Cognitive Impairment and Enduring Negative Symptoms: A Comparative Study of Geriatric and Nongeriatric Schizophrenia Patients

by Katherine M. Putnam and Philip D. Harvey

Abstract

Chronically institutionalized geriatric (n = 174; average length of hospitalization = 35.1 years) and nongeriatric (n = 59; average length of hospitalization = 17.3 years) schizophrenia patients were classified with regard to their enduring negative symptoms (ENS) over a year. All patients completed neuropsychological tests that have been previously found to be implicated in geriatric schizophrenia: the Mini-Mental State Examination (MMSE), the Modified Boston Naming Test, Constructional Praxis, and Word List Learning and Delayed Recall. With MMSE scores used as covariates, ENS status and age group effects were examined on the cognitive measures at the second assessment. Results indicated that there was considerable specificity of cognitive impairment in the ENS syndrome even in patients with a chronic course of unremitting illness. Furthermore, when specific cognitive measures were examined and global impairment statistically controlled for, patients with ENS manifested a distinct pattern of impairment, rather than uniformly inferior performance. In particular, patients with ENS performed more poorly on tests putatively sensitive to frontal and parietal lobe functions, replicating earlier results on younger patients with a much better overall functional outcome. These data suggest that ENS defines a distinct subgroup of patients that can be identified even against the backdrop of chronic institutionalization.

Keywords: Schizophrenia, geriatric, negative symptoms, deficit symptoms, neuropsychological tests, cognitive impairment.


While a complete consensus on the most important features of schizophrenia remains elusive, definitions of the illness from its earliest descriptions (Bleuler 1911/1950; Kraepelin 1919/1971) have consistently noted impairments in emotion and volition. Although there are other prominent features of schizophrenia, such as positive symptoms, social impairments (Strauss et al. 1974; Lenzenweger et al. 1991), cognitive impairments (Gold and Harvey 1993), and symptoms of disorganization (Liddle 1987; Harvey et al. 1997), the importance of negative symptoms in the illness remains undisputed (Crow 1980, 1985; Andreasen and Olsen 1982; Carpenter and Strauss 1991).

Negative symptoms have been found to be associated with global and specific cognitive impairments (Green and Walker 1985; Nuechterlein et al. 1986; Addington et al. 1991; Davidson et al. 1995) and to be cross-sectionally correlated with poor functional outcome in schizophrenia (Keefe et al. 1987; Perlick et al. 1992; Harvey et al. 1998). Negative symptoms early in the illness predict a poorer functional outcome at both short-term (Breier et al. 1991; Carpenter and Strauss 1991) and long-term (Knight et al. 1979) followup periods. An additional important aspect of negative symptoms is their strong temporal stability as compared to positive symptoms. This has been found with both nongeriatric patients (Pfohl and Winokur 1982; Pogue-Geile and Harrow 1985; Johnstone et al. 1986; Mueser et al. 1991) and geriatric patients (Putnam et al. 1996). Data also suggest that negative symptom severity may be established very early in the course of the illness and remain a consistent traitlike characteristic of most schizophrenia patients (Lindenmayer et al. 1986; Carpenter and Strauss 1991).

In order to reach criteria for the deficit syndrome, as proposed by Carpenter and colleagues (see Carpenter et al. 1988), specific negative symptoms must meet the requisite condition of being both primary and enduring. According to Carpenter and colleagues (Carpenter et al. 1988), the symptom profile of nondeficit patients is...
expected to fluctuate in time, whereas the negative symptoms of deficit patients are expected to be more persistent and to represent a core of primary and enduring features. As negative symptoms are multiply determined, it becomes imperative to separate negative symptoms that are secondary to neuroleptics, psychosis, depression, demoralization, or socioenvironmental deprivation (Carpenter et al. 1988) from those that are determined to be primary. The deficit criteria are based on the assumption that primary ENS will have more significance for subtyping than cross-sectional presentation of positive and negative dichotomy (Wagman et al. 1987). This pattern of symptomatology is thought to represent the presence of a specific pathophysiological process that is independent of the processes that determine psychotic or disorganized symptoms (Buchanan et al. 1990). The long-term predictive validity and temporal stability of the deficit distinction has been established (Fenton and McGlashan 1994). Strong interrater reliability and moderate correlations among items reveal that the syndrome is "cohesive but not redundant" (Kirkpatrick et al. 1989).

The deficit subgroup is characterized by emotional constriction and has been found to have clinical, social, neurobehavioral, and brain imaging correlates (for review, see Fenton and McGlashan 1991). Studies have also found specific patterns of cognitive impairment, rather than overall poorer global performance by deficit patients. Compared to schizophrenia patients who do not meet deficit syndrome criteria, schizophrenia patients who do meet criteria for the deficit syndrome have been found to exhibit poorer performance on neuropsychological tests, especially those sensitive to frontal and parietal lobe functions (Wagman et al. 1987; Buchanan et al. 1994), decreased accuracy on the Continuous Performance Test and Span of Apprehension task (Buchanan et al. 1997), and abnormal smooth pursuit eye movements (measures that are associated with decreased metabolism in the frontal and parietal association cortex) (Thaker et al. 1989; Ross et al. 1996).

In terms of brain imaging studies, deficit patients have been found to have reduced glucose metabolism in the frontal and parietal cortices and thalamus as assessed with positron emission tomography (Tinninga et al. 1992), larger right caudate volumes (Buchanan et al. 1993), decreased left temporal lobe brain volume (Turetsky et al. 1995), and a higher rate of neurological signs (Buchanan et al. 1990). These neuroimaging findings are consistent with the patterns of cognitive impairments seen.

Deficit patients have also been shown to have higher scores on measures of social and physical anhedonia (Kirkpatrick and Buchanan 1989), to demonstrate impairments in social skill acquisition (Kopelowicz et al. 1997), and to be characterized by poorer premorbid adjustment (Buchanan et al. 1990). However, deficit patients have not been found to differ from nondeficit patients in demographic variables such as their mean current age, age of illness onset, duration of illness, number of hospitalizations, age at first hospitalization, or positive symptom and total scores on the Brief Psychiatric Rating Scale (Carpenter et al. 1988; Buchanan et al. 1990; Buchanan et al. 1994). However, some studies report this subgroup to have significantly fewer years of education (Buchanan et al. 1993) and lower head-of-the-household socioeconomic status (Buchanan et al. 1993; Buchanan et al. 1994).

In addition to the impairments documented above, it has been proposed that the deficit syndrome is characterized by neuropsychological impairments (Wagman et al. 1987) and neural substrates that are distinct from those simply associated with severe negative symptoms (Buchanan et al. 1993). Buchanan et al. (1994) have suggested that the frontal and parietal lobes are implicated in the neuroanatomical substrate of deficit symptoms. Because of the reciprocal interconnections between the frontal and parietal cortices (Cavada and Goldman-Rakic 1989a, 1989b) and the extensive connections with the thalamus, Buchanan et al. (1994) suggest that these regions (i.e., the dorsolateral prefrontal and inferior parietal cortices and the thalamus) are implicated in the pathophysiology of the deficit syndrome. This suggestion is further strengthened by studies that have linked decreased rCBF and decreased glucose utilization in the frontal lobes with decreased rCBF in the inferior parietal cortex (Volkow et al. 1987; Andreasen et al. 1992; Liddle et al. 1992; Wolkin et al. 1992). However, it remains unclear if schizophrenia patients with the deficit syndrome have a specific pattern of neuropsychological impairment or simply a greater degree of global cognitive impairment that becomes manifest on more difficult tasks.

Schizophrenia patients have multiple cognitive impairments (Gold and Harvey 1993), with impairments on tests sensitive to brain dysfunctions in the frontal, temporal, and parietal lobes, as well as on measures of attentional functioning. As noted above, deficit patients appear to have a specific pattern of impairment on cognitive tests sensitive to damage to the frontal and parietal lobes in neurological patients. Thus, deficit patients are not simply deficient on a generalized basis.

Studies of the deficit syndrome have examined samples of relatively young schizophrenia patients, who varied substantially in their level of chronicity. Although there is much data that corroborates the symptom heterogeneity among younger people with schizophrenia, there is a paucity of research that chronicles symptomatic changes in late life in schizophrenia patients with an early illness onset (Harris et al. 1994). A recent study of chronically institutionalized
geriatric schizophrenia inpatients who have very poor functional outcome as defined by nearly any criteria, has suggested that these patients manifest negative symptom severity scores and levels of cognitive impairment that are substantially higher than those of extremely chronic younger schizophrenia patients who were from the same institution (Davidson et al. 1995). In contrast, positive symptom severity was reduced in comparison to the younger patients. The implication is that, at least for patients with very adverse functional outcome, there is a worsening of negative and cognitive symptoms that occurs at some point in the aging process. A retest study of geriatric patients from the same research group (Putnam et al. 1996) found that negative symptoms and cognitive symptom subtypes were extremely stable over a one-year follow-up while the positive symptoms and positive symptom subtype were exceedingly variable. These findings may implicate an enduring negative or deficit syndrome subtype that is ubiquitous at later stages of the life span in patients with poor functional outcome. A limitation of this earlier study was that patients were not characterized in terms of the enduring nature of their negative symptoms on a case-by-case basis.

One of the main goals of this study is to examine patients with a poor functional outcome individually and determine if all appear to have ENS. Variability in the enduring nature of negative symptoms in chronically institutionalized patients would indicate that chronic institutionalized does not induce a deficitlike state in all patients examined.

The present study examined geriatric and nongeriatric patients on measures of cognitive functioning that have been previously found to be considerably impaired in geriatric chronic schizophrenia patients. This study is novel in several respects. First, the use of the longitudinal determination of the enduring nature of negative symptoms will allow for examination of the prevalence of this syndrome in institutionalized patients. Secondly, the inclusion of a geriatric group of patients enables the testing of age-related differences and their interaction with the ENS syndrome. Third, global and specific measures of cognitive functioning allow for determination of the specific characteristics of cognitive differences between the groups. Since the geriatric patients in this sample are already known to have more profound global cognitive impairments than the younger patients studied previously, earlier findings of specific, rather than global, cognitive impairments in deficit patients can be replicated across samples with more variance in their level of global cognitive impairment. Although the enduring nature of the negative symptoms is examined longitudinally, only the cognitive variables from the second assessment are examined.

Four questions were addressed in this study:

1. What proportion of poor-outcome patients meet criteria for the ENS syndrome?
2. What are the age-related differences in the prevalence of the syndrome?
3. Is the pattern of cognitive impairment associated with the ENS syndrome global or specific?
4. Do these cognitive impairments differ according to the age of the patients?

Methods

Subjects. This study is part of a long-term project concerned with the clinical and cognitive impairments associated with long-stay schizophrenia inpatients. The recruitment and diagnostic process for this study has already been described (Davidson et al. 1995), yet a brief description will be provided here. In order to generate "life-time” DSM-III-R diagnoses of schizophrenia (American Psychiatric Association 1987), a psychiatrist reviewed all medical records over the patients’ entire life span, interviewed collateral informants (most often clinical staff), and used information from interviews with the patients. In the chart review process, only specific examples of symptoms were counted for the purpose of diagnostic determination. In order to be included in the study sample, patients had to meet DSM-III-R criteria for schizophrenia for at least the first 10 years of illness, and for an additional 10 years prior to the current diagnostic workup. If the presentation of the illness had changed such that a patient met criteria for "not currently mentally ill” or for a disorder that excludes the diagnosis of schizophrenia for any 10-year period including the present, the patient was excluded. Sixty-nine percent (565) of the total population of 819 geriatric (over age 65) inpatients met current and lifetime DSM-III-R criteria for schizophrenia on the basis of the diagnostic process. Ten percent (57) of those 565 cases had evidence of seizure disorder, idiopathic Parkinson’s disease, or substance abuse. As a result, we began with a cohort of 508 cases, which then were scheduled for an initial cognitive and functional assessment. Of the 508 patients, 200 had to be excluded for one or more of the following reasons: refusal to cooperate, cognitive impairments that were so severe that cognitive assessments and symptom ratings were impossible, a MMSE score of 0 (which could reflect poor cooperation as well as gross cognitive impairments), and sensory impairments. The resulting sample of subjects included 308 patients and was described in detail in Davidson et al. (1995). At the time of the first assessment, all patients had been hospitalized for at least 10 years.

A sample of 78 nongeriatric patients was also examined. These patients were also long-stay inpatients at the same psychiatric center and were reported on previously as well. All of these patients were also rediagnosed and assessed with a similar procedure. All of these patients...
had been hospitalized for at least one full year by the time of assessment.

All of these patients had a very poor functional outcome. The institution in which they resided had been actively involved in a program of downsizing for the past decade. These patients had been repeatedly passed over for discharge, even to nursing home care, because of the severity of their symptoms. As noted in previous reports on this sample (e.g., Harvey et al. 1998), these patients had much more severe cognitive, adaptive, and negative symptoms than community-dwelling patients of the same age and educational levels.

Followup Methods. Two hundred and two of the 308 geriatric schizophrenia inpatients received complete followup testing. The followup interval ranged from 10.5 to 19.5 months (mean = 12.96, standard deviation = 2.02; mode = 12 months). This consists of all geriatric patients from the initial study who were available for reassessment 12 months after their first evaluation and entry into the prospective study. Forty-three subjects had died during the followup period, and 63 subjects were unavailable for reassessment due to being discharged to nursing home care. The demographic and symptom variables (age, length of psychiatric illness, years of education, total positive symptoms, and total negative symptoms) of the 106 patients who were unavailable for reassessment and of the patients included in these analyses were compared with a multivariate analysis of variance (MANOVA). The MANOVA revealed no significant overall main effect of unavailability at the p < 0.05 level. Sixty-six of the original 78 nongeriatric patients were retested. The reason for unavailability of the rest was discharge in all cases. Likewise, those patients who were discharged did not differ from those who were not discharged on the above-listed variables.

Assessments

Positive and Negative Syndrome Scale (PANSS). The PANSS is a 30-item scale divided into three subscales and rated on a seven-point (1–7) scale (Kay et al. 1987). The first seven items fall under the rubric of positive symptoms and the next seven items under the rubric of negative symptoms; the last 16 items are used to rate general symptoms and to assess mood, disorders of activity, anxiety, and so forth. The interrater reliability of these ratings was acceptably high, with intraclass coefficients ranging from a low of 0.86 to a high of 1.0 (all p's < 0.001). No rater rerated the patient at the followup assessment.

The rater judged individual items from the PANSS as being ratable or not in each patient. Reasons for an item being judged as unratable were a patient’s lack of cooperation or the presence of a physical impairment that impeded the rating. All items judged as unratable were substituted with means within each scale. If a patient had more than three unratable items within either the positive or the negative scale, that patient’s data were excluded from the analyses. Twenty-eight geriatric cases were excluded according to the above criteria; thus, the final geriatric sample included in these analyses was 174. A total of 1.8 percent of the items were substituted by means. Seven of the 66 nongeriatric cases were excluded according to the above criteria; therefore, the final nongeriatric sample was 59 cases. Only one nongeriatric subject was missing one data point on the first assessment.

Cognitive Assessment. All subjects were examined with a variety of clinical and cognitive assessments, and the results are presented from the second assessment, after determination of enduring symptom status. Patients were examined with the MMSE (Folstein et al. 1975) and the Consortium to Establish a Registry for Alzheimer’s Disease (CERAD, Morris et al. 1989) cognitive battery. The CERAD battery was administered with the standard stimulus materials and instructions used in the original studies of Alzheimer’s disease with these instruments. We have previously demonstrated the reliability and validity of this battery in the assessment of patients with chronic schizophrenia (Davidson et al. 1996; Harvey et al. 1996).

Modified Boston Naming Test. Subjects are presented with 15 line drawings and asked to name the objects depicted. Of the 15 drawings, 5 are of objects whose names are used with high frequency in spoken English, 5 of objects whose names are used with moderate frequency, and 5 of objects whose names are used with low frequency. In order to examine difficulty effects, we used the most and least common occurrences as the dependent variables.

Constructional Praxis. Four drawings (a circle, a diamond, overlapping rectangles, and a cube) are presented to the subject, who is instructed to copy them exactly. Reproductions are scored according to predetermined criteria. Again, we used the easiest (circle) and the most difficult (cube) drawings as our dependent variables.

Word List Learning and Delayed Recall. A ten-item list of words is presented to the subject on three separate learning trials. After each trial, free recall of the list is required of the subjects. After a delay, filled by the Praxis examination, a delayed recall of the word list was required. The dependent variables for this report were the total number of words recalled over three learning trials and the number of words learned by trial 3 that were recalled at the delayed recall (savings).

Determination of ENS Status. The ENS/non-ENS (NENS) classification used was based on Carpenter et al.’s
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(1988) deficit criteria using the PANSS ratings at both assessments. Kirkpatrick et al. (1993) previously utilized a proxy case-identification tool based on the Brief Psychiatric Rating Scale (BPRS, Overall and Gorham 1962) to categorize deficit and nondeficit schizophrenia patients on a cross-sectional basis. This measure proved to be more useful than the severity of blunted affect alone, and the authors recommended the use of this proxy measure in circumstances that do not allow for the full deficit assessment.

Since the PANSS provided more complete symptom information than the BPRS, we developed a set of deficit criteria based on Carpenter et al.’s model that includes more aspects of the deficit criteria of the Schedule for Deficit Syndrome (SDS, Kirkpatrick et al. 1989). “Restricted affect” on the SDS was substituted with “Blunted affect” on the PANSS. “Diminished emotional range” on the SDS was substituted with “Emotional withdrawal” on the PANSS. “Poverty of speech with curbing of interest and decrease in curiosity” was unable to be substituted. “Diminished sense of purpose” on the SDS was substituted with “disturbance of volition” on the PANSS. “Diminished social drive” on the SDS was substituted with “Passive/apathetic social withdrawal” on the PANSS. If some combination of two or more of the negative symptoms listed above was present at a severity level of 4 (moderate) or more at both the first and second assessments, we then considered the patient to meet criteria for ENS.

To be able to compare our methods to those of Kirkpatrick et al. 1993, we generated a proxy measure based on their identification criteria. Therefore, we took a sum of the scores of the Anxiety, Guilt Feelings, Depression, and Hostility items, then subtracted this sum from the score for Blunted affect (Kirkpatrick et al. 1993). All patients had a proxy score for the first and the second assessment. Since we had previously demonstrated that the stability of positive symptom severity in this sample was essentially nil (Putnam et al. 1996), using a longitudinal determination of enduring symptom status reduced the likelihood that positive symptoms were causing inflation in the severity ratings of negative symptoms. In order to examine the influence of environmental deprivation on these symptoms, we compared the length of current stay across patients who did and did not meet ENS status within each age group. Descriptive characteristics of the subjects, including MMSE scores and PANSS ratings, are presented in table 1, including the breakdown of ENS status by age group and the proxy scores for the ENS syndrome.

Results

Twenty-five of the 59 nongeriatric patients (42%) and 94/174 (54%) of the geriatric patients met longitudinal criteria for ENS. In order to examine the validation of the
ENS measure utilized in this study, the proxy scores (Kirkpatrick et al. 1993) were compared across the ENS groups. The means and standard deviations of the proxy scores (blunted affect – [hostility + guilt + anxiety + depression]) for time 1 and time 2 are as follows: ENS/geriatric (n = 93) = -2.85(5.58)/-1.98(3.24); ENS/nongeriatric (n = 25) = -4.24(2.91)/-2.72(2.88); NENS/geriatric (n = 81) = -5.63(3.89)/-5.44(3.32); NENS/nongeriatric (n = 34) = -5.73(3.22)/-5.24(3.29).

Independent sample t tests indicated that the ENS group had significantly lower proxy measures for both the first and the second assessments, t(231) = -4.14, p < 0.0001, and t(231) = -7.62, p < 0.0001, respectively.

This is consistent with the findings of Kirkpatrick et al. (1993), thus validating our determination of ENS status by comparing the proxy scores of the ENS and the NENS patients. ENS patients did not statistically differ at the p < 0.05 significance level from NENS patients on the depression score from the PANSS on either the first or the second assessment. In addition, ENS patients showed less anxiety than the NENS patients at the second assessment, t(231) = 3.97, p < 0.01. This difference is in the opposite direction than would be expected if anxiety were accounting for negative symptoms. Therefore, our classification of ENS syndrome status is consistent with the SDS criteria in that at least two negative symptoms were present for the preceding 12 months even during periods of clinical stability and were not secondary to factors such as anxiety, positive psychotic symptoms, or depression. Then, length of current hospital stay was compared across the ENS and NENS patients in geriatric and nongeriatric patients with t tests. Neither of these two t tests were significant: t(57) = 0.24, p > 0.50, and t(172) = 0.45, p > 0.50. For the remainder of the analyses, the ENS classification measure used is the longitudinal classification rather than the proxy score.

Analyses of variance (ANOVAs) with age group and ENS status as the between-group variables were performed on the clinical measures at the second assessment and on the demographic variables. An age group effect was found for education, F(1,229) = 46.43, p < 0.0001; the nongeriatric patients had significantly more years of education. An age group effect was also found for age at first hospitalization, F(1,229) = 40.78, p < 0.0001; geriatric patients were hospitalized for the first time at an older age. There was an age group effect for the positive symptom subscale of the PANSS, F(1,229) = 15.73, p < 0.0001; younger patients had higher symptom scores on this subscale, and no main effects were found for ENS status on the positive symptom subscale of the PANSS. To ensure that ENS patients were not simply exhibiting more severe overall symptoms, the positive and the general scales of the PANSS at time 2 were combined and analyzed with an ANOVA, with age group and ENS status as the between-group variables. No main effects were found for age group or for ENS status. Effects were found for both age group and ENS group on the negative subscale of the PANSS: F(1,229) = 13.72, p < 0.001, and F(1,229) = 118.32, p < 0.0001, respectively. Geriatric patients had higher scores on the negative subscale, and ENS patients also had higher scores on the negative subscale. Examination of MMSE scores found main effects of age group, F(1,229) = 55.67, p < 0.0001, and ENS group, F(1,229) = 37.58, p < 0.0001. Both the geriatric patients and the ENS patients had lower scores on this measure.

Scores on the cognitive assessment battery at assessment are presented in table 2. Because of the strong relationship between MMSE scores, age, and ENS status, analyses of covariance (ANCOVAs) with MMSE as the covariate were done to examine the effects of age and ENS status on the cognitive measures. Between-group variables were age group and ENS group status.

A Repeated Measures ANCOVA was used to examine scores on the Modified Boston Naming Test; the within-subject variable was difficulty. An overall main effect of difficulty was found, with scores of all groups lower when naming lower frequency words; F(1,227) = 211.40, p < 0.0001. A significant main effect of age group was also found, F(1,228) = 7.31, p < 0.01; the geriatric patients performed worse than nongeriatric patients on both difficulty levels. No main effects of ENS group or interactions were found.

The analyses for the scores on the Constructional Praxis test also used a Repeated Measures ANCOVA with task difficulty as the within-subject variable. There was a main effect of age group, F(1,227) = 5.88, p < 0.02, with the geriatric group's performance significantly worse across both levels of difficulty and ENS status. A significant main effect of difficulty was found, in addition to a significant interaction between ENS group and task difficulty; F(1,227) = 332.91, p < 0.0001, and F(1,227) = 4.55, p < 0.05, respectively. Examination of the simple effects indicated that the ENS and NENS groups did not differ significantly on the easier trial, drawing the circle. However, the ENS patients, across age group, performed more poorly on the more difficult item, drawing the cube; t(231) = 4.21, p < 0.0001.

The ANCOVA examining Word List Learning (the sum of trials 1 through 3) found a main effect of age group, F(1,228) = 4.17, p < 0.05, and ENS status, F(1,228) = 8.08, p < 0.01. Compared to younger patients, geriatric patients learned significantly fewer words over the three trials. Similarly, ENS status patients learned significantly fewer words in comparison to NENS status patients.

Word List Savings was derived by subtracting Delayed Recall from the number of words learned on trial 3. The ANCOVA examining this score found a significant interaction between age group and ENS status group. In
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Table 2. Means and standard deviations of cognitive tests

<table>
<thead>
<tr>
<th>Test (maximum no. correct)</th>
<th>Nongeriatric Patients (n = 59)</th>
<th>Geriatric Patients (n = 174)</th>
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<tbody>
<tr>
<td></td>
<td>NENS (n = 34)</td>
<td>ENS (n = 25)</td>
</tr>
<tr>
<td></td>
<td>NENS (n = 80)</td>
<td>ENS (n = 94)</td>
</tr>
<tr>
<td>Modified Boston Naming Test—high (5)</td>
<td>4.94 (0.24)</td>
<td>4.52 (1.42)</td>
</tr>
<tr>
<td>Modified Boston Naming Test—low (5)</td>
<td>3.74 (1.26)</td>
<td>2.88 (1.79)</td>
</tr>
<tr>
<td>Constructional Praxis—circle (2)</td>
<td>1.97 (0.34)</td>
<td>1.88 (0.88)</td>
</tr>
<tr>
<td>Constructional Praxis—cube (4)</td>
<td>2.41 (1.40)</td>
<td>1.52 (1.58)</td>
</tr>
<tr>
<td>Word list trial 1 (10)</td>
<td>4.12 (2.07)</td>
<td>2.64 (2.08)</td>
</tr>
<tr>
<td>Word list trial 3 (10)</td>
<td>6.71 (2.08)</td>
<td>4.52 (2.97)</td>
</tr>
<tr>
<td>Word list recall (10)</td>
<td>5.35 (2.52)</td>
<td>2.44 (2.79)</td>
</tr>
</tbody>
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Note.—ENS = enduring negative symptoms; NENS = non-ENS.

the nongeriatric group, the NENS patients “saved” more words than the ENS patients did (about a half-word difference). However, in the geriatric group, the ENS patients “saved” more words than the NENS patients did (about a half-word difference). Thus, there were no consistent differences in memory performance across the ENS status.

In order to more directly test the different performance profiles of these groups, the test scores were standardized in the geriatric and nongeriatric samples separately and entered into a multivariate analysis of covariance with MMSE scores as the covariate (see figures 1 and 2). The overall model was significant for age group, Wilks's lambda F(1,219) = 2.35, p < 0.05 and for the ENS group, Wilks's lambda F(1,219) = 2.25, p < 0.05. Followup univariate tests on the standardized scores had the identical profile as the raw scores.

When assessment (either first or second) was included as a repeated measure in the above analyses, with or without the MMSE covariate, no effects of time or interactions with time were found for any of the dependent measures. Therefore, only the means from the second assessment are presented in the tables.

Discussion

There are several findings of interest in this study. First, not all chronically hospitalized patients meet criteria for ENS. This finding suggests considerable specificity of ENS even in patients with a chronic course of unremitting illness and also suggests that these criteria are not simply recapturing poor functional outcome. Patients with ENS, regardless of age, have more significant cognitive impairments than do NENS patients. These impairments are found on a very global measure, the MMSE. But, even when global impairments are controlled with covariance analysis, patients with ENS manifest specific deficits in their performance on tests that are sensitive to dysfunctions of the parietal cortex in neurological patients (Lezak 1997).

The proxy measure we have developed based on the longitudinal characteristics of the PANSS proved to be as accurate in identifying patients with ENS as the proxy measure developed by Kirkpatrick et al. (1993). Our measure is supplemented by the inclusion of symptoms that are commensurate with the items on the SDS and provides more complete and representative information. In addition to including more of the symptoms identified on the SDS, our measure also utilized two assessments rather than a one-time cross-sectional symptom snapshot. As the assessments were approximately a year apart and depression, anxiety, and positive symptom severity have all been shown to be quite unstable in this sample of patients (Putnam et al. 1996), meeting criteria for the ENS syndrome at both time points is unlikely to be due to those factors.

There are limitations in the generalizability of this study regarding both the types of patients examined and the assessments performed. The Modified Boston Naming Test, although sensitive to lesions in the frontal lobe, is not analogous to the frontal lobe tests used by Buchanan et al. (1994). When we tested our geriatric patients with a poor functional outcome on the tests employed by Buchanan et al., a floor effect was detected (Harvey et al. 1993). Our patients are continuously ill with a chronic course of illness, so it is impossible to determine if they would manifest a stable deficit syndrome if their positive symptoms were to remit. However, it is important to note that positive symptom severity was unassociated with
Figure 1. Means of the standardized scores (without covariate) of the cognitive tests for the nongeriatric group

Cognitive Measures of Nongeriatric Patients

Note.—ENS = enduring negative symptoms.

Figure 2. Means of the standardized scores (without covariate) of the cognitive tests for the geriatric group

Cognitive Measures of Geriatric Patients

Note.—ENS = enduring negative symptoms.
ENS status in these patients. We also did not assess our patients with the SDS, and as a result our selection criteria omits poverty of speech and could be identifying a slightly different sample of patients. Obviating this concern was our recent finding (Harvey et al. 1997) that poverty of speech, assessed with the Scale for Assessment of Thought, Language, and Communication (Andreasen 1979), was associated with low MMSE scores in this sample of patients.

The only other published data on the deficit syndrome or ENS in older schizophrenia patients (Harris et al. 1991) found the deficit syndrome to be present in 37 percent (total n = 46) of their patients. This stands in contrast to our finding of 54 percent in our geriatric patients. More comparable to the Harris et al. (1991) findings was the presence of ENS in 42 percent of the younger patients (total n = 59) in the present sample. In a younger, less chronic sample, Carpenter et al. (1988) found the deficit syndrome to be present in 15 percent of their patients (total n = 103). These data suggest that the deficit syndrome and ENS are associated but not synonymous with poor functional outcome and are more common in older patients, regardless of overall functional outcome. As the mean age of our sample was 75, and the mean age of the Harris sample was 62, it is possible that the prevalence of ENS increases with age in patients with poor functional outcome. It should be noted that both of these cited studies used the SDS, whereas we used a longitudinal measure of ENS. Another difference between our patients and the two previous samples is that in both of our ENS groups, the gender breakdown was almost equivalent. Forty-four percent of the younger ENS patients were female, and 45 percent of the geriatric ENS patients were female. In contrast, Harris et al. (1991) found 77 percent of their deficit patients to be male. Since our sample was preselected for poor functional outcome, the overall better functional outcome of female schizophrenia patients would not be expected in this study. Another discrepancy with the Harris et al. (1991) study involves age of onset, which they found to be lower for the deficit patients. The present study has no data on age of onset, but we did not find a difference between the two negative symptom groups in age of first hospitalization or length of stay (within age group). However, these data are difficult to interpret as the geriatric patients were hospitalized at a significantly older age, which may be partially determined by contemporary trends in mental health treatment. Although our ENS patients performed significantly worse on the overall MMSE at both time points, the Harris et al. (1991) study found no significant differences between deficit and nondeficit patients on the MMSE. This cannot be explained by the 13-year age difference between the two samples, as our younger ENS patients also had lower MMSE scores than their nondeficit comparison subjects. The most obvious difference between the samples is that the Harris et al. (1991) patients had a better lifetime functional outcome despite meeting deficit criteria. This finding suggests that poor functional outcome may be an important additional factor to consider when examining deficit versus nondeficit patients. As in the Carpenter sample, we found no differences between our ENS subgroups on mean current age, age of first hospitalization, or total positive symptom subscale.

Although the ENS patients performed significantly worse on the MMSE across both age groups, our results do not necessarily implicate a global cognitive impairment related to ENS status. Rather, the performance of the ENS patients, regardless of age group status, includes both global and specific features of cognitive impairment. It is of note that after covarying out these global impairments (as measured by the MMSE), the ENS patients still exhibit poorer performance on specific neuropsychological tasks. These findings are generally similar to the results of Buchanan et al. (1994) as they found lower intellectual functioning in deficit patients. In our study, ENS patients performed more poorly on the most difficult item on both Constructional Praxis, a test tapping both parietal and frontal lobe functions, and Word List Learning, a measure that requires intact frontal lobe functions (Goldberg et al. 1989). However, when “savings” was examined by examining the words saved from the last learning trial to the recall trial, an interaction between age group and ENS group was discovered. It was only within the nongeriatric group that the ENS patients exhibited impaired performance on this task. Therefore, this suggests that forgetting is not uniquely associated with deficit status. This is consistent with the Buchanan et al. (1994) hypothesis that deficit status is associated with frontal and parietal functions, as forgetting of information previously learned is sometimes attributed to deficits in the functions of the temporal lobe (Lezak 1997).

In conclusion, our results, based on a sample of geriatric and nongeriatric patients with poor functional outcome, provide evidence in support of the validity of the ENS syndrome and its correlates of cognitive impairment. The ENS syndrome was found to be common, but not uniform, in patients with a poor functional outcome, even those in very late life. The cognitive functioning correlates of the ENS syndrome included both global and specific cognitive impairments, with the profile of impairment relatively similar to that seen in much younger deficit patients and deficit patients with better outcomes. These results indicate that this syndrome is not simply an indication of overall poorer cognitive functioning or more severe disease status; rather, it may represent a different process of disease. Later longitudinal research will seek to determine if patients who did not meet criteria for the deficit syndrome earlier in life meet those criteria later.
and if so, whether these changes in status are part of a primary developmental process or an artifact of the consequences of aging.

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