

Self awareness and personality change in dementia

K P Rankin, E Baldwin, C Pace-Savitsky, J H Kramer, B L Miller

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See end of article for authors' affiliations

Correspondence to:
Dr K P Rankin, UCSF
Memory and Aging
Center, 350 Parnassus
Avenue, Suite 706, San
Francisco, CA 94143-
1207, USA; krankin@
memory.ucsf.edu

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Background: Loss of insight is a core diagnostic criterion for frontotemporal dementia (FTD), whereas failure to recognise cognitive deficits and unawareness of disease (anosognosia) are well established findings in Alzheimer's disease (AD). However, self awareness of personality has not been quantified in these patient groups.

Methods: Twenty two patients (12 with frontal variant FTD; 10 with early AD) and 11 older adult normal controls completed self report questionnaires (the Interpersonal Adjectives Scales) describing their current personality. First degree relative informants completed two questionnaires, one describing the subject's current personality, the other retrospectively describing the subject's personality before disease onset. Differences between subject and informant reports of current personality were used to measure the accuracy of self awareness.

Results: Discriminant function analysis showed significant differences in self awareness among the three groups, with those in the FTD group showing the greatest magnitude of error in the largest number of personality dimensions (dominance, submissiveness, cold heartedness, introversion, and ingenuousness). Despite personality changes over time, patients with AD showed accurate self awareness in all personality dimensions except submissiveness and extraversion. Normal controls showed a pattern of underestimating positive qualities, whereas patients with FTD exaggerated positive qualities and minimised negative qualities. For the personality facets showing impaired insight, the self reports of patients with FTD and AD most closely matched their premorbid personalities, suggesting a failure to update their self image after disease onset.

Conclusions: This study operationalises research criteria for loss of insight in FTD.

Frontotemporal dementia (FTD) is thought to account for between 12% and 20% of all dementia cases and is a common cause of presenile dementia.^{1,2} Misdiagnosis is common, and FTD is often mistaken for Alzheimer's disease (AD). Consensus guidelines for FTD emphasise early behavioural change as a feature of the disease, along with disinhibition, impulsive or inappropriate behaviour, difficulty in modulating behaviour, and other large departures from premorbid personality. In addition, patients are noted to show little insight or self awareness regarding these changes. The psychiatric nature of patients' symptoms is another cause for misdiagnosis: one study showed that seven of 12 patients with FTD were first evaluated by psychiatrists for their condition.³ This stands in stark contrast to AD, in which early memory difficulties, rather than extreme personality change, tend to be the hallmark of diagnosis. Indeed, patients with AD often maintain socially appropriate behaviour and can be adept at covering up memory losses, suggesting a preservation of insight that is lacking in patients with FTD.⁴

Personality tends to be stable in middle and later life,⁵ and profound changes in personality often reflect an underlying neurological disease. Because of this, measures of personality can be used to examine the complex changes in self image, insight, and interpersonal interaction that are the hallmarks of FTD. Previous research has shown a quantitative difference in the degree and type of personality change in FTD compared with other forms of dementia. Patients with FTD who have predominantly frontal disease show dramatically increased social submissiveness and introversion compared with patients with AD.⁶ However, no quantitative study of personality self awareness exists for this patient population, despite the evidence from clinical observation that lack of insight into personality change is a key feature of FTD. Given that loss of insight remains one of the primary diagnostic criteria for FTD, it is crucially important that we improve our

ability to quantify this behavioural feature objectively so that diagnostic accuracy can be improved.

Although there is a large body of literature studying lack of insight in patients with AD, this research has focused on deficits in disease awareness (anosognosia) and unawareness of cognitive and overt behavioural deficits, rather than on awareness of personality. Compared with patients with FTD, those with AD seem to exhibit smaller but significant changes in personality, often becoming more introverted, less socially dominant, less conscientious, and more neurotic.^{6,7} Recent studies have indicated that questionnaire instruments can effectively measure personality in dementia, and this information can be used to help differentiate between AD and FTD.^{6,8}

The goal of our study was to compare self awareness of personality in patients with frontal variant FTD (FTD by Neary criteria) and those with AD. We had two hypotheses about the form that this lack of self awareness would take, namely: (1) patients with FTD would give an inaccurate assessment of their current personality, whereas the self assessments of patients with AD would be more accurate, and (2) patients with FTD would be unaware of personality change, and would describe themselves as they had been before disease onset, whereas patients with AD would recognise the personality change that they had undergone, and thus would agree with an informant's current assessment of their personality. We tested a normal control group of similarly aged older adults to show the degree of concurrence normally to be expected between self and other reports of personality. In addition, because patients with FTD

Abbreviations: AD, Alzheimer's disease; CDR, Clinical Dementia Rating scale; FTD, frontotemporal dementia; IAS, Interpersonal Adjectives Scale; InsNow, insight into current personality; VL, vector length

typically experience a greater degree of personality change than either those with AD or normal controls, all of our analyses controlled for the magnitude of personality change.

METHODS

Subjects

Twenty two patients were recruited through a subspecialty dementia clinic in the San Francisco Bay area. Patients seen at this dementia clinic represented a broad sample of the population in terms of ethnicity, sex, educational level, and socioeconomic status, and an attempt was made to recruit all available patients for our study. Patient diagnosis was derived by a multidisciplinary team of neurologists, neuropsychologists, psychiatrists, and nurses, who performed extensive behavioural, neuropsychological, and neuroimaging assessments of these patients. Twelve of the patients were diagnosed with FTD according to the Neary criteria.⁹ This subtype of frontotemporal lobar degeneration is characterised by widespread frontal degeneration involving the dorsolateral, cingulate, orbitofrontal, and insular cortexes.¹⁰ Probable AD was diagnosed in 10 patients using the National Institute of Neurological and Communicative Diseases and Stroke–Alzheimer’s Disease and Related Disorders Association criteria.¹¹ Magnetic resonance imaging scans of patients with both FTD and AD were obtained to rule out dementia as a result of cerebrovascular disease. Patients were excluded if they had a Clinical Dementia Rating scale (CDR) of 2.0 or higher, because it was believed that they would then be unable to fill out a self report questionnaire for our study.

Eleven age matched healthy control subjects were also recruited from the pool of available study participants from the dementia centre. The subjects were recruited from the San Francisco Bay area through advertisements in local newspapers and recruitment talks at local senior community centres. Interested individuals were screened by telephone for a history of psychiatric or physical health problems or a substance abuse history. Participants who passed the telephone screen underwent a one to one and a half hour neuropsychological evaluation, routine laboratory tests, and brain magnetic resonance imaging. After the initial evaluation, a multidisciplinary team consisting of a neurologist, a neuropsychologist, and a nurse reviewed the data to determine whether the patient met the criteria to be a healthy control. For inclusion as a healthy control subject for our study, subjects had to have a normal neurological examination, a CDR score of 0, Mini Mental State Examination score equal to or greater than 28/30, and delayed memory performance equal to or greater than the 25th centile in both verbal and visuospatial domains. They also had to have an informant who was a first degree family member (spouse or partner, adult child, sibling, or parent).

Groups did not differ significantly with regard to age, sex, educational level, ethnicity, or informant relationship. Table 1 summarises the demographic data.

Procedures

Patients were identified from the clinic subject pool by diagnosis and then were recruited as potential study participants. These subjects and their informants signed an institutional review board approved research consent form, including an agreement to fill out questionnaires for research purposes.

The Interpersonal Adjectives Scale (IAS)¹² is a well validated self or other report questionnaire based on the “circumplex model”, a personality theory based on interpersonal constructs.¹³ This theory posits that social interactions, and by extension, individual personality styles, fall along two orthogonal axes: power or dominance, and love or affiliation. Eight facet scores, identified by two letter codes

that locate their position along the axes, denote traits representing blends of dominance and affiliation. These are: assured/dominant, arrogant/calculating, cold hearted, aloof/introverted, unassured/submissive, unassuming/ingenuous, warm/agreeable, and gregarious/extraverted (fig 1). The IAS also includes two composite scores (DOM and LOV) that provide information about the individual’s position on each of the two major axes. In addition, it includes a calculated value for “vector length” or VL, which describes the intensity with which the personality is expressed. A high VL T score occurs when the individual expresses personality traits in a rigid manner that does not vary in response to situational demands; thus, the VL T score provides a measure of overall personality pathology unrelated to the particular traits expressed. The IAS also provides information about how an individual’s profile compares with a large sex matched normative group. The behaviours described by the IAS all occur in interpersonal rather than intrapersonal space, and can thus be observed by both the subjects and the people who frequently interact with them. Therefore, the other report on the subject was considered a valid estimate of their social personality. This logic underlies our use of other reports as the standard against which patient self reports are judged for accuracy. Questionnaires were scored using the IAS computer scoring program,¹⁴ which generates T scores by comparing patient scores with a sex matched normative sample data set collected by the IAS developers.¹² All analyses used these T score data rather than raw scores.

Informants were asked to complete each personality questionnaire twice, first describing the patient’s current characteristics, and then describing how the patient was before the onset of disease. For the retrospective assessment, informants for normal controls were asked to rate the subject’s personality before retirement; if the subject was not retired, informants were instructed to rate the subject’s personality five years ago. Raters were selected on a case by case basis, with consideration given to the informant’s frequency of contact with the patient, their described level of closeness, the rater’s own cognitive capacity (for example, in the case of an aging spouse), and their willingness to participate. Spouses were used whenever possible (67%), an adult son or daughter if no spouse was available (21%), and in one case each, a sibling and a parent caregiver was used as an informant. Personality assessment by first degree relatives of patients with dementia has been shown to have very good interrater reliability,^{15 16} and informant ratings using the IAS in particular have excellent internal and temporal reliability.¹⁷

Analytical plan

Detailed analysis of group differences and disease induced personality changes on the IAS among patients with FTD and AD has been the subject of a previous report by our group⁶; thus, the IAS scores for the groups were of secondary importance here and will be discussed only briefly. Because the goal of our study was to investigate the self awareness of personality and of personality change, the variables of interest were the difference scores calculated by comparing patient reports with the reports of their caregivers (which we considered to be the best available estimates of the patients’ real personality). Three sets of difference scores were calculated by comparing the three questionnaires for each patient.

Self awareness of current personality

These difference scores were used as the primary dependent measure of interest for the analyses. To measure the accuracy of the patient’s self assessment of personality, the patient’s current self assessment was subtracted from the informant’s current assessment of the patient for the eight facets and

Table 1 Group differences in self awareness/insight (self versus other report) controlling for degree of personality change over time

IAS facet score	Overall ANCOVA for all groups	FTD		AD		NC	
		InsNow	PersChg	InsNow	PersChg	InsNow	PersChg
IAS summary score	F(2,31)=15.39*	146.67 (84.50)§†	146.92 (82.57)†	95.30 (45.69)	82.80 (61.96)	68.60 (25.37)	45.80(34.01)
Assured/dominant (PA)	F(2,31)=4.36*	8.92 (18.05)†	-16.00 (22.43)	6.1 (14.13)	-16.90 (15.73)	-3.80 (9.56)	-1.00 (6.85)
Arrogant/calculating (BC)	F(2,31)=2.65	0.17 (10.98)	-0.83 (13.64)	8.80 (9.67)	-2.70 (7.79)	-2.40 (12.75)	-1.10 (6.01)
Cold hearted (DE)	F(2,31)=5.78*	-15.50 (27.58)†§	10.75 (24.89)	0.30 (10.29)	-6.00 (12.28)	4.50 (16.28)	-0.80 (10.77)
Aloof/introverted (FG)	F(2,31)=10.54*	-20.67 (18.53)†§	21.92 (22.31)†	-3.10 (12.00)	6.70 (6.96)	0.90 (12.12)	3.10 (11.26)
Unassured/submissive (HI)	F(2,31)=7.73*	-15.42 (10.90)†	16.58 (12.46)†	-12.30(16.77)†	12.80 (12.05)†	0.70 (10.82)	0.70 (6.81)
Unassuming/ingenuous (JK)	F(2,31)=4.82*	-5.17 (16.72)†	-1.83 (17.47)	-9.50 (14.75)	6.80 (14.91)	-4.10 (8.29)	-6.20 (5.69)
Warm/agreeable (LM)	F(2,31)=3.38*	12.33 (29.84)	-7.42 (23.10)	-0.80 (16.44)	1.00 (14.67)	0.00 (10.30)	-2.00 (6.07)
Gregarious/extraverted (NO)	F(2,31)=5.31*	18.83 (24.85)†	-21.42 (26.63)	8.80 (13.16)†	-8.10 (13.24)	-0.80 (11.22)	-3.90 (10.84)
DOM	F(2,31)=10.32*	1.70 (1.15)†§	-1.88 (2.06)†	1.24 (1.36)†	-1.44 (1.26)	-0.21 (1.08)	-0.19(0.70)
LOV	F(2,31)=5.76*	1.56 (2.86)†§	-1.49 (2.57)	-0.21(1.08)	0.13 (1.20)	-0.14 (1.05)	-0.15(1.00)
Vector length (intensity)	F(2,31)=8.11*	-13.83 (24.07)†§	19.17 (24.01)	-18.00 (17.10)	5.00 (11.42)	-2.2 (14.51)	7.40(13.19)
Age	F(2,31)=2.82	61.6 (8.8)		69.3 (10.9)		71.1 (11.1)	
Education (years)	F(2,31)=0.36	16.0 (2.5)		16.0 (3.1)		17.1 (4.4)	
CDR score	F(2,31)=8.15*	0.77 (0.52)†		0.52 (0.52)†		0.06 (0.18)	
Sex (M/F)	χ ² =NS	10/2		6/4		5/6	
Race (white/other)	χ ² =NS	11/1		8/2		11/0	

InsNow, insight into current personality; PersChg, personality change over time; *Significant at p<0.05; †significant at p <0.05 versus NC; §significant at p<0.05 versus AD. AD, Alzheimer's disease; CDR, Clinical Dementia Rating scale; DOM, composite score for the dominance and power axis; FTD, frontotemporal dementia; IAS, Interpersonal Adjectives Scale; LOV, composite score for the love and affiliation axis; NC, normal control; NS, not significant.

three composite scores (DOM, LOV, and VL) of the IAS. The larger the absolute value of difference, the greater the discrepancy between patient and caregiver reports; thus, we suggest larger difference scores indicate poorer self awareness. The directionality of the difference score indicates whether the patient overestimated (positive value) or underestimated (negative value) the personality trait in relation to the informant's rating. An overall insight summary score was also derived by adding together the absolute values of all eight facet insight scores, measuring the magnitude but not the directionality of the discrepancy.

Personality change over time

This second difference score was included in analyses as a potentially confounding nuisance variable because we hypothesised that a patient's level of self awareness might be influenced by the degree to which his or her personality had changed over time. To determine the degree to which the subject's personality changed over time, this score was

calculated based only on the two informant reports. The subject's premorbid personality score was subtracted from the current score to obtain a directional measure of personality change for each of the eight IAS facet scores and for the three composite scores (DOM, LOV, and VL).

Awareness of personality change

This last difference score was derived to investigate our second hypothesis: that patients with FTD who have significant personality changes would not realise that their personality had changed, and would describe themselves as they once were, in high agreement with the informant's description of their premorbid personality. To determine the concordance between the patient's current self assessment of personality and the informant's description of the patient's premorbid personality, the caregiver's past assessment was subtracted from the patient's current assessment.

Because the IAS generates a large number of intercorrelated variables, group differences were explored by means of multivariate statistics. The dataset was reduced using univariate ANCOVAs (controlling for sex and age) to determine those variables in which the groups differed significantly. Then, discriminant function analyses were performed using these significant variables to determine which variables were best able to predict disease group. Although discriminant function analysis assumes that no variable may be a linear combination of the other discriminating variables, the three IAS composite scores (DOM, LOV, and VL) were included because they were analysed in conjunction with only a subset of the eight facet scores, and thus contained additional unique information derived from variables that were not included in the discriminant function. Because a Box's M test for the equality of population covariances was significant, individual group covariance matrices were used instead of the pooled variances to compute the probability of group membership for all discriminant functions. Violation of this assumption can decrease a discriminant function's capacity to provide maximum separation among the groups; thus, the percentage of correct classifications is probably an underestimate of the true discriminating power of the variables in these analyses.

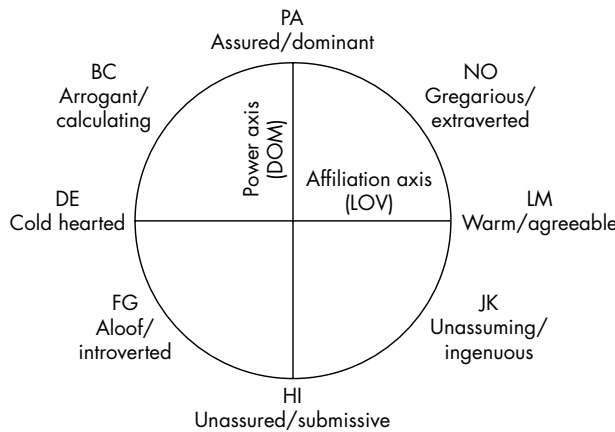


Figure 1 The IAS interpersonal circumplex model depicts interpersonal functioning as eight facet scores derived from two main axes, power and affiliation.¹²

RESULTS

Differences between patient and caregiver assessment of personality

Both patient groups showed significant changes in several areas of personality (table 1). Compared with controls, patients with FTD showed large, significant increases in the facets aloof/introverted and unassured/submissive, and a decrease in the composite score DOM, whereas patients with AD showed a smaller, significant increase in unassured/submissive. However, the aim of our study was not to describe personality change, but rather to compare patient awareness of personality and of these personality changes, so these difference scores were primarily used as covariates in subsequent analyses.

Hypothesis 1

Self awareness of current personality (InsNow)

Summary score

The overall accuracy of patient insight into current personality, as measured by the difference between the patient's current self assessment and the informant's current report, differed significantly for patients with FTD, patients with AD, and normal controls when the InsNow summary score was examined ($F = 15.39$; $p < 0.001$). As we had hypothesised, patients with FTD had significantly higher summary scores, indicating much poorer insight than either patients with AD or normal controls. Interestingly, summary insight scores did not differ significantly between patients with AD and normal controls, despite the significant changes in the personalities of patients with AD, indicating that overall accuracy of self assessment of personality is better preserved in AD than in FTD. Because the summary score was a composite of eight different variables, it was not possible to draw conclusions about the direction of change based on the summary score alone. Thus, to assess whether patients with FTD were overestimating or underestimating their personality change, we further examined each of the eight facets independently.

IAS subscale scores

Because the IAS consists of many interrelated variables, detailed characterisation of the differences in insight among the groups required multivariate statistics rather than a univariate approach. All three diagnostic groups were analysed together in one discriminant function analysis to determine which InsNow facet scores or summary scores best predicted group membership. Data reduction was performed by omnibus ANCOVA analysis, from which the IAS InsNow facet scores that showed significant group differences were entered into the discriminant function analysis. The best group discriminative ability was obtained using seven variables. The standardised canonical function coefficients for the first function (Wilks' $\lambda = 0.388$; Eigenvalue, 0.693; $p < 0.05$) were, in order of influence: DOM, 1.366; LOV, 1.139; unassured/submissive, 1.089; gregarious/extraverted, -1.403; aloof/introverted, -0.993; VL, 0.821; and cold hearted, -0.006. The second function's coefficients were: LOV, 0.831; DOM, -0.114; unassured/submissive, 0.804; VL, 0.401; gregarious/extraverted, -0.761; cold hearted, 0.466; and aloof/introverted, -0.472. Together, these two functions correctly categorised 75.8% of the patients into their diagnostic groups, showing a clear improvement over the 33% that would be expected at chance values. This lends further support to the hypothesis that the groups differed significantly with respect to their insight into personality change.

Compared with the current informant reports, patients with FTD greatly overestimated their positive qualities, such as assured/dominant (patients with FTD: mean, +8.92; SD, 18.05; normal controls: mean, -3.80; SD, 9.56) and

gregarious/extraverted (patients with FTD: mean, +18.83; SD, 24.85; normal controls: mean, -0.80; SD, 11.22), while underestimating their negative qualities, such as cold hearted (patients with FTD: mean, -15.50; SD, 27.58; normal controls: mean, +4.5; SD, 16.28), aloof/introverted (patients with FTD: mean, -20.67; SD, 18.53; normal controls: mean, +0.90; SD, 12.12), and unassured/submissive (patients with FTD: mean, -15.42; SD, 10.90; normal controls: mean, +0.70; SD, 10.82) (table 1; fig 2). In contrast, the control group estimated these qualities in the opposite direction, providing a slightly more negative self assessment than their informants. Patients with FTD also significantly underestimated the rigidity with which they enacted their current personality (VL). The personality facet in which the patients with FTD had the least self awareness was the aloof/introverted octant, which is also the area in which these patients were noted by their caregivers to undergo the greatest personality change (patients with FTD: mean, +21.92; SD, 22.31; normal controls: mean, +3.10; SD, 11.26). The differences between normal controls and patients with FTD remained significant in these areas ($p < 0.05$) even when ANCOVAs were performed controlling for the degree of change.

Although the differences were less pronounced than in FTD, patients with AD did differ significantly from normals in their accuracy of self assessment in two facets of personality. Similar to patients with FTD, they underestimated their level of unassuredness/submissiveness (patients with AD: mean, -12.30; SD, 16.77) and overestimated their level of gregariousness/extraversion (patients with AD: mean, +8.80; SD, 13.16). Although the direction of these differences was the same as in the FTD group, the differences were smaller in magnitude. This was particularly true in the case of insight into gregariousness/extraversion. Interestingly, whereas patients with FTD showed significantly worse insight in the areas in which they had undergone the greatest personality change, this trend was not apparent in the AD group. Patients with AD underwent the greatest change in assuredness/dominance, but they did not differ significantly from normal controls in their insight into this change.

The accuracy of the accounts of patients with FTD of their current personality was significantly worse than that of those with AD in two personality facets, even after the differences in magnitude of change over time were statistically removed. Patients with FTD significantly underestimated their current cold heartedness, whereas the self assessment of the patients with AD in this octant was as accurate as that of the normal controls (patients with FTD: mean, -15.50; SD, 27.58; patients with AD: mean, -0.30; SD, 10.29). The same pattern was seen with the trait of aloofness/introversion (patients with FTD: mean, -20.67; SD, 18.53; patients with AD: mean, -3.10; SD, 12.00). Because the insight of patients with AD into these current personality traits was statistically indistinguishable from that of normal controls, poor insight in these particular areas of personality may be a distinctive feature of FTD.

Hypothesis 2: awareness of personality change

We then compared the three subject groups to see whether their self reports best matched informant reports of their current personality or their past personality. To do this, we calculated the relative magnitude of discrepancy between the patients' current and informants' past reports, and again between the patients' current and the informants' current reports, using the IAS T score values for each facet (table 2); these two discrepancy scores were then compared. The patient's self report score was considered equidistant from both past and current other reports if the difference T scores were within two points of each other. Otherwise, the other

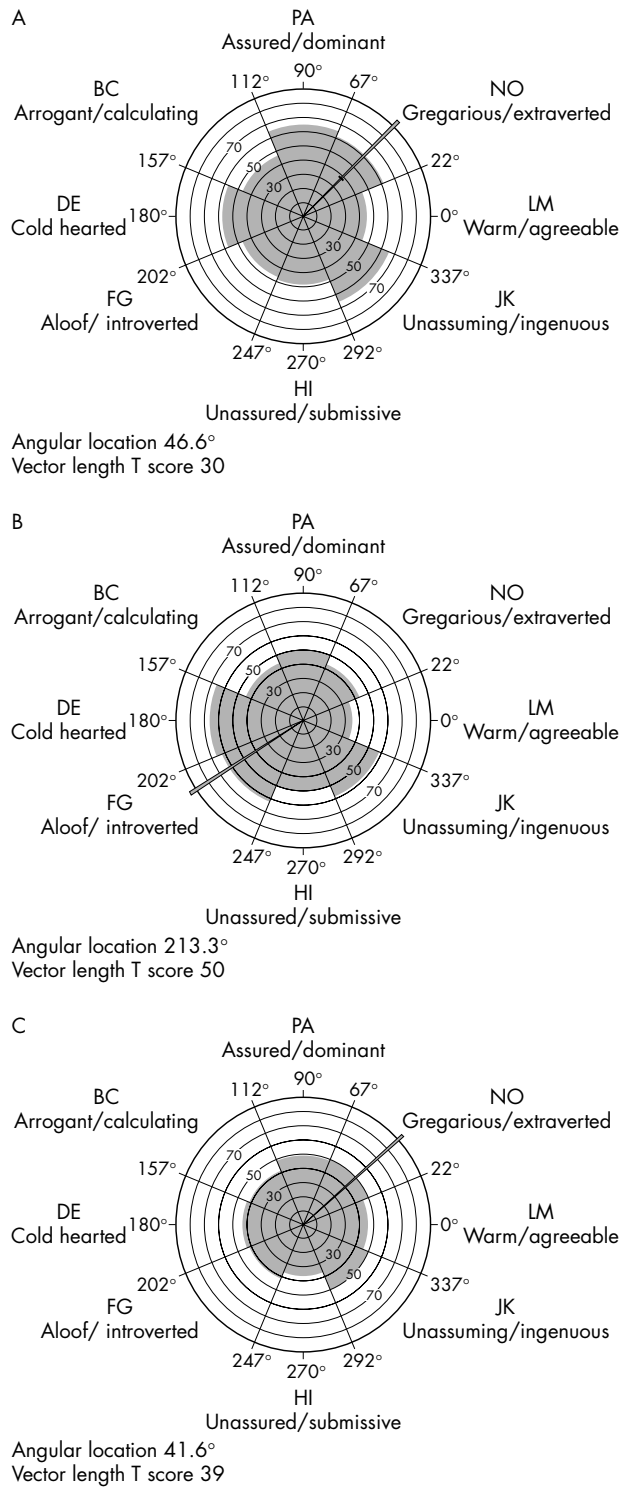


Figure 2 Comparison of (A) other retrospective, (B) other current, and (C) self current reports of the personality of a patient with frontotemporal dementia.

report score closest to the patient’s report score was considered to be a better fit.

Patients with FTD showed a closer match between their current self report and the other’s report of their premorbid personality on six of the eight facets of personality, namely: assured/dominant, cold hearted, aloof/introverted, unassured/submissive, warm/agreeable, and gregarious/extroverted. The facets for arrogant/calculating and unassuming/

ingenuous were equidistant from the caregivers’ premorbid and current ratings, so that the results were equivocal. This suggests that the patients with FTD are not only failing to report their current personality accurately, but they are in fact accurately describing themselves as they were premorbidly. In contrast, in none of the personality facets did the normal control subjects rate themselves more similarly to their informant’s past reports than to their current reports. The normal control group’s average current self report more closely matched their informant’s current report in four of the eight facets (aloof/introverted, unassuming/ingenuous, warm/agreeable, and gregarious/extraverted), with the other four matches being equivocal. Thus, the normal control group consistently described their current personalities in agreement with their informants, rather than describing themselves as they had been before retirement or five years earlier. This accuracy was even more notable given that the normal control group had undergone much less personality change, and thus had a smaller margin of error than the patients with FTD, who remained unable to perceive even the massive changes reported by caregivers.

Patients with AD showed mixed results in this comparison. Although four of the eight facets showed equivocal matches, the patients’ current self reports more closely matched their caregiver’s premorbid description for four of the eight facets (arrogant/calculating, unassured/submissive, unassuming/ingenuous, and gregarious/extraverted). In particular, the two facets on which patients with AD had showed significantly deficient self awareness compared with normal controls (controlling for degree of change)—unassured/submissive and gregarious/extraverted—showed a very close match with the caregivers’ premorbid description of the patients. The AD group’s average current self report more closely matched the informant’s current report on them for only two of the eight facets—assured/dominant and cold hearted—neither of which facets showed significant deficits in self awareness compared with controls in the previous analysis. For both of these facets, the average current self report of the patients with FTD had shown a better match with the informant’s premorbid report, despite changes of very large magnitude. Thus, like the patients with FTD, those with AD were likely to describe themselves as they had been premorbidly in some areas of personality, particularly submissiveness and gregariousness. However, unlike patients with FTD, their self report was up to date in the areas of dominance and cold heartedness, despite changes to these aspects of their personalities.

DISCUSSION

There are two primary findings from our study. First, compared with normal controls, patients with FTD showed significantly inaccurate self awareness of their current personality in almost every aspect of personality measured, whereas those with AD showed a mixture of accurate and inaccurate self assessments depending upon the facet of personality measured. Second, in the personality facets for which they showed significantly impaired self awareness, patients with both FTD and AD described their personality as it had been before the onset of dementia.

This lack of self awareness was most comprehensive in patients with FTD, despite the fact that they had undergone the largest and thus most obvious personality changes of all three subject groups. Even accounting for the different degrees of change over time among the groups, patients with FTD still showed the largest discrepancy between their self reported personality and their personality as assessed by first degree relative informants. This discrepancy occurred in most facets of personality—dominance and submissiveness, introversion and extraversion, ingenuousness, and cold

Table 2 Mean discrepancies between the patient's current report and the informant's report of the patient's personality: comparison of informant premorbid versus informant current report discrepancy

IAS facet score	Difference scores from subject current rating					
	FTD		AD		NC	
	Other current	Other premorbid	Other current	Other premorbid	Other current	Other premorbid
Assured/dominant (PA)	<u>8.9</u>	<u>-7.1</u>	6.1	-10.8	-3.8	-4.8
Arrogant/calculating (BC)	0.2	-0.7	8.8	6.1	-2.4	-3.5
Cold hearted (DE)	<u>-15.5</u>	<u>-4.8</u>	0.3	-5.7	4.5	3.7
Aloof/introverted (FG)	<u>-20.7</u>	<u>1.3</u>	-3.1	3.6	0.9	4.0
Unassured/submissive (HI)	<u>-15.4</u>	<u>1.2</u>	<u>-12.3</u>	0.5	0.7	0.0
Unassuming/ingenuous (JK)	<u>-5.2</u>	<u>-7.0</u>	-9.5	-2.7	-4.1	-10.3
Warm/agreeable (LM)	12.3	4.9	-0.8	0.2	0.0	-2.0
Gregarious/extraverted (NO)	<u>18.8</u>	<u>-2.6</u>	<u>8.8</u>	<u>0.7</u>	-0.8	-4.7

Bold: closer match to the patients' self report; Italic: an equivocal match (both difference scores within absolute T score of 2.0); Underline: facet pairs in which current self awareness was significantly inaccurate compared with normal controls, controlling for degree of change ($p < 0.05$). AD, Alzheimer's disease; FTD, frontotemporal dementia; IAS, Interpersonal Adjectives Scale; NC, normal control.

heartedness. Although normal control subjects showed a pattern of slightly understating their positive qualities and overstating their negative attributes, those with FTD showed the opposite pattern, describing themselves much more positively than caregivers. In addition, they significantly underestimated the rigidity with which they adhered to their current personality style.

It could be hypothesised that the inaccurate self assessments of the patients with FTD may have resulted from difficulty in responding to the questionnaires, particularly if the patients had apathetic, perseverative, or executively disorganised response sets resulting in random profiles. However, our second analysis showed that the patients' self reports were meaningful, because even though they were inaccurate estimates of their current personality, they accurately reflected their premorbid personality. This finding suggests that patients with FTD are failing to update their assessment of personality based on information gained after the onset of disease. As part of the disease process, they appear to maintain a static image of themselves that was created by the cognitive mechanism for self awareness while it was still functional.

The patients with AD in our study showed accurate insight into many domains of personality, including some in which they had undergone changes since the onset of disease. Whereas patients with FTD showed significantly poorer insight in those areas in which they had undergone the greatest change, this trend was not apparent in the AD group. Patients with AD underwent the greatest change in their assuredness and social dominance, but they did not differ significantly from normal controls in their awareness of this change. The overall degree of discrepancy between the self reports of the patients with AD and their informants' reports did not differ from that seen in normal control subjects. However, they did significantly underestimate the degree to which they exhibited unassured and submissive behaviours, and overestimated their degree of extraversion. In all of these personality facets, the current self assessments of the patients with AD closely matched the informants' description of their premorbid personality, suggesting that, like the patients with FTD, the source of their inaccurate self awareness in these areas was that they failed to update their self image.

A possible explanation for the different results found in the two dementia groups might take into account the known

neuroanatomical bases of the two diseases. In typical AD, the parietal lobes are damaged earlier and more severely than the frontal cortex, because the disease tends to start in the back of the brain and progress anteriorly. The patients with AD selected for our study were at the early stages of the disease (CDR, < 2), and studies consistently suggest that patients with AD show worsened insight into their cognitive deficits as the dementia becomes more severe and the disease spreads to involve the frontal cortex.¹⁸ Thus, it is possible that we were able to capture an initial phase of deficient self awareness in these patients, whereas patients with AD whose disease has progressed to the frontal lobes might begin to show lack of self awareness in more domains of personality, similar to that seen in the FTD group. If this is true, then it is possible that for the particular social areas in which patients with AD showed insight deficits (expression of submissive behaviours and loss of extraversion), input from parietal structures may be required to achieve accurate error monitoring.

The patients in the FTD group all met Neary criteria for this condition, which suggests that they suffer from disease predominantly affecting frontal lobe structures, but leaving the parietal cortex comparatively intact.¹⁰⁻¹⁹ Recent functional neuroimaging studies support the link between self awareness and the frontal lobe.²⁰⁻²⁵ However, a broader review of recent studies of self awareness suggests that these frontal structures are only one part of a larger circuit. Several studies implicate parietal structures, particularly the inferior parietal lobule, in identifying self generated actions and self referential mental states.²⁶⁻²⁷ In reviewing these data, Abu-Akel²⁸ argues that there are three main modules involved in mentalising about oneself. He suggests that information about oneself is first perceived and represented in parietal structures. This information is then relayed to a limbic-paralimbic module, where it is rapidly evaluated for personal relevance and emotional meaning. Lastly, that information is relayed to a prefrontal module, including the dorsal medial prefrontal and dorsolateral prefrontal regions, where Abu-Akel suggests executive processes such as planning, sequencing, inhibition of responses, and error monitoring are performed on this self related information.

This model is helpful for hypothesising why our study found extremely inaccurate self awareness in patients with FTD, but only limited deficits in self awareness of personality

in patients with AD. Although they may maintain the ability to identify self related mental processes because their parietal lobes are comparatively intact, patients with frontal variant FTD consistently have significant damage to structures ostensibly involved in the second and third steps of processing self related information—that is, the paralimbic and the dorsolateral regions. Patients with early AD are much less likely to have significant damage to the paralimbic structures,^{10–29} allowing them to perform a correct assessment of the emotional salience of their self related percepts and thoughts. However, the inferior parietal lobule is typically affected early on in AD,^{30–31} which may cause the quality of input into the self awareness system to be degraded in this group. The dorsolateral frontal cortex may also sustain mild damage quite early in AD, depending upon the idiosyncrasies of disease progression in each individual; however, patients with FTD probably have much more severe damage to the structures responsible for Abu-Akel's hypothesised “third step” of self related processing. This last part of the circuit will be highly susceptible to damage with advancing disease severity in patients with AD, which may help to explain why loss of insight into other domains such as disease status and cognitive ability worsens as AD progresses. Clearly, this hypothetical explanation is merely speculative at this point; however, it clarifies the need for additional studies directly linking deficient self awareness with structural and functional damage in these patient groups. Although the semantic loss typically experienced by the temporal variant of frontotemporal lobar degeneration (semantic dementia) makes it difficult for these patients to comprehend self report questionnaires, study of the quality of insight in this diagnostic group would also provide valuable information about the relative contributions of medial frontal and temporal structures to self awareness of personality and behaviour.

An important statistical issue for our study is that the standard deviations for many of the personality facets were quite broad, particularly in the patient groups. However, this is not surprising, given the fact that even within the normal population, insight does vary among individuals. The wide standard deviations for the self awareness scores in the normal control group suggest that the subjects sometimes overestimated and sometimes underestimated their ratings in comparison with the informants' reports, but that no group trend in a single direction was seen. The group means were extremely close to the others' ratings for them, suggesting that the large standard deviations represent the normal variability one would expect between one's self perception and another's perception of oneself, particularly for a factor that is as variable as personality. The fact that the deviations tended to be larger in the dementia groups than in the normal control group can be explained by the fact that these groups were more clinically heterogeneous, because they were necessarily composed of patients with varying degrees of dementia. Indeed, the fact that highly significant differences emerge between the groups despite the “noise” introduced by these wide standard deviations is suggestive of a large effect size, and gives further credibility to the findings.

There is no existing research describing whether self awareness of personality normally varies between men and women, or whether there are age differences throughout the lifespan. We used only standardised scores based on sex matched normative samples, so despite the fact that the FTD group contained more men than the AD and normal control groups, sex differences in personality between groups should have been nullified and probably did not contribute to our findings of poorer insight in the FTD group. Those with FTD were on average 10 years younger than the patients in the other two groups, although this difference was not

significant. Even if there were research suggesting differences in insight and self awareness between cohorts of differing ages (for example, young adults versus retired adults), the non-significant 10 year age difference between our groups does not place the patients with FTD in a clearly different age cohort from the other groups, and is unlikely to account for the massive group differences in self awareness seen in our study.

Our study has several clinical implications with relevance to patients with FTD and AD. First, the current research criteria for frontal variant FTD suggest that lack of insight is a core diagnostic finding.¹⁹ However, given that patients with FTD often present initially with no significant cognitive deficits, this lack of insight necessarily refers to a failure to recognise changes in behaviour and personality. Although this can be assessed in a qualitative manner by clinical interviewing, quantitative operationalisation of this core criterion is necessary to allow thorough characterisation of this disease. The introduction of measurement instruments that have already been psychometrically validated by psychological researchers is a crucial step that will allow more precise study of FTD. Using such an instrument in our present study, we were able to provide a quantitative statistical analysis of this phenomenon in patients with FTD to validate and build upon existing descriptive case studies. Our study also has relevance for the differential diagnosis of FTD versus AD and other dementias in which self awareness may be affected. We also found that in addition to established deficits in disease awareness (anosognosia) and awareness of cognitive dysfunction, patients with AD show selected impairments in self awareness of personality. However, the quality, breadth, and degree of this lack of self awareness can help differentiate between patients with AD and FTD. More specifically, our study showed that patients with FTD provide a startling underestimation of their emotionally cold and introverted behaviours, whereas those with early AD (despite some increases in these qualities after disease onset) remain capable of providing an accurate self assessment of these qualities. Patients with both AD and FTD show a decrease in assertive behaviours in response to their illness; however, patients with AD can report this accurately, whereas those with FTD cannot. The question of why insight into particular facets of personality is preserved in AD whereas it is lost for others remains unanswered; however, this does provide an impetus for continued research into the neuroanatomy of personality. Finally, the different degrees to which patients with FTD and AD have lost self awareness of personality can be used to challenge or support existing theories concerning the anatomical substrate of self awareness.

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Authors' affiliations

K P Rankin, E Baldwin, C Pace-Savitsky, J H Kramer, B L Miller,
University of California San Francisco Memory and Aging Center, 350
Parnassus Avenue, Suite 706, San Francisco, CA 94143-1207, USA

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