When Metacognition Fails: Impaired Awareness of Deficit in Alzheimer's Disease

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Abstract

■ Two new measures were developed to assess quantitatively the degree to which patients with Alzheimer's disease (AD) are aware of their memory deficit, and to evaluate the relation between dementia severity and awareness of deficit. Results of a questionnaire measure indicated that AD patients rated their own difficulties with cognitive activities of daily life significantly lower than relatives rated patients' problems, and this discrepancy was related to patients' dementia severity. On another measure involving task performance predictions, AD patients were inaccurate in predicting their performance on most cognitive tasks when compared to both their actual performance and relatives' predictions, despite generally accurate prediction of their relatives' performance on the same tasks. These results are discussed in terms of a breakdown in metacognitive processes. ■

Many clinical descriptions of dementing illnesses include unawareness of deficits or loss of insight as a major feature (for review see McGlynn & Kaszniak, 1991; McGlynn & Schacter, 1989). Frederiks (1985) referred to this phenomenon as "anosognosia for dementia." Despite the prevalence of this observation in clinical descriptions, there is little experimental evidence concerning unawareness of deficits in dementing populations.

Impaired awareness of deficits is most frequently reported as a clinical feature of so-called "cortical" dementias such as Alzheimer's disease (AD) and Pick's disease (e.g., Benson, 1983; Gustafson & Nilsson, 1982; Mahendra, 1984; Neary et al., 1986; Reisberg, Gordon, McCarthy, & Ferris, 1985; Schneck, Reisberg, & Ferris, 1982). A brief overview of the literature concerned with the issue of awareness of deficits in dementia, particularly AD, will serve to raise some theoretical questions about the processes and mechanisms disrupted in dementing disorders that may prevent people from being aware of and monitoring their own cognitive functions.

Several observers suggested that awareness of deficits in AD diminishes with increasing severity of the disease process (e.g., Schneck et al., 1982). Reisberg et al. (1985) assessed awareness of deficit in 25 AD patients, 5 subjects with a primary diagnosis of age-associated cognitive decline consistent with "senescent forgetfulness," and 10 control subjects with no memory impairment. Subjects were interviewed and questioned about their own functioning as well as their spouses' functioning. Spouses of subjects were similarly interviewed and questioned about their own functioning and the subject's functioning. Findings revealed that subjects with senescent forgetfulness rated their memory problems as somewhat worse than did the controls, and "Early Confusional Phase" AD patients rated their problems as being considerably worse than did the "Forgetfulness Phase" AD patients. However, once beyond the "Early Confusional Phase," AD patients tended to rate the degree of their memory impairment as progressively less severe, whereas objective measures and spouses' reports of patients' memory function provided evidence of progressive deterioration. However, patients did retain insight into their ability to communicate with the spouse, and displayed awareness of their spouses' cognitive functioning. Consistent with the results of this study, Anderson and Tranel (1989) recently found a strong association between unawareness of deficits (as assessed by a standardized interview) and degree of intellectual impairment in a dementia group consisting largely of AD patients. Other investigators indicated that there may be substantial variability in awareness among AD patients depending on their neuropsychological profiles (e.g., Neary et al., 1986).

Contrary to the foregoing results, several clinical reports of AD emphasized an early loss of insight, rather than impaired awareness restricted to the late stage (Frederiks, 1985; Joynt & Shoulson, 1985; Mahendra, 1984). For example, Frederiks (1985) indicated that the patient is usually unaware of the gradual onset of dementia occurring in both AD and Pick's disease. Similarly, Mahendra (1984) noted the early loss of insight in both AD and Pick's disease. However, Gustafson and Nilsson

(1982) developed clinical rating scales to identify AD and Pick's disease and found that patients with Pick's disease were rated substantially worse than AD patients with respect to early loss of insight. Interestingly, both of these kinds of dementia are typically associated with signs of frontal lobe pathology (see Kaszniak, 1986; Mahendra, 1984), but frontal degeneration is generally more severe in the early stages of Pick's disease than AD.

Danielczyk (1983) designed a clinical rating scale consisting of 18 parameters, including "insight into own illness," to assess mental deterioration in four groups of patients: Parkinson's disease (PD), AD, atypical Parkinson's disease (AP) with signs of vascular disease, and multiple infarction dementia (MID). Although the PD group had suffered from the disease for over 8 years, there was little evidence of cognitive impairment, whereas the other three groups were impaired to a significantly greater extent on a variety of measures. Paralleling this pattern of cognitive functioning, PD patients were found to retain reasonably good insight into their illness, whereas those in the other three groups exhibited disturbed awareness of their deficits. The AD patients showed the least awareness of their illness followed by the AP group. The MID patients, though also lacking full awareness of their condition, were significantly less impaired on this dimension than the AD group.

Experimental evidence of impaired awareness of memory dysfunction in AD patients was provided by Schacter, McLachlan, Moscovitch, and Tulving (1986). Alzheimer's patients were given a categorized list and were asked to predict how many items they would be able to recall. Relative to control subjects, AD patients grossly overestimated their ability to remember.

In summary, the literature concerned with awareness of deficits in dementia suggests that patients with disorders involving cortical atrophy and cognitive impairment appear to lose insight into their deficits. However, the paucity of experimental evidence for unawareness of deficits in various dementing illnesses, and conflicting clinical reports of the phenomenon, make it impossible to reach any conclusions about the degree to which disturbed awareness occurs in these disorders. Two major methodological shortcomings are evident in studies of anosognosia in dementia. First, clinicians and investigators have often relied solely on their subjective observations of the patient to determine the presence of anosognosia; few investigators developed quantitative methodologies for objectively evaluating the presence or degree of awareness disturbance. Second, although the relation of dementia severity to anosognosia is an important issue, its contribution has rarely been assessed in a systematic fashion.

The present study was designed to assess awareness of memory deficit in Alzheimer's disease (AD), and to further investigate the relation between dementia severity and awareness of deficit. Two objective measures of awareness were developed to evaluate quantitatively the degree to which AD patients exhibit diminished awareness of their memory deficit. The first measure, the Daily Difficulties Questionnaire, asked AD patients to rate their own and their relatives' difficulties on a variety of items related to memory functions in everyday life. In addition, relatives were asked to rate their own functioning and patients' functioning on the questionnaire items. Discrepancies between patients' and relatives' ratings were examined to provide an index of patients' awareness of their own memory deficit.

The second measure, the Cognitive Task Performance Predictions, assessed patients' awareness of their memory disorder by asking them to perform a variety of cognitive tasks following prediction of their own performance on each task. Relatives were also asked to predict patients' performance. Significantly greater prediction accuracy by relatives when compared to patients would suggest impaired awareness of memory deficit on the part of AD patients. Patients and relatives were also asked to predict the relatives' performance on the various cognitive tasks, and objective measures of their performance were collected. This component was included to establish that patients are capable of making reasonable performance estimates with respect to others' memory functioning, and that their inaccurate predictions regarding their own performance reflect a specific self-monitoring breakdown. Patients' knowledge of general memory processes was also assessed by examining their pattern of performance predictions for different kinds of memory tasks compared to relatives.

RESULTS

Daily Difficulties Questionnaire

A general linear model analysis for a repeated measures design was conducted on each of two parts of the Daily Difficulties Questionnaire data. The first analysis was concerned with patients' and relatives' ratings of patients' difficulties. Variables entered into this analysis included patients' Mini Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) scores (measure of cognitive impairment) and rater (patient versus relative). Results revealed that AD patients rated their own cognitive difficulties significantly lower than relatives rated patients' problems [$F(1,6) = 17.70, p<.01$]. These results are presented in Figure 1. A significant interaction was found between degree of cognitive impairment and rater [$F(1,6) = 7.89, p<.05$], indicating that the discrepancy between AD patients' ratings of themselves and relatives' ratings of the patients increases as patients' cognitive functioning deteriorates (Figure 2). Figure 1 also illustrates the results of a second analysis concerning patients' and relatives' ratings of relatives' difficulties. The same variables were included in this analysis as those described for the former one. In contrast to results of the first analysis, no difference was evident between patients'

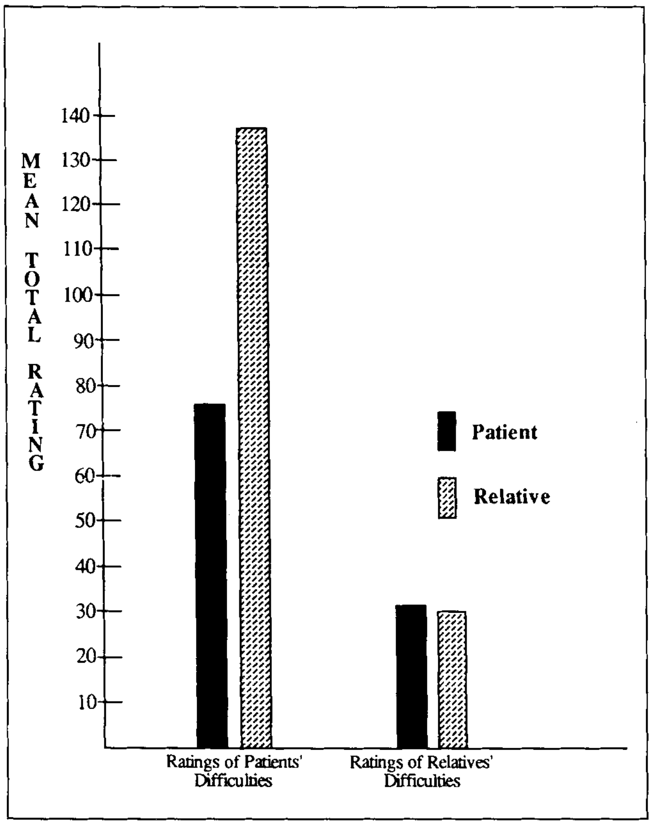

Figure 1. Daily Difficulties Questionnaire ratings, by Alzheimer's disease patients and by relatives, for degree of patients' versus relatives' difficulties.

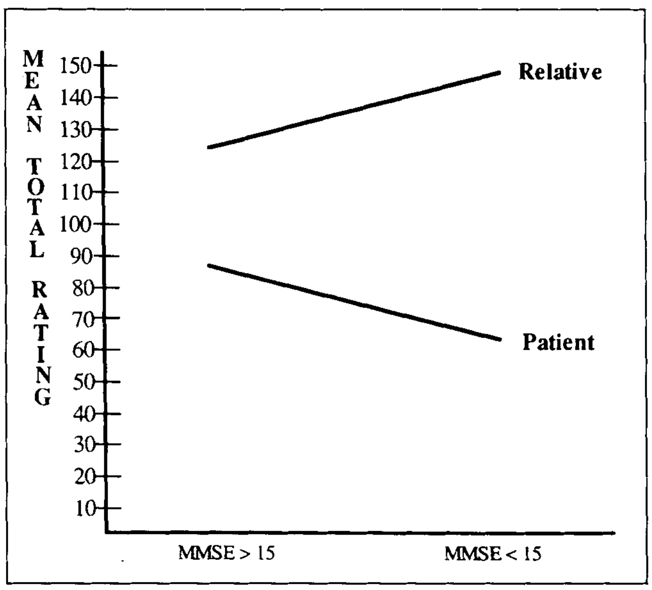

Figure 2. Interaction between Alzheimer's disease patient Mini-Mental State Examination (MMSE) scores and rater for Daily Difficulties Questionnaire ratings of patients' difficulties.

ratings of relatives and relatives' ratings of themselves ($F(1,6) = 0.11, p > .05$).

If we assume that relatives are reasonably accurate in their judgments about patients' difficulties, these results suggest that AD patients do not appreciate the severity of their memory deficit. The fact that patients were accurate in their assessment of relatives clearly indicates that patients understood how to use the rating scale, thus eliminating the possibility that their reduced awareness of their own memory difficulties was simply a consequence of a general impairment of judgment. In addition, both the mildly and moderately demented AD patients rated their own daily difficulties as greater than those of their relatives. This finding further weakens a general intellectual impairment explanation of the diminished awareness observed in AD patients.

Cognitive Task Performance Predictions

Results from the Cognitive Task Performance Predictions suggest that AD patients generally overestimate their memory abilities. Mean accuracy scores for patients' and relatives' predictions of patients' performance as well as differences between the two sets of scores are provided in Table 1. Accuracy scores were calculated by dividing the predicted performance by the actual performance for each task. Thus, an accuracy score of 1.0 indicates a perfect match between predicted performance and actual performance, whereas a score greater or less than 1.0 reflects an overestimation or underestimation of patient performance, respectively. A series of one-tailed t tests revealed that patients' accuracy scores were significantly different from relatives' accuracy scores (all $ts > 1.87$) on 8 of the 12 memory tasks (Word Recall Immediate and Delayed, Picture Recall Immediate and Delayed, Picture Recognition Delayed, Digit Span, Verbal Span, Verbal Fluency), and approached significance on another [Word Recognition Delayed; $t(7) = 1.797, p = .0577$]. These differences are all in the same direction, indicating that patients tend to overpredict their cognitive performance. It is important to note, however, that significant differences were found on some tasks because the relatives were underestimating the patients' abilities and the patients were overestimating to some extent. For example, on the Digit Span task the mean accuracy score for patients is 1.20, whereas for relatives the mean accuracy score is 0.72. The patients are actually more accurate than the relatives in this case. Similarly, on the Picture Recognition Delayed task, patients and relatives are equally as accurate in their predictions but the patients overestimate and the relatives underestimate. In other cases, both the patients and relatives overestimate the patients' performance, but significant differences are found because the patients' overestimate to a larger degree.

In marked contrast to the considerable overestimation on the part of patients when predicting their own per-

Table 1. Mean (SD) Accuracy Scores for Cognitive Task Performance Predictions (AD patients)

Task	*Patient Predict/Actual*	*Relative Predict/Actual*	*Patient–Relative Differences*
Word Recall—Immediate	3.39 (2.54)	1.66 (0.94)	1.73 (1.83)*
Word Recall—Delayed	5.56 (2.32)	1.81 (1.19)	3.75 (2.82)*
Word Recognition—Immediate	2.26 (2.75)	0.92 (0.69)	1.35 (2.38)
Word Recognition—Delayed	2.95 (2.01)	1.36 (1.60)	1.59 (2.51)
Picture Recall—Immediate	2.71 (1.50)	1.47 (0.46)	1.24 (1.62)*
Picture Recall—Delayed	5.56 (3.40)	1.99 (1.34)	3.58 (3.72)*
Picture Recognition—Immediate	1.55 (1.15)	0.99 (0.54)	0.56 (0.96)
Picture Recognition—Delayed	1.40 (1.12)	0.59 (0.31)	0.82 (1.22)*
Digit Span	1.20 (0.48)	0.72 (0.41)	0.48 (0.53)*
Verbal Span	2.13 (0.87)	1.00 (0.38)	1.13 (1.11)*
Spatial Span	1.70 (0.62)	1.14 (1.02)	0.56 (1.02)
Verbal Fluency	1.78 (1.12)	0.99 (0.34)	0.79 (1.16)*

* $p<.05$ for paired one-tailed t test on patient vs. relative.

formance, they were quite accurate when predicting their relatives' performance. A series of two-tailed t tests revealed that patients' and relatives' accuracy scores with respect to the relatives' performance were equally good for 11 of the 12 tasks (all ts > -2.08 and < 1.36; Table 2). A significant difference was only found for the Picture Recall Delayed task [$t(7) = -2.55$, $p<.05$], but this was attributable to underestimation on the part of relatives rather than inaccurate predictions by the patients. Differences approached significance for the Word Recall Delayed [$t(7) = -2.285$, $p = .0562$] and the Word Recognition Delayed [$t(7) = -2.27$, $p=.0573$] tasks.

A mixed-model analysis of variance was conducted for each memory task that included an immediate and delayed component in order to assess patients' knowledge about how memory generally functions over time. Similarly, a mixed-model analysis of variance was conducted for each memory task that included a delayed recall and recognition component to examine patients' knowledge of the cognitive demands of these two kinds of memory tasks. The Rater (patient versus relative) variable was included in each analysis coupled with the particular Task variable of interest (Word Recall—Immediate versus Delayed, Word Recognition—Immediate versus Delayed, Picture Recall—Immediate versus Delayed, Picture Rec-

Table 2. Mean (SD) Accuracy Scores for Cognitive Task Performance Predictions (Relatives of ADs)

Task	*Relative Predict/Actual*	*Patient Predict/Actual*	*Relative–Patient Differences*
Word Recall—Immediate	1.18 (0.31)	1.46 (0.47)	−0.28 (0.41)
Word Recall—Delayed	2.77 (1.72)	5.21 (4.03)	−2.44 (3.02)
Word Recognition—Immediate	0.96 (0.21)	0.94 (0.31)	−0.02 (0.25)
Word Recognition—Delayed	0.96 (0.63)	1.26 (0.80)	−0.30 (0.37)
Picture Recall—Immediate	0.83 (0.15)	0.99 (0.29)	−0.16 (0.33)
Picture Recall—Delayed	0.72 (0.28)	1.06 (0.29)	−0.34 (0.38)*
Picture Recognition—Immediate	0.88 (0.08)	0.77 (0.19)	0.10 (0.21)
Picture Recognition—Delayed	0.71 (0.29)	0.76 (0.22)	−0.06 (0.39)
Digit Span	0.89 (0.14)	1.01 (0.18)	−0.12 (0.16)
Verbal Span	0.70 (0.12)	0.77 (0.26)	−0.07 (0.25)
Spatial Span	0.91 (0.37)	1.09 (0.22)	−0.17 (0.36)
Verbal Fluency	0.68 (0.20)	0.80 (0.18)	−0.12 (0.23)

* $p<.05$ for paired two-tailed t test on relative vs. patient.

ognition—Immediate versus Delayed, Delayed Word Recall versus Recognition, Delayed Picture Recall versus Recognition). No interaction between Rater and Task was found when patients and relatives were predicting the patients' performance for the immediate and delayed components of these tasks or for the delayed recall and recognition components [$F(1,14) < 3.13$]. This lack of interaction effects suggests that patients tend to respond like their relatives; that is, they tend to reduce their predictions for memory performance after a delay, in comparison to predictions for immediate recall or recognition. In addition, they provide lower predictions for delayed recall than delayed recognition. These same six analyses were repeated for the case where patients and relatives were predicting the relatives' performance. A significant interaction between Rater and Task was observed on one of the six tasks [Picture Recall—Immediate versus Delayed, $F(1,14) = 5.2, p<.05$] and another interaction approached significance [Word Recognition—Immediate versus Delayed, $F(1.14) = 4.2, p<.06$]. These interactions reflect the patients' tendency to predict consistent performance for the relatives at the immediate and delayed tests, in contrast to relatives' tendency to substantially reduce their predictions for the delayed tests. Interestingly, the patients' predictions were more accurate than the relatives' predictions for these two tasks. Overall, these results suggest that AD patients possess the general knowledge about how memory functions over time on various kinds of memory tasks.

DISCUSSION

The present study provides two sources of evidence for impaired awareness of deficit in AD. The Daily Difficulties Questionnaire data suggest that AD patients substantially underestimate the degree to which they experience difficulty with cognitive tasks in everyday life. Similarly, the Cognitive Task Performance Prediction results indicate that AD patients are generally inaccurate when predicting their performance on a variety of memory tasks. They tend to overestimate their memory abilities, particularly on cognitive tasks in which their performance has changed most dramatically as a consequence of dementia.

Several interpretations may be proposed to explain the impaired awareness of AD patients observed on both the questionnaire and task prediction measures. One possible account of the findings is that AD patients have a general estimation deficit that prevents them from making accurate judgments on any task that involves rating or predicting cognitive performance, be it their own or another persons's performance. However, their accuracy in predicting relatives' performance on many cognitive tasks indicates that a general estimation deficit cannot explain AD patients' inaccurate ratings and predictions with respect to themselves.

Related to the foregoing account is the proposal that AD patients exhibit impaired knowledge of the memory system and its processes in general, and therefore could not be expected to reasonably predict how they or anybody else would perform on different kinds of memory tasks. Again, however, patients were able to make reasonable estimates for relatives' performance. More importantly, AD patients demonstrated preserved knowledge of memory processes in general. Like their relatives, AD patients were sensitive to the effects of a retention interval on memory, and they appreciated the different cognitive demands of recall versus recognition memory tests.

An alternative explanation of these findings is that patients may be engaging in defensive denial to minimize the psychological impact of their progressive deterioration. This interpretation seems unlikely given the strong relation between dementia severity and impaired awareness found in our study. If the defense mechanism of denial was the major factor accounting for patients' apparent awareness disturbance, one would expect the denial to be most marked early in the disease process when patients are beginning to recognize changes in their functioning but are not yet prepared to confront the serious implications of those changes. Our findings suggest the opposite pattern—patients are more likely to admit their memory difficulties at earlier stages of the disease process than at later stages. Psychogenic factors may contribute to the impaired awareness observed in AD patients, but we argue that they are not the major factors accounting for our results.

Another interpretation of our findings is that marked cognitive impairment associated with the disease process interferes with AD patients' ability to *monitor and report* changes in their own cognitive *functioning over time*, and to make reasonable predictions about their own performance on specific cognitive tasks. Stuss and Benson (1986) view impaired awareness as a deficit in self-monitoring that may involve frontal lobe dysfunction, but could also result from simultaneous lesions of several cerebral areas. We propose that a breakdown in metacognitive functions occurs with progressive AD, resulting in patients' failure to update knowledge about their *own* cognitive performance. This monitoring deficit appears to be restricted to the self, since AD patients were generally accurate when making judgments about their relatives' cognitive abilities. However, it is important to note that the relatives' cognitive functioning is unlikely to have changed significantly over the past 5 years. This study does not provide information about AD patients' monitoring abilities with respect to others, who like themselves, are suffering from a progressive dementing illness.

Evidence for impaired awareness in dementia is not limited to AD. In an earlier study examining awareness of motor and cognitive deficits in Huntington's disease (HD) patients (McGlynn & Kaszniak, 1991), a significant

relation between dementia severity and impaired awareness of deficits was found on the HD version of the Daily Difficulties Questionnaire. This result suggests that diminished awareness may be a manifestation of other dementing illnesses when cortical functions, particularly those involving the frontal lobes, are compromised.

In conclusion, the current investigation provides evidence for impaired awareness of memory deficit in AD that becomes more marked as dementia progresses. Further research directed at elucidating the specific processes and mechanisms disrupted in AD that prevent patients from monitoring their own cognitive functioning would be fruitful.

METHOD

Subjects

Patients with Alzheimer's Disease

A group of eight AD patients were included in the study (Table 3). Seven of these patients were substantially below the cutoff for cognitive impairment on the MMSE, as defined by a cutoff score of 25. Patients' scores on the MMSE ranged from 11 to 25, and patients ranged in age from 59 to 89.

Control Subjects

Spouses of the AD patients or family members who lived with the patients served as control subjects.

Procedure

Daily Difficulties Questionnaire

Patients were asked to rate, on a 7-point scale, the degree to which they currently experience difficulty performing a variety of activities in everyday life, compared to 5 years ago. The questionnaire consisted of 24 items related to memory functions (e.g., remembering what you just said a few minutes ago, remembering where you put things), and was administered verbally by the examiner. Subjects were shown the rating scale numbered 1 through 7, and could respond to each item with a verbal rating or simply by pointing to the number on the rating scale. Patients were asked to rate themselves and control subjects on these items. In addition, control subjects were asked to rate their own functioning and patients' functioning on the questionnaire items. A significant difference between patients' self-ratings and relatives' ratings of patients on this questionnaire would suggest some degree of impaired awareness on the part of patients. That is, if patients rate themselves as having considerably less difficulty than relatives report them having, patients may be underestimating their problems. If patients' ratings of relatives closely match relatives' ratings of themselves, this would rule out the possibility that a general impairment of judgment is responsible for patients' underestimation of their difficulties.

Table 3, AD patient information

Patient	*Age*	*MMSE*
HD	84	11
CH	82	12
HP	80	12
WK	72	13
JR	69	16
MC	89	18
LH	89	18
JH	59	25

Cognitive Task Performance Predictions

This measure evaluated patients' insight into their memory disorder by asking patients to perform each of 12 cognitive tasks following prediction of their own performance on each task. Control subjects were also asked to predict patients' performance. The cognitive tasks sampled various aspects of memory function: recall and recognition of a word list consisting of 10 randomly selected common words from the Kucera and Francis (1967) norms (immediate and 20-min delay), recall and recognition of 10 pictures from the Corwin and Snodgrass (1987) Picture Memory Test (immediate and 20-min delay), digit span (Wechsler, 1958), verbal and spatial recognition span (Albert & Moss, 1984), and verbal fluency (Benton, 1968).

For both the word list and picture list, patients and control subjects were asked to predict how many of 10 words/pictures patients would be able to remember immediately after hearing/seeing the list of words/pictures, and how many they would be able to recall after a delay interval of 20 min. The same questions were posed with respect to recognition of the words/pictures from a larger set (immediate and delayed). Patients and control subjects did not have any exposure to the test stimuli before making their predictions. On the word and picture recognition tasks, an equal number of distractor items were included at test, providing a measure of false positive responding. The total correct was computed by subtracting false positives from hits.

The Digit Span task required patients to repeat back digits in the same order that they were presented. There were two trials for each string of digits and patients were given credit for a particular string length if they completed one of the two trials. Patients were asked to predict how many digits they would be able to repeat back prior to administration of the test. Control subjects also predicted patients' performance on this task.

Instructions for the verbal and spatial recognition span tasks were consistent with those provided by Albert and

Moss (1984), but in addition, patients and control subjects were asked to predict how many words/discs patients would be able to remember, i.e., the number of discs on the board before making a recognition error.

Finally, for the Verbal Fluency Test, patients were asked to predict how many words that begin with a particular letter they would be able to generate in 1 min, and they were subsequently given the letters "F" and "S" for 1 min each. Actual performance was based on the average number of words generated for the two letters. Control subjects also predicted patients' performance on the Verbal Fluency Test.

For all tasks except *delayed* recall and recognition of words/pictures, patients and control subjects were told how the average person performs based on available normative data. This standard was not provided for delayed recall and recognition in order to examine whether patients possess knowledge about how memory generally functions, i.e., that remembering is more difficult after a delay and that recognition is easier than recall after a delay.

Patients were asked to predict their own performance on each task prior to actually performing the task. Similarly, control subjects were asked to predict the patients' performance on these tasks. A comparison of patients' predictions to both their actual performance and to relatives' estimates of patients' memory ability provides a method of assessing the degree to which patients lack awareness of their memory impairment. The accuracy of patients' estimates of their own performance is compared to the accuracy of relatives' estimates of patients' performance on each memory task.

Patients were also asked to predict the control subjects' performance, and control subjects were asked to predict their own performance on each cognitive task. Objective measures of the control subjects' memory performance on each task were also obtained. This component was included to determine whether dementing individuals exhibit more general intellectual and judgment problems, rather than a specific estimation problem with respect to their own cognitive performance.

Notes

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REFERENCES

Albert, M., & Moss, M. (1984). The assessment of memory disorders in patients with Alzheimer's disease. In L. R. Squire & N. Butters (Eds.), *Neuropsychology of memory* (pp. 236–246). New York: Guilford Press.

Anderson, S. W., & Tranel, D. (1989). Awareness of disease states following cerebral infarction, dementia, and head trauma: Standardized assessment. *The Clinical Neuropsychologist, 3,* 327–339.

Benson, D. F. (1983). Subcortical dementia: a clinical approach. In R. Mayeux & W. G. Rosen (Eds.), *The dementias* (pp. 185–193). New York: Raven Press.

Benton, A. L. (1968). Differential behavioral effects in frontal lobe disease. *Neuropsychologia, 6,* 53–60.

Corwin, J., & Snodgrass, J. G. (1987). The picture memory and fragmented pictures tests: Use with cognitively impaired populations. *Psychopharmacology Bulletin, 23,* 286–290.

Danielczyk, W. (1983). Various mental and behavioral disorders in Parkinson's disease, primary degenerative senile dementia, and multiple infarction dementia. *Journal of Neural Transmission, 56,* 161–176.

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-Mental State." *Journal of Psychiatric Research, 12,* 189–198.

Frederiks, J. A. M. (1985). The neurology of aging and dementia. In J. A. M. Frederiks (Ed.), *Handbook of clinical neurology* (Vol. 2, pp. 199–219). Amsterdam: Elsevier.

Gustafson, I., & Nilsson, L. (1982). Differential diagnosis of presenile dementia on clinical grounds. *Acta Psychiatrica Scandinavica, 65,* 194–207.

Joynt, R. J., & Shoulson, I. (1985). Dementia. In K. M. Heilman & E. Valenstein (Eds.), *Clinical neuropsychology* (2nd ed., pp. 453–479). New York: Oxford University Press.

Kaszniak, A. (1986). The neuropsychology of dementia. In I. Grant & K. M. Adams (Eds.), *Neuropsychological assessment of neuropsychiatric disorders* (pp. 172–220). New York: Oxford University Press.

Kucera, H., & Francis, W. (1967). *Computational analysis of present-day American English.* Providence, RI: Brown University Press.

Mahendra, B. (1984). *Dementia.* Lancaster: MTP Press.

McGlynn, S. M., & Kaszniak, A. W. (1991). Unawareness of deficits in dementia and schizophrenia. In G. P. Prigatano & D. L. Schacter (Eds.), *Awareness of deficit after brain injury: Clinical and theoretical issues* (pp. 84–110). New York: Oxford University Press.

McGlynn, S. M., & Schacter, D. L. (1989). Unawareness of deficits in neuropsychological syndromes. *Journal of Clinical and Experimental Neuropsychology, 11,* 143–205.

Neary, D., Snowden, J. S., Bowen, D. M., Sims, N. R., Mann, D. M. A., Benton, J. S., Northen, B., Yates, P. O., & Davison, A. N. (1986). Neuropsychological syndromes in presenile dementia due to cerebral atrophy. *Journal of Neurology, Neurosurgery, and Psychiatry, 49,* 163–174.

Reisberg, B., Gordon, B., McCarthy, M., & Ferris, S. H. (1985). Clinical symptoms accompanying progressive cognitive decline and Alzheimer's disease. In V. L. Melnick & N. N. Dubler (Eds.), *Alzheimer's dementia* (pp. 19–39). Clifton, NJ: Humana Press.

Schacter, D. L., McLachlan, D. R., Moscovitch, M., & Tulving, E. (1986). Monitoring of recall performance by memory-disordered patients. *Journal of Clinical and Experimental Neuropsychology* (Abstract), 8, 130.

Schneck, M. K., Reisberg, B., & Ferris, S. H. (1982). An overview of current concepts of Alzheimer's disease. *American Journal of Psychiatry, 139,* 165–173.

Stuss, D. T., & Benson, D. F. (1986). *The frontal lobes.* New York: Raven Press.

Wechsler, D. (1958). *The measurement and appraisal of adult intelligence* (4th ed.). Baltimore: Williams & Wilkins.