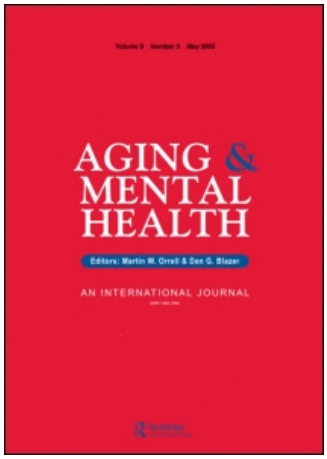

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Personality changes in Alzheimer's disease

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Abstract
Background: Assessment of personality changes in patients with dementia has received little systematic investigation, although caregivers report personality modifications in every phase of dementia. *Methods*: A group of 52 patients with probable Alzheimer's disease (AD) vs. a group of fifteen control subjects were selected for these personality tests before and after the manifestation of dementia using an Italian version of Brooks and McKinaly's Personality Inventory (PI). *Results*: After the onset of AD, a significant shift from positive to negative characteristics in PI was observed in 12 of 18 bipolar pairs of adjectives constituting the instrument and the total mean PI score decreased significantly ($p < 0.001$), indicating a substantial worsening of personality profile. In the control group however, evaluated before and after retirement, personality traits and total mean PI score did not show a significant change. The association of personality traits and total PI score with demographic, cognitive and functional characteristics of AD patients was calculated. Conclusion: Personality changes have been depicted to be influenced by severity of cognitive, functional and behavioural complaints rather than age, sex, education and disease duration. These first applications of the Italian version of PI confirmed that personality modifications make a consistent aspect of the phenomenology of AD although in the negative direction. Further studies are needed to understand the nature of personality changes in dementia and the utility of PI to investigate these changes.

Introduction

In addition to the cognitive deficits, Alzheimer's disease (AD) manifests personality changes and behavioural symptoms in almost all patients (Aitken, Simpson, & Burns, 1999; Binetti et al., 1998). Cognitive impairment has been widely studied with respect to the standardised neuropsychological tests and a series of extensively validated instruments used to assess behavioural disturbances (Bianchetti et al., 2004; Finkel, 2003). Assessment of personality in patients with dementia, however, presents particular methodological problems and, for this reason, personality changes have received little systematic investigation and few tools are available for clinical purposes (Shah, Foli, & Ian O Nnatu, 2005). Informant-reported instruments to evaluate personality in subjects with dementia have been validated (such as Neo Personality Inventory [NEO-P]) but a clinically extensive application of such instruments is limited because of their relatively longer duration (Costa et al., 1997). Moreover, the reliability of self-report in subjects with impairment in insight, judgement and memory is questionable and more so in the advanced stages of dementia. For these reasons, caregivers are considered as the more reliable source of information with respect to the changes in personality after the onset of symptoms of AD.

Brooks and McKinley (1983) formulated a brief questionnaire, holding the carer responsible to assign accurate ratings of the patient according to his/her condition prior to the onset of illness and after receiving treatment. Brooks and McKinley's Personality Inventory (PI) (1983) was originally applied to patients with head injuries and it was sensitive to behavioural alterations produced by brain dysfunction as well as to changes as brain function restored. The PI was also validated to retrospectively detect personality changes in patients with dementia (Aitken et al., 1999; Petry, Cummings, Hill, & Shapira, 1988). In a recent study, it was used to examine the effects of anticholinesterase drugs on the ratings of personality changes in AD (Purandare, Bloom, Page, Morris, & Burns, 2002).

The aim of this study was to examine the personality changes in a group of patients with AD in relation to the clinical characteristics of dementia, using the Brooks and McKinley PI translated and validated in Italian.

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Methods

The Brooks and McKinley Personality Inventory consisted of 18 bipolar pairs of adjectives describing the extremes of 18 attitudes and behaviours. The caregiver was asked to rate the patient on a 5-point scale, ranging from −2 (negative extreme of personality trait) to +2 (positive extreme of personality trait), on which zero was assigned as being neutral. Positive and negative adjectives were randomly positioned to avoid response bias. The carer was asked to fill in two separate inventories, the first describing the patient before the onset of symptoms of AD (pre-morbid personality) and the second, at the time of interview (current personality). Both the inventories were completed in the same setting.

The original Brooks and McKinley PI was translated and adapted into Italian and then independently back-translated into English. The reliability of the Italian version of PI was assesed through a test-retest procedure, aiming at conducting the test twice (after a one-week interval) for the same caregivers. For the validation, the PI was submitted to a sample of 15 principal caregivers (five spouses, eight sons/daughters and two other relatives) of patients having confirmed the manifestation of dementia of various aetiologies, mainly AD (12 subjects) or Vascular dementia (VD) (three subjects).

After validation of the Italian PI, a new group of 52 principal caregivers of community dwelling patients with probable AD (defined using NINCDS-ADRDA criteria) were evaluated and compared to 15 control subjects (relatives of people without dementia), being similar for sex and age. Patients with dementia were recruited from the Alzheimer Evaluation Clinic, while the controls were selected from patients admitted to the Medical Ward of the same hospital (Istituto Clinico S. Anna, Brescia, Italy) for acute diseases (excluding neurological diseases, severe medical conditions, cancer and languages difficulties). The control subjects and all caregivers were cognitively healthy and did not present any behavioural symptoms.

Alzheimer's disease and control subjects were assessed for: cognitive functions through the Mini-Mental State Examination (MMSE) (Folstein, Folstein, & McHugh, 1975); functional status through the Barthel Index (BI) (Mahoney et al., 1965) and through the Instrumental Activities of Daily Living (IADL) (Lawton et al., 1969); depression with the 15-items version of the Geriatric Depression Scale (GDS) (Yesavage, Brink, & Rose, 1983); and behavioural symptoms with the Neuropsychiatric Inventory (NPI) (Cummings et al., 1994). The sample of the caregivers of AD subjects consisted of 12 spouses, 30 sons/daughters, seven brothers/sisters and three other relatives. Among AD patients were 37 women and 15 men, with a mean age of 78.4 ± 5.6 years (range 58–91), a mean MMSE score of 18.1 ± 6.4 (range 3–24) and a mean duration of illness of 34.3 ± 22 months (range 6–96). The control subjects were 15 retired elderly (nine women and six men), with MMSE scores greater than 24 (mean score 26.7 ± 1.6, range 25–29), a mean age of 75.1 ± 7.1 years (range 66–91) and mean duration of retirement of 169 ± 82.3 months. To assess their personality changes after retirement, a close relative (sons/daughters in ten cases or spouses in five cases) was interviewed.

Prior to the study informed consent was obtained from all subjects and caregivers.

Statistical analysis

The results were analysed using the Statistical Package of the Social Science (SPSS) package (version 11.5.1 for Windows (2002)). The correlation coefficients r of Pearson was used to assess the reliability of test-retest procedure.

The one-way analysis of variance was used to compare the personality of AD with control patients, before illness and retirement, respectively. A paired-sample *t* test was used to assess the significant specific changes 'before' to 'after' AD diagnosis in AD group and 'before' to 'after' retirement in control group.

The possible influence of cognitive and non-cognitive characteristics on perceived personality changes was investigated through the Pearson correlation analysis.

Results

The group of 15 patients with dementia recruited for the validation phase, presented a mean age of 76.7 ± 8.7 years (range 58–95), with 60% being females, having an MMSE mean score of 17.7 ± 9.6 (range 0–26) and a mean duration of illness of 30.6 ± 18.1 months (range 10–60). Patients with AD included in this validation phase were not successively included in the AD group selected for the second phase of this work aiming to investigate the changes in personality. The test-retest correlations for both pre-morbid and actual personality were described in Table I. The Pearson coefficient was found to be significantly correlated in 14 of 18 pairs of adjectives both in actual and pre-morbid profile, with an r ranging from 0.55–1.00 and between 0.52–0.95, respectively. For 11 pairs of adjectives, a high correlation was present both on actual and pre-morbid judgments. These results indicate that our Italian version of Brooks and McKinley PI was highly reproducible, except for the items 'unreasonable-reasonable'. All other items revealed excellent reproducibility, with 95% confidence interval for the concordance coefficient.

Demographic and clinical characteristics of the AD and control groups are shown in Table II. The two groups appeared well matched for age,

education and absence of depressive symptoms. There was however, a significant difference for those variables describing status of dementia: MMSE (global cognitive decline), NPI and NPI distress (behavioural symptoms and related stress of caregiver). The BI and IADL (functional status) did not differ significantly, most probably due to the small number of control subjects and to the fact that they were a hospital sample at the time of evaluation.

Table III shows the PI scores (mean ± standard deviations) before and after the onset of AD. Caregivers indicated for most of the personality traits a shift from positive to negative characters after the onset of AD: patients were described as more: quiet, relying on others, disliking of company, unhappy, lifeless, out of touch, rash, listless, childish, mean, unreasonable and changeable.

The total score of the PI (range −36 to +36) was calculated by adding scores on individual traits (ranging from −2 to +2), using the same method as Purandare et al. (2002).

The mean total score of PI after the onset of dementia (0.6 ± 11.9) differed significantly ($p < 0.000$) from PI before illness (17.9 ± 11.6), indicating that the onset of dementia had a negative effect on personality traits.

The personalities of control subjects before retirement were substantially similar to that of pre-morbid AD patients (the two groups differed only in the dimension cruel-kind; in particular, AD patients were described as less kind: 1.1 ± 1.1 vs. 1.8 ± 0.6 respectively for AD and control subjects, $p < 0.01$). Personality traits obtained stability after retirement (subjects were only described as 'less energetic'). Likewise, the total PI score did not change significantly after retirement (18.5 ± 9.9 vs. 21.1 ± 9.3), before and after retirement ($p = 0.073$) respectively.

We examined the association of personality traits with the demographic and clinical characteristics of AD patients. Age, sex, education and disease duration neither correlated with each of PI personality traits, nor with PI total score. The total PI score was positively correlated with cognitive functions (higher MMSE scores correlated with higher PI scores, indicating more favourable personality traits) and with the ability to perform basic functions (indicated by BI scores). On the other hand, the PI score was negatively correlated with behavioural symptoms (higher NPI scores correlated with lower PI scores, indicating less positive personality traits), disability in instrumental activity of daily living (IADL) (functions lost) and distress of caregivers (NPI distress scores). Table IV shows the

Table I. Test-retest reliability (two submissions at a distance of one week) for each of the Personality Inventory traits.

Item	Premorbid	Actual
Talkative/Quiet	0.41	0.66*
Even tempered/Quick tempered	0.59*	0.85*
Relies on others/Does things himself	0.58*	0.10**
Affectionate/Cold	0.58*	0.93**
Fond of company/Dislikes company	0.79*	0.92**
Irritable/Easy going	0.70*	0.88**
Unhappy/Happy	0.82*	0.86**
Excitable/Calm	0.51	0.63*
Energetic/Lifeless	0.75**	0.52*
Down to earth/Out of touch	0.51	0.93**
Rash/Cautious	0.52*	0.33
Listless/Enthusiastic	0.75**	0.41
Mature/Childish	0.64**	0.72**
Sensitive/Insensitive	0.91**	0.94**
Cruel/Kind	0.95**	0.97**
Generous/Mean	0.82**	0.55**
Unreasonable/Reasonable	0.09	0.20
Stable/Changeable	0.59**	0.31

The table shows the correlations between the judgments about pre-morbid and actual personality traits obtained in two interviews, at the distance of one week. r of Pearson = *0.05; **0.01.

Table II. Demographic and clinical characteristics of AD and control subjects.

	AD ($n = 52$)	Controls ($n = 15$)	p
Age (years)	78.4 ± 5.6	75.1 ± 7.1	0.064
Sex, female %	71	60	–
Education (years)	5.3 ± 1.8	5.7 ± 3.0	0.473
MMSE	18.1 ± 6.4	26.7 ± 1.6	<0.001
GDS (15 item)	5.0 ± 2.8	3.5 ± 2.6	0.112
NPI	36.9 ± 27	12.8 ± 15.2	<0.002
NPI distress	11.1 ± 8.7	2.9 ± 3.4	<0.001
BI	81.7 ± 25.7	95.4 ± 8.2	0.086
IADL (number of functions lost)	3.8 ± 3	2.2 ± 2.2	0.079
Use of anticholinesterases (%)	55	0	–
Disease duration or time from retirement (months)	34.3 ± 22	169 ± 82.3	<0.001
Caregiver			
Spouse (%)	23.0	33.3	/
Son/daughter (%)	57.7	66.7	/
Others	19.3		/

Data are expressed as mean ± standard deviation or percentage; statistical analysis was performed with t test for unpaired data (95% confidence intervals). MMSE = Mini-Mental State Examination; GDS = Geriatric Depression Scale; NPI = Neuropsychiatric Inventory; BI = Barthel Index; IADL = Instrumental Activities of Daily Living.

Table III. Profile of personality as measured by PI, before and after the onset of AD ($n = 52$).

	Before onset of AD	After onset of AD	p
Talkative/Quiet	0.8 ± 1.3	-0.5 ± 1.3	0.000
Even tempered/Quick tempered	0.5 ± 1.5	0.2 ± 1.3	0.290
Does things himself/Relies on others	1.5 ± 1.1	-0.9 ± 1.5	0.000
Affectionate/Cold	0.8 ± 1.3	0.8 ± 1.3	0.911
Fond of company/Dislikes company	0.9 ± 1.2	0.1 ± 1.5	0.001
Irritable/Easygoing	0.2 ± 1.4	-0.0 ± 1.4	0.543
Happy/Unhappy	0.8 ± 1.1	-0.4 ± 1.2	0.000
Excitable/Calm	0.2 ± 1.5	0.4 ± 1.3	0.247
Energetic/Lifeless	1.6 ± 0.9	-0.6 ± 1.4	0.000
Down to earth/Out of touch	1.6 ± 0.8	-0.6 ± 1.3	0.000
Cautious/Rash	1.2 ± 1.1	0.4 ± 1.3	0.000
Enthusiastic/Listless	1.2 ± 0.9	-0.8 ± 1.2	0.000
Mature/Childish	1.2 ± 1.1	-0.2 ± 1.4	0.000
Sensitive/Insensitive	1.0 ± 1.3	0.8 ± 1.2	0.229
Cruel/Kind	1.2 ± 1.1	1.1 ± 1.1	0.261
Generous/Mean	1.2 ± 1.0	0.8 ± 1.1	0.013
Reasonable/Unreasonable	1.2 ± 1.0	-0.1 ± 1.3	0.000
Stable/Changeable	1.0 ± 0.9	-0.4 ± 1.3	0.000
Total personality inventory score	17.9 ± 11.6	0.6 ± 11.1	0.0001

Mean score $\pm$ standard deviation on each personality traits and total score of Personality inventory before and after the onset of AD. Statistical analysis was performed with paired sample t test (95% confidence intervals). The arrows indicate the direction of significant personality changes after the onset of AD.

Table IV. Correlations between PI scores and cognitive, behavioural and functional status in AD patients ($n = 52$).

	MMSE	IADL	BI	NPI	NPI distress
Talkative/Quiet	0.332*	−0.347*	ns	ns	ns
Even tempered/Quick tempered	ns	ns	ns	−0.493**	−0.576*
Does things himself/Relies on others	0.477*	−0.658*	0.503**	−0.485**	−0.635*
Affectionate/Cold	ns	ns	ns	−0.401**	ns
Fond of company/Dislikes company	ns	ns	ns	ns	ns
Irritable/Easygoing	ns	ns	ns	−0.334*	ns
Happy/Unhappy	ns	ns	ns	−0.305*	ns
Excitable/Calm	ns	ns	ns	−0.378*	−0.301*
Energetic/Lifeless	ns	ns	ns	−0.369*	−0.364*
Down to earth/Out of touch	0.450**	−0.407*	ns	−0.538**	−0.477*
Rash/Cautious	ns	ns	ns	ns	ns
Enthusiastic/Listless	ns	ns	ns	−0.371*	−0.364*
Mature/Childish	0.497**	−0.488**	0.287*	ns	ns
Sensitive/Insensitive	ns	−0.452**	ns	−0.301*	ns
Cruel/Kind	ns	−0.398*	ns	−0.519**	−0.363*
Generous/Mean	ns	−0.359*	ns	−0.619**	−0.504**
Reasonable/Unreasonable	0.363**	−0.521*	0.355*	−0.673**	−0.620**
Stable/Changeable	ns	ns	ns	ns	ns
Total PI score	0.290*	−0.573*	0.313*	−0.759**	−0.636*

Pearson correlation coefficient: *$p < 0.05$; **$p < 0.01$. PI = Personality Inventory; MMSE = Mini Mental State Examination; IADL = Instrumental Activity of Daily Living; BI = Barthel Index; NPI = Neuropsychiatric Inventory; ns = not significant.

relationship between each of the personality traits and clinical variables.

Discussion

In this first application, the Italian version of the PI confirms itself as a valid, reliable and easy to apply test for the analysis of personality changes in AD.

Our data confirms that the personality changes following the onset of AD are in negative direction. The results are comparable to other findings (Aitken et al., 1999; Chatterjee, Strauss, Smyth, & Whitehouse, 1992; Petry et al., 1988; Purandare et al., 2002; Siegler, Dawson, & Welsh, 1994), emphasising negative personality changes in the following areas: reliance on others, liking company, irritability, unhappiness, energy, enthusiasm, contact with reality, maturity, kindness, being reasonable and stable. Purandare et al. (2002) found, in a group of mild to moderate AD patients, a mean total score on the PI test of 20.2 ± 12.0 prior to the onset of dementia, and 9.2 ± 13.2 following the onset of dementia. In our sample, the PI score was similar

prior to the onset of dementia (17.9 ± 11.6) while, after the onset of dementia, the PI score declined (0.6 ± 11.1), indicating more marked changes in personality traits in our sample. In the present study, the most common personality changes were diminished enthusiasm, energy and stability. However, only two characteristics remained unchanged in our sample: tenderness and goodness.

We further introduced a control group as the one formed by Petry et al. (1988); they described that AD patients could be distinguished from normal (control) subjects on the basis of their PI profile. They instructed the caregiver to judge the relative's personality before and after retirement; the choice of assessment of the personality before and after retirement can be open to criticism, but it was because retirement could be considered a relevant event in life that could modify some traits of personality and the prior balance in families, similar to the appearance of illness. Our results were in accordance with those of Petry et al. (1988): the personality profile in healthy subjects was estimated as being substantially stable after retirement. The significant difference between the mean duration of illness of AD and the mean months of retirement in healthy subjects did not appear to reduce the ability of PI to measure the changes of personality due to illness, considering that the personality before the onset of AD and before retirement remained substantially similar.

The natural progression of personality modifications in AD and the relationship of personality change to cognitive and non-cognitive symptoms have been analysed in a limited number of studies with rather inconsistent results. Much is known about the initial personality changes that often occur early, even before the clinical diagnosis (Balsis, Carpenter, & Storandt, 2005). Elderly subjects with changes in personality had approximately twice the odds of having dementia as those without a personality changes independently from cognition and functional status (Smith-Gamble et al., 2002).

Some studies have described changes in personality in relation to the duration and the stage of dementia (Cooper, Mungas, & Weiler, 1990; Rubin, Morris, & Storandt, 1987), while others failed to find any correlation (Cummings, Petry, Dian, Shapira, & Hill, 1990; Heinik, Keren, Vainer-Benaiah, Lahav, & Bleich, 1999; Petry et al., 1988; Purandare et al., 2002; Petry, Cummings, Hill, & Shapira, 1989; Teri, Borson, Kiyak, & Yamagishi, 1989). Bozzola, Gorelick, and Freels (1992) found a relationship between personality changes and the duration of illness, but not with the MMSE scores. Aitken et al. (1999) found that personality modifications correlated moderately with the degree of cognitive impairment and poorly with the duration of illness. Purandare et al. (2002) observed modifications in personality traits measured with the PI in mild to moderate AD subjects treated with anticholinesterase drugs. After 11 months of treatment, cognitive functions were substantially stable, while the total score on the PI remained the same or increased in 39% of the patients. In approximately one-fifth of the patients, the traits: does things himself, happy, calm and cautious showed improvement after anticholinesterase treatment (Purandare et al., 2002).

In our study we found a correlation between the mean PI total score and cognitive and functional impairment and behavioural symptoms, in addition to the fact that personality characters were in most cases influenced by severity of cognitive, functional and behavioural complaints. No association was observed between personality traits and age, sex or illness duration. Only the traits fond of company/dislikes company, cautious/rash, stable/changeable did not show correlations with the clinical variables, despite the fact that they underwent changes significantly after the onset of AD. This might be due to the possibility that these dimensions could be particularly sensitive to the judgement and emotional involvment of caregivers. Does things himself/relies on others and reasonable/unreasonable were the only traits that presented a significant correlation with all cognitive, functional and behavioural measures. The gradual loss of autonomy and the decrease of the ability of reasoning were in fact often present with the initial symptoms of dementia, which were destined to get worse with time.

Personality traits frequently correlated with NPI scores and the NPI was developed to assess specific behavioural symptoms in patients with dementia in terms of frequency and severity the PI provides a number of adjectives that have a corresponding measured behaviour in NPI and a possible limitation is that these two instruments explore similar dimensions. Mini-Mental State Examination scores and functional status (number of IADL lost and BI) correlated with modifications in most, but not all, of the personality traits evaluated with the PI test, indicating that the severity of dementia, may have an effect on personality. In particular, talkative/quiet, does things himself/relies on others, down to earth/out of touch, mature/childish, reasonable/unreasonable seemed more sensitive to the severity of dementia than the other personality traits examined. These data may be useful in the clinical setting to help understand personality changes in people with dementia.

In this study, caregivers of both AD sufferers and control group were mostly sons/daughters, in contrast to Purandare et al. (2002), where most were spouses. Heinik et al. (1999) found spouses and children agreed on practically all items concerning personality attributes before the onset of illness and on 16 out of 18 items after it. This supports the evidence that the relationship of the carer with the patient does not influence the description of

personality changes (Strauss, Pasupathi, & Chatterje, 1993).

The awareness of illness and of cognitive deficits and personality modifications is compromised in dementia subjects but the accuracy of self-report is not sufficient and, for these reasons, caregivers are the most important source of information in connection with personality changes in dementia. In particular, the reliability of caregivers' descriptions of premorbid personality has been shown in a three-year longitudinal investigation where the repeated characterizations of pre-illness personality profile, as determined by the PI, were found to be reliable (Petry et al., 1989). Caregiver's stress could be an important factor that might influence recall about both the premorbid and actual personality of patients, but the NPI distress of caregiver's patients and control's patients differed significantly in the presence of behavioural symptoms. This suggests that the negative descriptions of personalities after the onset of dementia given by the caregiver across the items of the PI can be reliable.

Our study, even in the presence of limitations due to the small sample size, confirms that personality alterations are an important and consistent aspect of the phenomenology of AD, in particular in getting worse with disability progression, the severity of cognitive decline and in the presence of relevant behavioural symptoms. These data need to be confirmed in longitudinal studies.

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