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# Memory performance of geriatric and nongeriatric chronic schizophrenic patients: A cross-sectional study

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**Abstract**

Memory functioning has been studied extensively in nongeriatric schizophrenic patients, leading to the suggestion that schizophrenic patients manifest a "subcortical" pattern of memory deficits. Few previous studies examined very poor outcome patients with a chronic course of hospitalization. This study examined the association of age and global cognitive dysfunction with verbal and spatial learning and delayed recall, as well as examining differential impairments in delayed recall as compared to delayed recognition memory. Sixty-six chronic schizophrenic patients were studied, with 30 of these patients over the age of 65. Verbal (California Verbal Learning Test) and spatial (Biber Figure Learning Test) serial learning and delayed memory tests were administered. All aspects of memory functioning were correlated with estimates of global cognitive status. When global cognitive status was controlled, age effects were still found for the majority of the memory measures. Delayed recognition memory was not spared, being performed as poorly as delayed recall. In contrast to previous studies of better-outcome patients with schizophrenia, geriatric patients with chronic schizophrenia performed more poorly than nongeriatric patients. The lack of sparing of delayed recognition memory suggests that previous findings of specific recall memory deficit and a subcortical profile of memory impairments may apply to schizophrenic patients with less severe global cognitive impairments. These data suggest that poor-outcome patients may have a pattern of memory impairments that has some features in common with cortical dementia. (*JINS*, 1999, *5*, 494–501.)

**Keywords:** Verbal memory, Figural memory, Geriatric schizophrenia, Cognitive deficits, Learning

## INTRODUCTION

Although different types of memory impairments have been reliably found in schizophrenic patients, the pattern of deficit and the progression of these deficits throughout the lifespan remain largely unexplored. Deficits in memory have consistently been reported in schizophrenic patients relative to normal controls (Saykin et al., 1991), to unaffected MZ co-twins (Goldberg et al., 1990), and to the patients' own concurrent overall intelligence level (Gold et al., 1992; Tamlyn et al., 1992). These deficits are wide ranging (Levin et al., 1989) and include reductions in verbal delayed recall (Calev, 1984a; Green & Walker, 1985; Harvey et al., 1986) and recognition (Calev, 1984a, 1984b; Calev & Monk, 1982; Calev et al., 1983; Gold et al., 1992; Goldberg et al., 1989); impairments in memory span (Gruzelier et al., 1988) and short-term and long-term memory (Landro et al., 1993); deficits in working memory (Park & Holzman, 1992, 1993); and in visuospatial learning and memory (Heaton et al., 1994). Some researchers have attributed aspects of these memory deficits to other cognitive deficits, including attentional limitations (Gjerde, 1983; Nuechterlein & Dawson, 1984) or to other strategic failures (Goldberg et al., 1989; Harvey et al., 1986; Koh, 1978). Gold et al. (1992) demonstrated that memory deficits exist for memory tasks requiring both controlled and automatic information processing, thus contradicting the hypothesis that strategic or executive control deficits are the basis for all aspects of memory dysfunction.

Distinct patterns of memory impairment may be present for schizophrenic patients with different levels of symptom severity and overall functional outcome. Calev et al. (1983) found chronic schizophrenic individuals had higher rates of rapid forgetting than acute patients. Using memory tests sensitive to dysfunction in both the frontal and temporal lobes in neurological patients, Harvey et al. (1995) found that

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schizophrenic patients with moderate cognitive impairment had more severe memory deficits on both types of tests than less cognitively impaired patients. Although performance differences have been found between acute and chronic patients at younger ages, the specific memory impairments of geriatric patients with lifelong schizophrenia are less well explored. In the largest study to date of cognitive impairment in geriatric schizophrenia (Davidson et al., 1995), it was found that a substantial portion of chronically hospitalized patients with schizophrenia were deteriorated in their cognitive functioning. Recently published data on memory functions in schizophrenic patients with a generally good lifetime functional outcome found no age-associated changes in performance for geriatric patients compared to younger patients (Heaton et al., 1994). Thus, the effects of aging on memory functioning in better-outcome patients appear to be minimal.

The geriatric chronically institutionalized schizophrenia patients reported on in our previous studies had considerable evidence of global cognitive impairment, much more severe than the levels of impairment previously reported for better-outcome patients. Similar levels of cognitive impairment in geriatric long stay patients with schizophrenia (e.g., Arnold et al., 1995; Harvey et al., 1997) have been found at other research sites, suggesting that the results generalize to geriatric chronically institutionalized schizophrenic patients. These geriatric long-stay patients also have been found to manifest deterioration in other cognitive skills that are typically found to be relatively spared in patients with schizophrenia, such as visual confrontation naming performance (Davidson et al., 1996). The lack of impaired performance in naming on the part of good-outcome patients with schizophrenia (Barr et al., 1989), in conjunction with relatively spared recognition memory in the context of greater impairment in delayed recall (Paulsen et al., 1995a), has led to the suggestion that schizophrenia is typically associated with a "subcortical" profile of cognitive impairments. Since these geriatric poor-outcome patients have evidence of deficits in cortical cognitive functions such as naming, it is not yet known if their memory performance would also have a cortical, rather than subcortical, profile. A cortical profile of impairment could be inferred if recognition memory was also found to be as impaired as delayed recall when compared to normative standards. It is further unclear if the memory changes seen in poor-outcome patients are specific to any certain aspects of the memory system and how aging in very poor-outcome patients impacts on memory performance.

The present study examined various types of memory dysfunctions in geriatric and nongeriatric schizophrenic inpatients with a chronic course of hospitalization: serial learning, recognition, and delayed recall with verbal and visuospatial stimuli. There has been no study to date that has explored all of these particular patterns of memory dysfunction in poor-outcome patients with schizophrenia. This report is an expansion of the previous report of Harvey et al. (1995) on this population, with examinations of different memory processes and the use of younger patients as a comparison sample. It offers a multimodal study of memory impairment, with investigation of content areas that allow for comparison of performance profiles to deficits seen in cortical *versus* subcortical dementia. Assessment of global cognitive impairment allowed for the dissociation of the effects of age and global cognitive deficits on memory performance. The use of tests that examined multiple aspects of memory performance allowed for information about the generality of the aging-related performance differences in schizophrenia. Since other factors such as education, illness history, and current symptoms could also be related to memory performance, the influence of these variables on memory functioning was also examined.

## METHODS

### Research Participants

Participants in this study were chronically institutionalized schizophrenic patients who were participating in a longitudinal study of cognitive functioning and clinical symptoms in poor-outcome schizophrenia. They ranged in age from 30 to 86 with 30 patients age 65 and above and 36 patients age 64 or below. All patients were required to have been hospitalized for at least 1 consecutive year, although the shortest current stay for any patient was over 6 years, and all were receiving clinical treatment with conventional antipsychotic medication, with some also receiving treatment with anticholinergic medications. Diagnoses utilized DSM–III–R (Robins et al., 1989) criteria and were generated according to a structured procedure described previously (Davidson et al., 1995); every patient in this study was a participant in that previous study. Diagnoses were generated with a lifetime chart review procedure. In this procedure, a psychiatrist read the lifetime clinical chart in its entirety, interviewed the caregivers, and interviewed the patient. The patients were required to meet DSM–III–R criteria for the first and current decades of illness and not meet full criteria for a disorder that would exclude a schizophrenia diagnosis at any time. A reliability study of this procedure, based on 25 cases reviewed by two psychiatrists, yielded a kappa reliability coefficient of .88 ($p < .001$) for the diagnosis of schizophrenia.

All patients were treated with conventional antipsychotic medication, with 24 (66%) of the younger patients and 2 (6%) of the older patients also treated with anticholinergic medications. The average daily neuroleptic dose in chlorpromazine equivalents for the younger patients was 840 mg/day ($SD = 650$), while the older patients received considerably less medication, 200 mg/day ($SD = 370$). All patients with a history of substance abuse in the past 6 months or evidence of rapid cognitive decline in the past year on the basis of clinical impression by a neurologist at an annual examination were excluded, as were all patients with hospital-chart evidence of head trauma with loss of consciousness or disease of the central nervous system. CNS diseases that lead to exclusion included seizure disorders,

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brain tumors, history of stroke or definite vascular pathology, and a possible or definite diagnosis of a degenerative condition, such as Multiple Sclerosis, Picks disease, or Alzheimer's disease.

All of the patients from the original sample (Davidson et al., 1995) who were still in the hospital and had a global Clinical Dementia Rating (CDR; Berg, 1988) score of less than 2 (*moderate*), who had not received leukotomy, and who did not fail the other exclusion criteria were included in this research protocol. The CDR is a staging scale for the severity of cognitive impairment. This scale consists of six categories of functioning: (1) *memory*, (2) *orientation*, (3) *judgment and problem solving*, (4) *community affairs*, (5) *home and hobbies*, and (6) *personal care*, which are rated on a graduated scale (0 = *absent*, .5 = *questionable*, 1 = *mild*, 2 = *moderate*, 3 = *severe*, 4 = *profound*). Patients with CDR scores of 2 (*moderate dementia*) or more were not tested in this study, because of the concern that nonmemorial cognitive impairments (e.g., deficits in verbal comprehension or speech production) might unduly influence performance on the memory tests. Participant characteristics are presented in Table 1.

## Memory Assessment

Two different tests of memory functioning were conducted on the patients in this study. All patients were also examined with the Mini-Mental State Examination (MMSE; Folstein et al., 1975). The MMSE examines a variety of the aspects of cognitive functioning associated with global impairments, yielding a score that ranges from zero to 30.

### *Verbal learning and memory*

Verbal memory performance was measured with the California Verbal Learning Test (CVLT; Delis et al., 1987). The CVLT involves the repeated presentation of a word list that consists of common items that are semantically related to four common conceptual categories ( *food*, *clothing*, *spices*, or *tools*). The list (Monday List) is presented in fixed order five times, with each presentation followed by free recall for the list. A second word list (Tuesday List) with two of the same conceptual categories and two different categories is then presented and the respondent is asked to recall the items from that list. Following the free recall of the Tuesday List, participants are asked to recall items from the Monday List, first without and then with semantic cues, first at a short delay and then after a 20-min delay. There is then a forced-choice recognition trial. There are multiple possible dependent measures for this test and in this study we used performance on Learning Trial 1, total learning over five trials, the total score at delayed recall, and recognition discriminability between targets and foils.

### *Visual learning and memory*

Visual memory was measured using the Biber Figure Learning Test (BFLT; Glosser et al., 1989). This test was developed in order to measure a variety of components of memory similar to those measured in the CVLT. A series of 10 line drawings are presented for 3 s each and, following the presentation of the last figure, the respondent is asked to reproduce the designs from memory. When the respondent has reproduced as many figures as possible, the series is again presented at 3 s/figure and the participant again attempts to draw each figure from memory. Following five presentations and attempts to reproduce the series participants are presented with another series, which includes the target designs and similar distractors, and immediate recognition is assessed. Following a 20-min delay, free recall of the 10 items is requested, followed immediately by another recognition test. Finally, tests of pure reproduction ability are conducted, with the participants reproducing the designs immediately after a 3-s exposure and being then asked to copy them during exposure if they fail at immediate reproduction. Each drawing is scored on a 4-point scale (0–3). Although there are multiple dependent variables possible, the ones used in this study are the scores for designs produced correctly on the first acquisition trial, total score for serial learning over five trials, total score at the delayed free recall assessment, and the long-delay recognition performance discrimination score.

**Table 1.** Participant characteristics

| | Nongeriatric | | Geriatric | | | |
|---|---|---|---|---|---|---|
| Characteristics | *M* | *SD* | *M* | *SD* | *t*(64) | *p* |
| Age | 44.50 | 10.90 | 75.93 | 6.82 | | |
| Percent female | 33 | | 66 | | | |
| Length of current hospital stay | 12.46 | 12.40 | 40.84 | 16.80 | | |
| Years of education | 11.49 | 1.77 | 9.78 | 2.34 | 3.26 | .005 |
| Age at first admission to psychiatric care | 20.38 | 3.85 | 30.40 | 8.53 | 6.17 | .001 |
| PANSS Positive Symptom Score | 20.80 | 5.86 | 19.77 | 2.40 | .40 | .59 |
| PANSS Negative Symptom Score | 21.89 | 6.10 | 25.20 | 7.21 | 2.00 | .05 |
| MMSE Total Score | 24.69 | 5.08 | 18.33 | 5.60 | 4.79 | .001 |

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**Table 2.** Raw and scaled scores for memory performance on all variables

| | Raw nongeriatric | | Geriatric | | Scaled nongeriatric | | Geriatric | |
|---|---|---|---|---|---|---|---|---|
| Measures | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| California Verbal Learning Test | | | | | | | | |
| Trial 1 Performance | 3.75 | 1.93 | 2.25 | 1.55 | | | | |
| Trials 1–5 Total | 19.87 | 12.81 | 16.17 | 11.04 | | | | |
| Delayed Free Recall | 5.05 | 2.98 | 1.82 | 2.18 | −2.69 | 1.35 | −2.28 | 1.08 |
| Recognition Discrimination | 0.75 | 0.15 | 0.57 | 0.17 | −2.71 | 1.67 | −3.89 | 1.34 |
| Biber Figure Learning Test | | | | | | | | |
| Trial 1 Performance | 6.09 | 4.35 | 3.31 | 2.69 | | | | |
| Trials 1–5 Total | 43.68 | 32.16 | 20.42 | 15.22 | | | | |
| Delayed Free Recall | 11.03 | 8.23 | 5.50 | 3.87 | −3.00 | 1.82 | −2.56 | 0.68 |
| Recognition Performance | 17.18 | 8.62 | 14.90 | 9.48 | −3.80 | 1.40 | −3.24 | 1.10 |

### Calculation of Standardized Scores

Since we were interested in the idea of cortical *versus* subcortical profiles of memory performance, standard scores were calculated. In the Paulsen et al. (1995a) study, performance on the final CVLT learning trial (Trial 5) as well as the number of cued intrusions was compared to delayed recognition memory, as the comparison of cortical *versus* subcortical profiles. The available age norms for the Biber Figure Learning Test (Glosser et al., 1989) do not include Trial 5 performance and cued intrusions are not a dependent variable in this type of test. As a result, we chose to use standard scores for long-delay free recall and long-delay recognition for both the CVLT and the BFLT. For the CVLT, we used the Paolo et al. (1997) elderly norms as well as the CVLT research manual norms for the younger patients. These norms are standardized for age and sex. For the BFLT, we used the age norms published by the authors of this test, which do not provide corrections for sex. The youngest normals in the Glosser et al. (1989) study were 45 and above, so there may be a slight bias in favor of the younger patients in the schizophrenia sample, 12 of whom were under the age of 45. In order to compare the cortical *versus* subcortical profiles, we computed paired *t* tests between the age corrected standard scores for delayed recall and delayed recognition in the CVLT and BFLT. We did not, however, compare CVLT and BFLT standard scores, because we have no way to determine if the normative samples for the CVLT and BFLT are similar.[1]

## RESULTS

### Comparison of Sample Characteristics

The geriatric patients had significantly lower overall MMSE scores and significantly higher PANSS total negative symptom scores, although there was no difference in the overall severity of PANSS positive symptoms. The older patients also had significantly fewer years of formal education and had a later age at first admission to psychiatric care. As would be expected in a sample with essentially continuous lifetime institutionalization the older patients had a much longer stay at their current admission. The correlation between dose of antipsychotic medication and each of the memory performance measures was computed with Pearson correlations; none of the correlations were significant [all $r$s $<$ .23, all $p$s $>$ .05].

### Correlation of MMSE Scores and Memory Performance

In order to examine the relationship between global cognitive functioning and memory performance, Pearson product-moment correlations were calculated between the raw scores on all of the memory variables presented in Table 2 and MMSE scores, in the entire sample of patients. All correlations were statistically significant and all correlations shared at least 10% of the variance [all $r$s $>$ .34, all $p$s $<$ .05]. In addition, MMSE scores were also significantly correlated with scores on negative symptom severity and years of education, but not with positive symptom scores ($r = -.01$) or with age at first psychiatric admission ($r = -.21$, $p < .10$).

### Memory Performance

The relationship of memory performance and age, as well as other predictor variables was examined with regression analyses. In these analyses, the influence of age, MMSE score, age at first psychiatric admission, years of education completed, PANSS positive symptom severity and PANSS negative symptom severity were all used as predictors for each of the memory dependent variables. In order to ensure that we did not capitalize excessively on chance in stepwise analyses, all analyses were initially run with a simultaneous entry procedure with all variables forced into the equation. For all aspects of memory performance there was a signif-

[1] Standard scores on Trial 5 performance and long-delay cued intrusions are available from the authors.

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icant overall regression result [all $F(5,54) > 3.88$, all $p < .05$], indicating systematic relationships between memory functions and the other variables examined. Following this finding, a forward entry stepwise regression was then computed for each variable, with the $p$ value for entry into the analysis set at $p < .05$, and the order of importance for prediction of each variable was determined. Since MMSE scores were correlated with performance on every variable, MMSE scores were entered into the regression analysis first and then the other five variables were entered with a forward stepwise procedure. The results of these regression analyses are presented in Table 3.

As can be seen in Table 3, significant worsening with age, even beyond that associated with changes in MMSE scores, was found for CVLT total learning, delayed recall, and delayed recognition. No variables other than global MMSE scores were related to CVLT Trial 1 performance. A similar pattern of performance was found for BFLT performance, where all dependent variables were negatively associated with age in addition to MMSE scores. No significant regression coefficients were found for the relationship between education, age at first admission, or either positive or negative symptoms and any of the memory variables when MMSE scores were entered first.

### Comparison With Normative Standards

As can be seen in the table, the average age-corrected standard scores for all of the memory variables reflect very low levels of performance. In order to test the hypothesis that poor outcome patients have a cortical pattern of deficits, paired-sample $t$ tests were performed for both the CVLT and the BFLT, comparing standard scores for long-delay free recall and delayed recognition performance. For the older patients, performance on the delayed recognition discrimination was significantly worse than delayed recall performance on both the CVLT [$t(29) = 7.10$, $p < .001$], and on the BFLT [$t(29) = 3.86$, $p < .001$]. For the younger patients, recognition memory was again found to be more impaired than delayed recall on the BFLT [$t(33) = 2.60$, $p < .01$], with no significant differences between delayed recall and delayed recognition on the CVLT [$t(33) = 0.2$, $p > .50$].

## DISCUSSION

Memory functions in our sample of poor outcome patients with schizophrenia are associated with both global estimates of cognitive impairment and with age. In contrast to previous studies of better outcome patients with schizophrenia (e.g., Heaton et al., 1994; Paulsen et al., 1995b) each aspect of memory functioning other than Trial 1 performance on the CVLT was performed significantly more poorly by older patients. Every memory measure that we collected was also correlated with MMSE scores. When global cognitive impairment effects are controlled with regression analysis, there are still multiple age-associated differences in memory functioning. These age differences are not caused by the effects of treatment with anticholinergic medication, because of the small number of geriatric patients receiving these drugs.

When compared to previous studies of higher functioning schizophrenic patients, the level of performance of all of our participants is extremely impaired on the CVLT (Paulsen et al., 1995b). The MMSE scores of the nongeriatric patients are consistent with those previously reported for treatment nonresponsive patients of similar age (Schulz et al., 1989), but the MMSE scores of the geriatric patients are considerably lower on average than would be expected on the basis of normative comparison to individuals of their age and education (Crum et al., 1993), suggesting cognitive decline at some point in time. The average MMSE score of our older patients is in the range that is generally considered *moderately demented*. In previous longitudinal and cross-sectional studies of the patients in our sample, only about one-third of patients do show evidence of modest decline during a 3-year follow-up interval (Harvey et al., in press), while the profile of cognitive impairment in these poor-outcome schizophrenic patients is quite different from

**Table 3.** Regression predictors of memory performance on all variables

| | | Regression results | | |
|---|---|---|---|---|
| Measures | Predictor | $F$ | $p$ | Percent variance |
| California Verbal Learning Test | | | | |
| Trial 1 Performance | MMSE | | | |
| Trials 1–5 Total | MMSE; Age | 17.74 | .001 | 24 |
| Delayed Free Recall | MMSE; Age | 12.94 | .001 | 20 |
| Recognition Discrimination | MMSE; Age | 11.22 | .001 | 19 |
| Biber Figure Learning Test | | | | |
| Trial 1 Performance | MMSE; Age | 13.56 | .001 | 21 |
| Trials 1–5 Total | MMSE; Age | 6.83 | .01 | 8 |
| Delayed Free Recall | MMSE; Age | 22.12 | .001 | 30 |
| Recognition Performance | MMSE; Age | 18.60 | .001 | 26 |

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that seen in Alzheimer's disease (AD; Davidson et al., 1996). Thus, poor-outcome patients do not show the profile or course of cognitive impairments expected in degenerative dementias such as AD. These findings are also consistent with the results of postmortem studies finding negligible levels of AD-related neuropathology in brains of prospectively assessed schizophrenic patients (Arnold & Trojanowski, 1996; Purohit et al., 1998) and finding that the brains of over 80% of cognitive impaired schizophrenic patients show no evidence of neuropathology (AD, PD, Lewy bodies, ischemic changes, or other degenerative features; Powchik et al., 1998) adequate to explain the level of cognitive impairment seen.

The limitations of the study should be delineated before proceeding with the interpretation. These are very chronic patients with an extended stay and they are not typical of schizophrenic patients in general, especially outpatients. Although the nongeriatric patients are very persistently ill by current standards, the geriatric patients have a longer length of stay and length of stay and its correlates could have some impact on memory performance. A normal comparison sample was not examined and it is therefore not possible to make direct comparisons of the performance of these patients to normal individuals despite our use of normative standards. The normative standards for the BFLT are based on a different and smaller sample of normal individuals than the CVLT norms, but the overall level of impairment still appeared similar. Although the geriatric patients are not now treated with anticholinergic medications, it is likely that they have extensive lifetime exposure to these drugs, which may have an overall deleterious effect on their memory functions. The performance of the younger and older schizophrenic patients on each of the measures of the CVLT and BFLT is approximately 3 SDs below normative expectations on the basis of age, which may have led to some floor effects in the regression analyses. This finding suggests that for clinical evaluation of poor outcome geriatric patients with schizophrenia, a less challenging cognitive test may be more suitable.

The profile of memory performance seen in these poor outcome schizophrenic patients, both younger and older, with severe cognitive impairments resembles that seen in cortical dementia. Specifically, performance on delayed recognition memory on the CVLT was as poor as delayed recall. In subcortical dementia, recognition memory is relatively preserved when compared to recall memory (Paulsen et al., 1995c). A subcortical profile of memory deficits is most common in schizophrenic patients with no clinical evidence of excessive cognitive and behavioral deterioration (Paulsen et al., 1995b). Thus, our patients show a profile that has more of a cortical profile than might be expected on the basis of other research. It should be noted that about 15% of the better outcome patients reported on by Paulsen et al. also had a cortical pattern of memory deficit. It is not clear whether the patients in that study with a cortical profile of memory impairments had a worse overall outcome or deteriorated over time and it is possible that a profile of cortical memory deficit identifies those patients with a worse overall outcome. Thus, despite the relative preservation of delayed-recall memory that discriminates them from patients with AD, poor-outcome patients with schizophrenia have apparently equivalent deficits in delayed-recall and delayed-recognition memory.

There is earlier evidence that poor-outcome patients with schizophrenia have some deficits similar to those seen in cortical dementias. For example, we (Davidson et al., 1996) found that geriatric poor outcome patients with schizophrenia performed more poorly on tests of naming and praxis than patients with AD who were matched to the schizophrenic patients on the basis of MMSE scores. This poor performance was inconsistent with a global deficit, such as amotivation, because the schizophrenic patients in that study outperformed the patients with AD on delayed recall and performed equivalently to them on serial verbal learning. Thus, poor-outcome patients with schizophrenia who manifest greater cognitive impairments do not manifest a typical subcortical profile of memory impairments. In contrast, patients with Huntington's disease and AD can be discriminated even in the late stages of illness (Paulsen et al., 1995a). The results of this study suggest the possibility that poor outcome in schizophrenia is associated with impairment in both cortical and subcortical memory functions, a possibility to be addressed in later research.

In conclusion, poor-outcome patients with schizophrenia show considerable age effects in their memory performance, although both younger and older patients perform very poorly when compared to age-corrected norms. Global cognitive impairment in schizophrenia is correlated with all aspects of memory functioning that were measured in this study and the profile of impairment was similar to that seen in cortical, rather than subcortical, dementia. The commonly reported subcortical memory profile in schizophrenic patients may be limited to patients with better overall functional outcome and greater cognitive intactness than the current sample. These findings suggest that the cortical profile of memory impairments in patients with schizophrenia may be associated with cognitive deterioration, with the biological correlates of that deterioration remaining to be identified.

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