


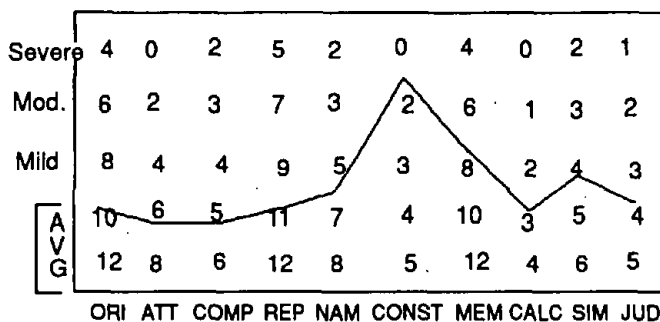
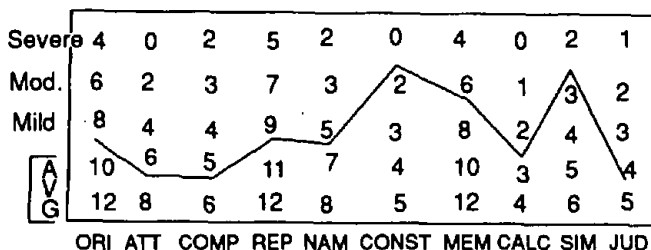
FIGURE 2. Mean NCSE Profile for the Psychiatric Group ($n = 100$)



controlling for patient age and education. The probit regression equation was statistically significant and the results of this analysis are presented in Table 4. The individual subscales which independently differentiated a primary diagnosis of depression from a diagnosis of dementia were Comprehension, Constructions, and Memory.

DISCUSSION

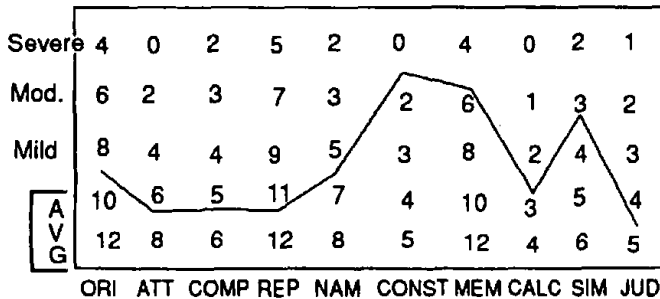
The NCSE has been proposed as a brief yet sensitive screening instrument for cognitive impairment (Kiernan et al., 1987). In the

FIGURE 3. Mean NCSE Profile for the Cerebrovascular Accident Group ($n = 16$)FIGURE 4. Mean NCSE Profile for the Vascular Dementia Group ($n = 11$)

current study we investigated the nature of the NCSE as used with geropsychiatric inpatients. Among general psychiatric inpatients, Logue et al. (1993) found decreased scores on the subscales of the NCSE with advancing age. We too found that scores on the subscales were generally inversely related to age, even though our sample consisted of geriatric patients. We also found that scores on some subscales, most notably Similarities and Calculations, were positively related to number of years of formal education. Accordingly, clinicians should consider the patient's educational level when evaluating NCSE profiles.

What about the intercorrelations among subscales? Our findings with geropsychiatric inpatients were consistent with those of

FIGURE 5. Mean NCSE Profile for the Alcohol-Induced Persisting Dementia Group ($n = 19$)



Logue et al. (1993) who studied general psychiatric inpatients. Like that study, we found that intercorrelations across subscales were fairly consistent, a finding which does not support the notion that some of the subscales are more conceptually related than others as the constructors of the test implied (Kiernan et al., 1987). Further, the correlation coefficients obtained in the current study were remarkably similar in magnitude to those obtained by Logue et al. (1993, p. 85). With regard to differences in score profiles as a function of diagnostic category, the mean profiles for the Depression and Psychiatric groups were remarkably similar (see Table 3 and Figures 1 and 2) and were indicative of average cognitive functioning. When the Dementia and Depression groups (see Figure 1) were statistically compared (Table 4) the two groups were reliably differentiated based on NCSE scores. In particular, the Comprehension, Constructions, and Memory subtests all contributed uniquely to the differentiation of depression from dementia. The relationship of memory deficits to the diagnosis of dementia is not new (Mitrushina, Satz, Drebing, Van Gorp, Mathews, Harker, & Chervinsky, 1994) and a recent meta-analysis (Lachner & Engel, 1994) revealed that the best memory tests for differentiating dementia from depression involve delayed recall after distraction. The memory subtest in the NCSE involves such recall after a period of distraction. Use of a formal memory test is important as those with dementia are most likely to deny memory deficits when

TABLE 4. Results of the Probit Regression Analysis Using the Subscales of the NCSE to Differentiate Dementia ($n = 194$) from Depression ($n = 163$) After Controlling for Age and Education

Variable	Coefficient	Standard Error	t Ratio	Probability
CONSTANT	5.74	1.82	3.16	.002
AGE	.02	.01	1.82	.07
EDUCATION	.04	.03	1.52	.13
ORIENTATION	-.08	.05	-1.58	.11
ATTENTION	-.10	.07	-1.38	.17
COMPREHENSION	-.25	.11	-2.25	.02
REPETITION	-.10	.11	-.90	.37
NAMING	.02	.08	.28	.78
CONSTRUCTIONS	-.26	.07	-3.74	.0002
MEMORY	-.31	.05	-6.51	.00000
CALCULATIONS	-.14	.10	-1.37	.17
SIMILARITIES	-.10	.06	-1.68	.09
JUDGMENT	-.12	.08	-1.46	.14
Log of Likelihood Function = -93.46				
$\chi^2 (12, N = 357) = 305.29, p < .0001$				

asked for a self-report (Sevush & Leve, 1993). The current results suggest that the practicing clinician pay closest attention to scores on the Comprehension, Constructions, and Memory subtests when using the NCSE in attempting to distinguish dementia from depression.

The mean profile for the Dementia group closely approximated the typical profile for mild to moderate dementia provided in the test manual (Northern California Neurobehavioral Group, Inc., 1988, p. 17). What about the other etiologies for cognitive impairment explored in the current study? The mean profiles for the CVA, vascular dementia, and alcohol-induced persisting dementia groups were all similar to each other (see Figures 3-5) and were similar to the mean profile for the group diagnosed with dementia of the Alzheimer's type

(Figure 1). It appears that the NCSE may be a useful instrument for determining the existence of cognitive impairment in general, but, in line with its development as a screening device, it may not be sensitive to differentiation among organic causes of impairment.

In summary, the Comprehension, Constructions, and Memory subtests of the NCSE each uniquely contributed to the statistical differentiation of membership in the depression versus dementia categories. Scores on the subtests of the NCSE were generally inversely related to age and positively related to years of formal education, but these correlations were rather small in magnitude. Subtest intercorrelations suggested that the subscales are relatively independent measures of different facets of cognitive functioning. Although further research is needed with different samples, the NCSE shows promise as screening instrument for cognitive impairment among elderly adults in a clinical setting.

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