Aphasic Patients' Performance on a Mental Status Examination

Lee Ann C. Golper, Marie T. Rau, Barbara Erskine,
Joseph J. Langhans, and John Houlihan

Portland Veterans Administration Medical Center, Portland, Oregon

Impaired performance on a mental status examination, neuroradiologic evidence for cortical atrophy, and a history suggesting cognitive decline are key indicators for a diagnosis of dementia. This diagnosis is made with relative confidence when these factors combine to indicate dementia. However, in acutely ill patient populations, or among elderly patients, neuroradiologic findings and medical history often are equivocal. Mental status performance then becomes very important in the diagnosis of dementia or in differentiating dementia from delirium. Consequently, given the importance of mental status assessment, physicians in training, emergency room physicians and physicians in hospital practices are being strongly encouraged to use standardized bedside examinations of mental status (Allen and Rosse, 1986; Litovitz, Hedberg, Wise and Mann, 1985; Rovner and Folstein, 1987). Probably the most popular standardized instrument for quickly evaluating cognition is the Mini-Mental State (MMS) (Folstein, Folstein and McHugh, 1975) or the slightly modified Mini-Mental State Examination (MMSE) (Folstein, Robins and Helzer, 1983).

The validity and reliability of this instrument has been well-documented (Anthony, Le Resche, Niaz, Korff, and Folstein, 1982; Folstein, Folstein and McHugh, 1975; Goldschmidt, Mallin and Still, 1983). There are several reports of its usefulness in differentiating dementia from cognitive deficits resulting from depression (Folstein, Anthony, Parhad, Duffy and Gruenberg, 1985; Hyer, Gouvela, Harrison, Warsaw and Coutoursidis, 1987; Kay, Henderson, Scott, Rickwood and Wilson, 1985; Miller, Barasch, Sacks, Levitan and Ashcroft, 1986; Young, Manley and Alexopolous, 1985); in assessing the severity of dementia in various psychiatric populations (Taylor and Abrams, 1984; Myslobodsky, Tomer, Holden, Kempler, Sigal, 1985); and in examining for treatment effects for schizophrenia and Alzheimer's disease (Brambilla, Aguglia, Massironi, Maggioni, Grillo, Castiglioni, Catalano and Drago, 1986; Fields, MacKenzie, Charlson and Perry, 1986; Steele, Lucas and Tune, 1986).

The use of standardized mental status examinations in screening for dementia has many obvious benefits. However, brief assessments such as the MMS examination or the "Mental Status Questionnaire" (Goldfarb, 1975) as well as more comprehensive published tests, such as that described by Mattis (1976) contain a predominant number of tasks requiring language facility. Aside from the so-called "language" subtests, these standardized mental status examinations assess orientation, mental vigilance, memory, visuospatial functioning and learning in a manner in which auditory comprehension deficits and verbal formulation problems are likely to compromise test performance.

Language clinicians might question the validity of such tests as the MMS, because they appear to be largely tests of language facility, rather than tests of overall cognitive status. Escobar and co-workers (1986) examined the use of the MMSE with Hispanic and non-Hispanic populations and found that age, education, ethnicity and language of the interviewer influenced the number of MMSE errors. In another study, Anthony et al.

(1982) felt that age and education contributed to a 39% false positive error rate in tests of hospital inpatients. In a review of five bedside screening instruments, Nelson, Fogel and Faust (1986) found all five screening tests had substantial false positive and false negative errors. The group most commonly missed by these tests were those patients with predominantly right hemisphere lesions. A London group (Dick et al., 1984) made similar criticisms, suggesting that the MMSE was not a sensitive indicator of focal versus diffuse desease. Although aphasia as an isolated factor was not specifically examined in the London study, they reported that the group with left hemisphere focal lesions had scores ranging from 8 to 30 (of a possible total of 30); while the group with right hemisphere focal lesions had scores ranging from 24 to 30. Subjects with left hemisphere focal lesions were described as behaving like the bilaterally impaired subjects in this study.

These studies lead us to predict that mildly aphasic persons (particularly if they are acutely ill and/or elderly) could be misdiagnosed as demented if evaluated only with screening examinations such as the MMSE. To explore this issue, we are conducting an ongoing study of MMSE performance by gathering data from: 1) patients with focal, left hemisphere infarctions and mild language deficits, who are functionally independent and, by conventional standards, not considered demented; 2) healthy controls; and 3) patients with dementia.

The study reported here examined MMSE performances of a group of functionally independent but mild-to-moderately aphasic persons compared with groups of demented subjects and healthy, aged controls. In this ongoing study two questions are being explored: 1) How does aphasic subjects' performance across MMSE subtests compare with that of demented subjects? and 2) Will aphasic subjects' mental status scores vary as a function of the degree of their communicative impairment?

METHOD

Aphasic Subjects. Ten aphasic persons participated in the present study. Nine had incurred focal left hemisphere cortical infarctions as the result of a cerebrovascular accident. One aphasic subject had a left temporoparietal tumor diagnosed and was irradiated six months prior to this testing. The aphasic subjects were 35 to 78 years old (see Table 1). All aphasic subjects were at least 3 months post onset of aphasia and each was described by their primary clinician and their family as functionally independent with respect to all activities of daily living and self care. These aphasic subjects were the "highest level" and most functionally independent patients in our current clinic registries. However, none of the younger subjects had returned to work.

Healthy, Aged Controls. Fifteen healthy, aged controls were given the MMSE to provide a comparison sample. These subjects were non-hospitalized elders aged 65 to 89 years ($\bar{x}$ = 73.8) who had no history of neurologic injury or disease.

Demented Subjects. Findings from two groups of demented subjects will be discussed. First, 20 geriatric inpatients diagnosed as having clinically-significant dementia of at least six months duration were examined with the MMSE. These subjects had mixed etiologies for their dementia and ranged in age from 65 to 95 years (see Table 2). Based on the geropsychologist's and geriatrician's evaluation, the presumed etiologies included: Dementia of the Alzheimer's Type (DAT) (n=6), multi-infarct dementia (n=3), dementia

Table 1. Aphasic subjects' information summary.

Subject #	Etiology	Age	MPO	PICA OA%ile
1	Thrombo-embolic	57	10	92
2	Thrombo-embolic	60	28	88
3	Hemorrhagic	35	6	85
4	Tumor (irradiated)	57	6	85
5	Thrombotic	60	18	82
6	Embolic	45	3	75
7	Thrombo-embolic	64	10	70
8	"CVA"	65	40	65
9	Thrombotic	46	10	62
10	Embolic	78	13	62

resulting from subcortical disease (n=6), the dementia of alcoholism (n=2) and undetermined etiology (n=3).

Table 2. Demented subjects' information summary.

Subject #	Presumed Etiology	Age
1	DAT	74
2	DAT	88
3	DAT	92
4	Not Determined	88
5	Multi-infarct	69
6	DAT	89
7	Subcortical	68
8	Not Determined	85
9	Subcortical	87
10	Subcortical	95
11	Not Determined	75
12	Alcoholism	86
13	DAT	90
14	DAT	70
15	Subcortical	82
16	Multi-infarct	81
17	Subcortical	69
18	Subcortical	90
19	Alcoholism	65
20	Multi-infarct	77

Findings from a second group of 36 outpatients who had undergone a thorough medical and psychological examination and were confidently diagnosed to have Alzheimer's disease are also presented. These subjects ranged in age

from 59 to 94 years and had been grouped by mild, moderate or severe dementia at the time of this testing, based on the Goldfarb scale (Goldfarb, 1975).

ASSESSMENTS

Mini-Mental State Examination. All subjects were administered the Folstein et al. (1983) Mini-Mental State Examination, using standard procedures, by either a speech-language pathologist or psychologist (geropsychologist or neuropsychologist). The MMS examination is divided into two sections, the first part (which the authors refer to as the "verbal" subtests) requires spoken responses only and covers orientation, memory and attention/calculation; the maximum score is 21. The second part (the "performance" subtests) tests the ability to name, follow verbal and written commands, write a sentence spontaneously and copy a complex polygon similar to a Bender-Gestalt Figure; the maximum score is 9. The maximum total score is 30. The test is not timed but takes approximately 10 to 20 minutes to administer. Total MMSE scores are interpreted in the following manner: 28 to 30 = normal; 20 to 27 = mild dementia or pseudodementia; 12 to 19 = moderate dementia; and 0 to 11 = severe dementia (Folstein et al., 1975).

Language Assessment. All of the aphasic subjects were or had recently been involved in either individual or group outpatient treatment. As a measure of the severity of their communicative deficits their most recent Porch Index of Communicative Ability (PICA) (Porch, 1981) scores were taken from clinical records. The aphasic subjects had PICA Overall scores ranging from the 62nd to the 92nd percentile (see Table 1).

RESULTS

MMSE Performance Comparisons. Table 3 provides a summary of MMSE scores for healthy, aged controls. Few errors were found among these subjects, with the exception of occasional difficulties with calculating serial sevens. The performances of the 20 demented inpatients with mixed etiologies are summarized in Table 4. The total MMSE scores for this group ranged from 10 to 26. As a group, these subjects made errors across all subtests, with the greatest source of errors in the Orientation, Attention/Calculation, and Recall subtests.

Table 5 provides the MMSE scores of the 10 aphasic subjects across subtests. The aphasic group's total scores ranged from 11 to 29 correct (out of 30). The aphasic subjects made errors in all subtests but had particular difficulty with the Attention/Calculation subtest.

The mean MMSE scores for the 36 outpatients with DAT are summarized in Table 6. The mild DAT subjects (n=5) had total scores ranging from 16 to 28 with a mean score of 23.8; the moderate DAT subjects (n=22) had scores ranging from 11 to 26; and the severe DAT subjects (n=9) had scores ranging from 2 to 15.

Comparing the performance of the aphasic group with that of the demented inpatients across subtests, the aphasic group generally performed equivalently to the demented group on the Language subtest (means of 7.0 and 7.2, respectively). This demented group generally performed worse on Orientation and Recall subtests compared with the aphasic group. The aphasic group had more difficulty with Attention/Calculation (serial sevens or spelling the word "world" backward) than did the demented group.

Table 3. MMS performance summaries: Healthy, aged persons' scores.

[Subj.#] -age-	MMS Subtests (# possible)					TOTAL [30]
	Lang.(9)	Orienta.(10)	Registra.(3)	Attention(5)	Recall(3)	
[1] -65-	9	10	3	5	3	[30]
[2] -66-	9	10	3	5	3	[30]
[3] -66-	9	10	3	5	3	[30]
[4] -71-	9	10	3	5	3	[30]
[5] -72-	9	10	3	2	3	[27]
[6] -73-	9	9	3	5	3	[29]
[7] -73-	9	9	3	5	3	[29]
[8] -73-	9	10	3	4	3	[29]
[9] -74-	9	10	3	5	3	[30]
[10] -74-	9	10	3	5	3	[30]
[11] -76-	9	10	3	5	3	[30]
[12] -77-	9	10	3	5	3	[30]
[13] -77-	9	9	3	5	3	[29]
[14] -81-	9	10	3	3	3	[28]
[15] -89-	9	10	3	5	3	[30]
n=15 $\bar{x}$ age= 73.8 $\bar{x}$ =	9.0	9.8	3.0	4.6	3.0	[29.4]

Table 4. MMS performance summaries: Demented subjects' scores (geriatric inpatients with mixed etiologies).

[Subj.#]	MMS Subtests (# possible)					TOTAL [30]
	Lang.(9)	Orienta.(10)	Registra.(3)	Attention(5)	Recall(3)	
[1]	6	5	3	0	0	[14]
[2]	6	7	2	1	0	[16]
[3]	9	5	3	1	0	[18]
[4]	8	7	3	5	1	[24]
[5]	9	1	3	0	1	[14]
[6]	6	5	3	2	1	[17]
[7]	9	6	3	1	0	[19]
[8]	6	3	3	4	0	[16]
[9]	8	7	3	5	3	[26]
[10]	7	2	3	5	1	[18]
[11]	4	5	3	0	0	[12]
[12]	6	6	3	3	1	[19]
[13]	8	4	3	5	1	[21]
[14]	8	2	1	0	0	[11]
[15]	8	3	2	3	0	[16]
[16]	7	3	3	5	0	[18]
[17]	5	9	3	0	0	[17]
[18]	9	10	3	1	0	[23]
[19]	9	7	3	1	1	[21]
[20]	5	3	2	0	0	[10]
$\bar{x}$=	7.2	5.0	2.75	2.1	.5	[17.5]

Table 5. MMS performance summaries: Aphasic subjects' scores.

[Subj.#]	MMS Subtests (# possible)					TOTAL [30]
	Lang.(9)	Orienta.(10)	Registra.(3)	Attention(5)	Recall(3)	
[1]	9	9	3	5	3	[29]
[2]	7	10	2	3	2	[24]
[3]	7	9	2	2	0	[20]
[4]	7	8	3	0	3	[20]
[5]	6	7	3	0	2	[18]
[6]	7	7	0	3	2	[20]
[7]	8	9	2	0	2	[21]
[8]	7	4	3	0	0	[13]
[9]	8	9	3	1	2	[23]
[10]	4	5	0	0	2	[11]
$\bar{x}$=	7.0	7.7	2.1	1.4	1.8	[19.9]

Table 6. Mean MMS performances in patients with Alzheimer's disease (n=36).

	Lang.	Orient.	Regis.	Atten.	Recall	Total
Mild (n=5)	8.4	7.2	3.0	2.6	2.6	23.8
Moderate (n=22)	7.2	2.9	2.6	1.8	1.0	15.5
Severe (n=9)	3.9	.6	1.7	.2	.6	7.1
$\bar{x}$ =	7.6	2.9	2.3	1.5	1.6	14.6

Figure 1 compares the aphasic group's performance with that of Alzheimer's outpatients, looking only at those subjects having mild and moderate dementia. The aphasic group generally performed worse than the mildly demented subjects on all subtests, with the exception of the Orientation subtest, where there were equivalent percentages. The aphasic subjects' performance more closely resembled that of moderately demented Alzheimer's subjects than that of mildly demented subjects.

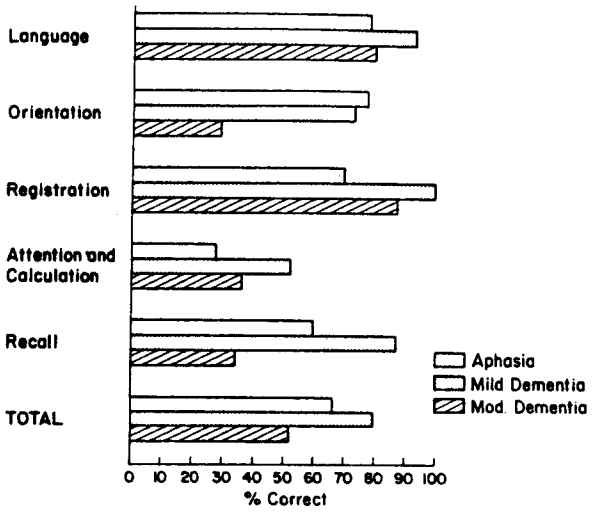

Figure 1. MMS scores comparing aphasia to mild and moderate dementia.

Statistical Analysis. A Kruskal-Wallis statistic was applied to multiple between-group comparisons. Significant between group differences at ($p \leq .001$) were found. The Control group differed significantly from all other groups except the mild Alzheimer's subjects. The aphasic group differed significantly from the control group and the severe Alzheimer's group, but not from the inpatient demented group or the mild or moderate Alzheimer's group.

MMSE Scores Versus PICA OA Percentiles. The only aphasic subject to score within the "normal" range of performance (score between 28-30) on the MMSE had the highest PICA Overall score of the group (92nd percentile). Six of the remaining aphasic subjects' scores fell within the "mild dementia" range of performance (with scores between 20 and 27); two subjects fell into the "moderate dementia" range (scores between 12 and 19) and one subject's score fell within the "severe dementia" range (scores between 0 and 11). This latter subject was one of two aphasic subjects with the lowest PICA Overall percentiles.

To examine the relationship between PICA Overall percentiles and MMSE scores, a regression formula was applied to the intercepts on a scatterplot.

There was a strong correlation between these MMS and PICA Overall scores for all but one of the aphasic subjects (Subject 9). This patient had a high MMSE score despite a PICA Overall at the 62nd %ile. After examining the source of his lower PICA performance it was found that, although his verbal abilities were quite high, he had severe limb apraxia and had refused all PICA graphic subtests. Only two items on the MMSE require graphic facility. Figure 2 illustrates the MMSE/PICA scatterplot correlations (without the outlier, Subject 9). Note also that one intercept point represents two subjects who had exactly the same scores on both the MMSE and PICA.

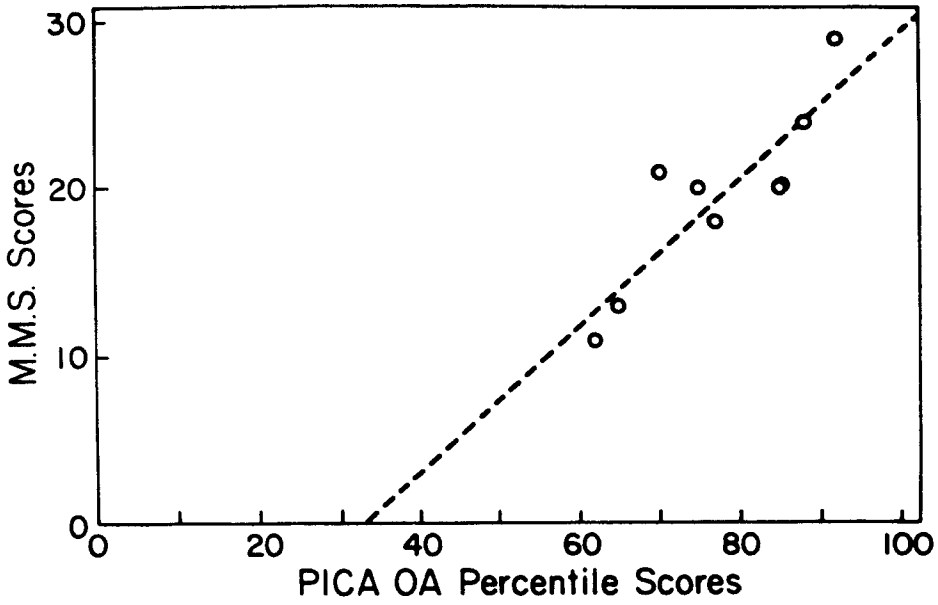

Figure 2. Scatterplot of MMS scores by PICA Overall percentiles for the aphasic subjects.

DISCUSSION

In our study, ten mild-to-moderately aphasic patients had mental status examination scores generally falling within a range that would be indicative of dementia. Their performance appeared to depend predictably upon their degree of language impairment. Compared with groups of demented subjects' performances on the MMSE, the aphasic patients performed similarly to subjects with more diffuse lesions. Although there were no significant differences between the aphasic subjects and the mildly and moderately demented Alzheimer's subjects, the percentages correct across subtests more closely resembled the moderately than the mildly demented Alzheimer's patients.

The aphasic subjects had about as much difficulty with the Orientation subtest as the Language subtest, and had considerable difficulty with the Attention/Calculation subtest. This performance ought not be interpreted to suggest that these aphasic patients were disoriented or had

attention deficits. They made errors because the procedures used to assess these functions actually are tests of communicative ability.

The MMSE provides a valuable method for quick, reliable bedside examination. Its brevity and standardized presentation allows clinicians to make routine, serial assessments and thus examine for progressive declines. But the Mini-Mental State, like other mental status screening instruments, primarily tests left hemisphere functions and in particular, language facility. Thus, these mental status tests are not valid measures of the mental status of patients with focal cortical damage. In certain neurologic populations an abnormal score should be viewed only as indicating the need for more extensive diagnostic inquiries.

REFERENCES

Allen, A. and Rosse, R.B. Hospital evaluation and treatment of dementia. Resident and Staff Physician, November, 1986, 71-77.

Anthony J.C., Le Resche, L., Niaz, U., vonKorff, M.R., and Folstein, M.F. Limits of the 'Mini-Mental State' as a screening test for dementia and delirium among hospital patients. Psychological Medicine, 12, 297-408, 1982.

Brambilla, P., Aguglia, B., Massironi, R., Maggioni, M., Grillo, W., Castiglioni, R., Catalano, M., and Drago, F. Neuropeptide therapies in chronic schizophrenia: TRH and vasopressin administration. Neuropsychobiology, 15, 114-121, 1986.

Dick, J.P., Builoff, R.J., Stewart, A., Blackstock, J., Bielawaska, C., Paul, E., and Marsden, C.D. Mini-mental state examination in neurological patients. Journal of Neurology, Neurosurgery, and Psychiatry, 47, 496-499, 1984.

Escobar, J.I., Burnam, A., Karno, M., Forsythe, H., Landsverk, J., and Golding, J.M. Use of the Mini-Mental State Evaluation (MMSE) in a community of populations of mixed ethnicity. Cultural and linguistic artifacts. Journal of Nervous and Mental Disorders, 174, 607-614, 1986.

Fields, S.D., MacKenzie, C.R., Charlson, M.E. and Perry, S.W. Reversibility of cognitive impairment in medical inpatients. Archives of Internal Medicine, 146, 1593-1596.

Folstein, M.F., Folstein, S.E., and McHugh, P.R. "Mini-Mental State": A practical method for grading cognitive state of patients for the clinician. Journal of Psychiatric Research, 12, 189-198, 1975.

Folstein, M.F., Robins, L.N., and Helzer, J.E. The Mini-Mental State Examination. Archives of General Psychiatry, 40, 812, 1983.

Folstein, M.F., Anthony, J.C., Parhad, I., Duffy, B., and Gruenberg, E.M. The meaning of cognitive impairment in the elderly. Journal of the American Geriatric Society, 33, 228-235, 1985.

Goldfarb, A.I. Memory and aging. In R. Goldman and M. Rockstein (Eds.), The Physiology and Pathology of Human Aging. New York, NY: Academic Press, 1975, 149-186.

Goldschmidt, T.J., Mallin, R., and Still, C.N. Recognition of cognitive impairment in primary care outpatients. Southern Medical Journal, 76, 1264-1265, 1270, 1983.

Hyer, L., Gouvela, I., Harrison, W.R., Warsaw, J., and Coutsouridis, D. Depression, anxiety, paranoid reactions, hypochrondiasis and cognitive decline of later life inpatients. Journal of Gerontology, 42, 92-94, 1987.

Kay, D.W., Henderson, H.S., Scott, R., Wilson, J., Rickwood, D., and Grayson, D.A. Dementia and depression among the elderly living in the Hobart community: The effect of the diagnostic criteria on the prevalence rates. Psychological Medicine, 15, 771-788, 1985.

Litovitz, G.L., Hedberg, M., Wise, T.N., White, J.D., and Mann, L.S. American Journal of Emergency Medicine, 3, 400-402, 1985.

Mattis, S. Mental status examination for organic mental syndrome in the elderly. In L. Bellak and T.B. Carasu (Eds.), Geriatric Psychiatry. New York, NY: Grune and Stratton, 1976, 77-106.

Miller, F., Barasch, A., Sacks, M., Levitan, J., and Ashcroft, L. Serum prolactin correlates with depressed mood during alcohol withdrawal. Drug-Alcohol-Dependency, 17, 331-338, 1986.

Myslobodsky, M.S., Tomer, R., Holden, T., Kempler, S., and Sigal, M. Cognitive impairment in patients with tardive dyskinesia. Journal of Nervous and Mental Disorders, 173, 156-160, 1985.

Nelson, A., Fogel, B.S., and Faust, D. Bedside cognitive screening instruments: A critical assessment. Journal of Nervous and Mental Disorders, 174, 73-83, 1986.

Porch, B.E. Porch Index of Communicative Ability. Palo Alto, CA: Consulting Psychologists Press, 1981.

Taylor, M.A. and Abrams, R. Cognitive impairment in schizophrenia. American Journal of Psychiatry, 141, 196-201, 1984.

Rovner, B.W. and Folstein, M.F. Mini-Mental state examination in clinical practice. Hospital Practitioner, 22, 99, 103, 106, 110, 1987.

Steele, C., Lucas, M.J., and Tune, L. Haloperidol versus thoridiazine in the treatment of behavioral symptoms in senile dementia of the Alzheimer's type: preliminary findings. Journal of Clinical Psychiatry, 47, 310-312, 1986.

Young, R.C., Manley, M.W., and Alexopoulos, G.S. "I don't know" responses in elderly depressives and in dementia. Journal of the American Geriatric Society, 33, 253-257, 1985.

DISCUSSION

C: I think you've presented empirical evidence that it's no more useful to give so-called "intellectual" tests to an aphasic patient and call them demented than it is to give a language test to a demented patient and call them aphasic.

C: The problem with these mini mental scales, is even though they use different tasks, every task requires that they understand and talk. And, it should be surprising that when you give a test to an aphasic patient and one of their best categories is the use of language.

C: Also, it points out that things can be significantly related and can be misleading because they are. Your regression is probably significant when you compared performance on this task with performance on the PICA even without the outlier in there.

C: There's a recent paper in the Mayo Clinic Proceedings where they present data on a mini mental test that was developed there and they cautioned that it should not be given to patients with significant language impairment.

R: Sometimes these precautions don't make it into the articles that are encouraging house staff and other physicians and hospital personnel to use standardized mental status exams. Then, when they go from an interview format to a "check off" test they might be less inclined to use clinical intuition or good judgment and refer questionable cases on for more complete assessment.

C: An additional problem is when you have a lot of nonspecialized interviewers administering the test.

R: Of course. That's a problem, too.