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Farsi version of the Neuropsychiatric Inventory: validity and reliability study among Iranian elderly with dementia

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ABSTRACT

Background: This study aimed to validate the Farsi version of Neuropsychiatric Inventory (F-NPI), with the aim of promoting clinical assessment and local research on evaluation of neuropsychiatric symptom profiles of individuals with dementia in Iran.

Methods: In this cross-sectional, psychometric study, 100 patients with dementia in the age range of 60–90 years participated. Two trained psychiatrists interviewed the study subjects. Positive and Negative Symptoms Scale (PANSS) and Geriatric Depression Scale (GDS) were used to determine the concurrent validity. Test-retest, inter-rater reliability and internal consistency were calculated. Discrimination validity was determined, using a matched control group consisting of 49 participants without dementia. Cronbach's α and Pearson's correlation coefficients were used to analyze the data.

Results: The internal consistency (Cronbach's $\alpha = 0.9$) was excellent. The inter-rater reliability varied between 0.6 and 0.98 for frequency, severity and total scale of the F-NPI, and test-retest reliability was between 0.4 and 0.96. Concurrent validity varied between 0.3 and 0.9 ($P < 0.05$). The most prevalent symptom was "apathy" and the least prevalent was "euphoria".

Conclusion: The Farsi version of NPI has satisfactory psychometric indexes and is applicable for clinical and study works in Iranian community.

Key words: neuropsychiatric inventory, dementia, validity, reliability, elderly, Iran

Introduction

Behavioral and psychological disturbances are commonly found among patients with neuro-degenerative disease (e.g. Parkinson's disease patients may not present with dementia but still display associated neuropsychiatric changes, which the Neuropsychiatric Inventory (NPI) may tap into without the presence of cognitive changes), regardless of its type (Fuh *et al.*, 2005). Symptoms such as apathy/indifference, disinhibition, depression, psychosis and agitation commonly accompany cognitive and performance decline in dementia. It has been suggested that neuropsychiatric manifestations in patients with dementia may become a more consistent feature of the disease as it progresses over time (Kaufer *et al.*, 2000). The prevalence of these symptoms is estimated to be more than 80% in patients with Alzheimer's disease (AD) (Hope *et al.*, 1999). Neuropsychiatric symptoms contribute considerably to the overall burden of AD of both patients and caregivers, thus underscoring the importance of identifying and quantifying patient symptoms and their impact on caregivers (Schulz and O'Brien, 1995; Kaufer *et al.*, 1998).

Several measures have been constructed to assess the psychological and behavioral symptoms of dementia patients, including the Behavior Rating Scale for Dementia of the Consortium to Establish a Registry for Alzheimer's Disease (CERAD-BRSD), the Behavioral Pathology in Alzheimer's Disease Scale (BEHAVE-AD), and the Neuropsychiatric Inventory (Conn and Thorpe, 2007).

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The Neuropsychiatric Inventory (NPI) was constructed with the aim of assessing psychiatric symptoms in patients with dementia (Conner *et al.*, 2008). Cummings *et al.* (1994) developed the Neuropsychiatric Inventory (NPI) to assess a wide range of behaviors encountered in dementia patients to provide a means of distinguishing frequency and severity of behavioral changes, and to facilitate rapid behavioral assessment. The NPI uses a structured, caregiver-based interview format to assess 10 behavioral domains including delusions, hallucinations, agitation/aggression, depression/dysphoria, anxiety, apathy/indifference, irritability/lability, euphoria, disinhibition and aberrant motor behavior. The domains are rated according to both their frequency and severity. Two other domains have also been assessed: night-time behavioral disturbances and appetite/weight changes (Cummings *et al.*, 1994). NPI uses both screening and in-depth questions; a further advantage is that this instrument allows the practitioner to complete it in a relatively quick and easy format. The instrument also allows the emotional stress of the caregiver to be registered in the same interview if needed (Kaufer *et al.*, 1998).

Alternate forms of the standard NPI have also been designated including the Neuropsychiatric Inventory-Nursing Home Version (NPI-NH) (Wood *et al.*, 2000) referred to as the Neuropsychiatric Inventory Questionnaire (NPI-Q)(2), and Caregiver-Administered Neuropsychiatric Inventory (CGA-NPI) (Kang *et al.*, 2004). The NPI has been translated into many languages such as Chinese, Dutch, Finnish, German, Japanese, Portuguese, Greek, French and Thai (Fuh *et al.*, 2001; Leung *et al.*, 2001; Boada *et al.*, 2005; Selbaek *et al.*, 2008).

This instrument has not been studied and normalized for the Farsi-speaking population. In Iran, as in the rest of the world, we have witnessed a noticeable shift in the demographics of the aging population. In recent decades in Iran, the number of people aged 65 years and over has increased to more than 3,500,000, nearly 5% of the total population (www.amar.org.ir). Considering the strong association between age and developing dementia, it is expected that the number of dementia patients and their caregivers needing health services will rise in the near future. The NPI, as a clinical and research instrument for assessing psychological and neurobehavioral disturbances of these patients as well as caregivers' burden, can be helpful in these situations. To the best of our knowledge, no other instruments with similar utility have been validated to date in Iran. The present investigation can be regarded as the first attempt in this regard.

Methods

The human subject committee of Tehran Psychiatric Institute approved this project.

To prepare the Farsi version of the NPI (F-NPI), it was first translated into the Farsi language by two bilingual psychiatrists and then back-translated into English by two other independent bilingual psychiatrists. Then the F-NPI was discussed in a meeting to resolve the discrepancies between the two transcripts, comparing them with the original English version. The modified version was tested for its acceptability by using it in interviews with five caregivers of individuals with dementia. The final version was developed for use in the validation study.

Participants

One hundred participants were selected from members of the Iranian Alzheimer's Association (IAA) through convenience sampling. The IAA registration system was used to recruit the study sample. They were contacted via telephone and those who agreed to participate in this study made an appointment in the IAA office for a clinical interview and examination. Fifty participants were used to assess inter-rater reliability, and of these, 30 subjects were selected randomly for test-retest reliability. Another 50 participants were recruited to the study for concurrent validity evaluation. The inclusion criteria were: (1) a diagnosis of dementia; (2) aged 60–90 years; (3) able to read and write; and (4) able to communicate properly.

Two psychiatrists were trained to perform the interview and complete the study instruments. The study samples were re-evaluated to confirm the diagnosis before recruitment. First, the interviewees were screened by Mini-Mental State Examination (MMSE) and Geriatric Depression Scale (GDS) for dementia and depressive disorder; next, using DSM-IV criteria, a clinical interview was performed to confirm the diagnosis of dementia and major depressive disorder.

Forty-nine subjects were selected as a control group and compared with study subjects in a concurrent study for discriminating validity. The criteria for control participants were: (1) not having dementia, according to MMSE score $\geq$ 23 and DSM-IV criteria; (2) not being depressed, ascertained by screening with GDS; (3) being matched with 49 study participants yielded from concurrent study sample, on age ($\pm$2 years) and education level (in the same class of education: able to read and write/primary/middle/high schooling and college level). The control participants, after being screened by MMSE (for dementia) and GDS (for depression), were interviewed for

Table 1. Demographic features of study sample (N = 149)

VARIABLES		STUDY SAMPLES: INTER-RATER RELIABILITY STUDY (N = 50) n (%)	STUDY SAMPLES: CONCURRENT VALIDITY STUDY (N = 50) n (%)	CONTROL GROUP (N = 49) n (%)
Gender	Male	22 (44)	25 (50)	25 (51)
	Female	28 (56)	25 (50)	24 (49)
Educational level	Primary	43 (86)	39 (78)	8 (16.3)
	Middle school	1 (2)	4 (8)	8 (16.3)
	High school	4 (8)	4 (8)	9 (18.4)
	College	2 (4)	3 (6)	24 (49)
Marital status	Married	32 (64)	29 (58)	29 (59.1)
	Widowed	17 (34)	20 (40)	17 (34.8)
	Divorced/single	1 (2)	1 (2)	3 (6.1)
Household members	Only with partner	13 (26)	19 (38)	22 (44.9)
	With partner and children	31 (62)	19 (38)	16 (32.6)
	Other family members/ friends	6 (12)	12 (24)	11 (22.5)

The mean age of the sample in inter-rater study was 75 years, SD = 8.1, (male: 73, 8; female: 76.5, 8); in concurrent study group 73.7 years, SD = 8.4, (male: 73.8, 9.6; female: 73.6, 7.3); and in control group 74.3 years, SD = 8.5, (male: 74.7, 9.4; female: 73.9, 7.5).

DSM-IV criteria to rule out dementia and depressive disorders.

The demographic features of the study sample are presented in Table 1. The numbers of men and women were almost the same. The mean and standard deviation of age were 74.5 and 8.3 years respectively. Most of the sample were living with their family members (51%) and were able to read and write ability.

Instruments

GDS-15 (Geriatric Depression Scale-15 items): the GDS-15 is a short form of the GDS-30 (Sheikh and Yesavage, 1986). Its Farsi version was validated among Iranian elderly with an optimum cutoff score of 7/8, sensitivity and specificity of 0.9 and 0.84, respectively (Malakouti *et al.*, 2006).

MMSE (Mini-Mental State Examination): used as a screening tool (Folstein *et al.*, 1975). The MMSE was used in this study to evaluate the severity of dementia of those in the study with dementia and for matching the control cases. The Farsi version has been validated with a cutoff score of 21–23, sensitivity and specificity of 90–98% and 84–100%, respectively (Foroughan *et al.*, 2008; Ansari *et al.*, 2010). In this study the cutoff score was 23.

PANSS (Positive and Negative Symptoms Scale): this scale has been translated and used extensively in Iranian clinical and research works (Noorbala *et al.*, 1999; Akhondzadeh *et al.*, 2006; Malakouti *et al.*, 2009; Abbasi *et al.*, 2010). Inter-rater reliability for the PANSS was reported to be 0.71 (Amini *et al.*, 2009). Although the PANSS is generally used to evaluate the psychopathology of severely mentally ill patients, the diversity of its items is useful to evaluate the behavioral symptoms of individuals with dementia. In this study, 11 items corresponding to the NPI domains of "delusion", "hallucination", "emotion", "grandiosity", "aggressive behaviors", "apathy/indifference", "isolation", "anxiety", "impulsivity" and "violence" were selected and used for concurrent validity with the NPI symptoms domain.

Procedures

The following methods were used to evaluate the reliability and validity of the NPI questionnaire.

1. Inter-rater reliability was determined by comparing the NPI score of 50 caregivers (the caregivers were close family members who were living with and spending most of their time with the patients). In this study most of them were spouses. Twenty-five interviews were conducted by the first psychiatrist in the presence of the second psychiatrist, and the next 25 interviews were performed by the second psychiatrist by the same method. NPI scoring was done simultaneously and independently.
2. Test-retest reliability was conducted on 30 caregivers selected randomly from among study

subjects of the between-rater study by the same interviewer two weeks after the first interview. The first and second interviews were conducted by using the method of a face-to-face interview.

3. For concurrent validity, another 50 patients with dementia were recruited. PANSS and GDS were used to evaluate concurrent validity of NPI items. PANSS items including delusion, hallucination, agitation/aggression, violence, anxiety, apathy/indifference, disinhibition, irritability/lability and motor/behavioral disturbances were used in this study. The GDS score was used to compare with the dysphoric domain of NPI. Given that it was difficult for some study subjects to complete the questionnaire, in these instances the GDS was completed by interviewers who read the items to interviewees. The MMSE was conducted to assess the severity of dementia.
4. Discriminant validity was determined with 49 recruited normal control subjects. They were selected from one of the residential areas of Tehran. Appointments were made at the volunteers' home and the interview performed with the control cases and their partners (or close family member).

Statistical analyses

Cronbach's α coefficient was used to determine internal consistency. Inter-rater and test-retest reliability were conducted using intra-class correlation and Pearson correlation coefficient statistical methods, respectively. For assessing the concurrent validity and discriminant validity, Pearson correlation coefficient and independent t-test statistics were used.

Results

The neuropsychiatric symptoms were prevalent among the study subjects as follows: apathy/indifference 74%, irritability/lability 54%, aberrant motor behavior 54%, anxiety 54%, delusion 52%, depression/dysphoria 48%, night distorted behavior 44%, hallucination 42%, disinhibition 34%, eating distorted behavior 28%, and euphoria 4%. Table 2 shows the frequency and severity scores of 12 items. "Apathy/indifference" was the most common item and "euphoria/elation" and "disinhibition" the least frequent/severe items as reported by the caregivers.

The mean of total NPI scores was 35.2 (SD = 26.7), for frequency 16 (SD = 10) and for the severity of symptoms 10 (SD = 7.3) (Table 2).

Reliability

Internal consistency was evaluated on 50 NPIs from the concurrent validity study. Cronbach's coefficient α was 0.8. For severity it varied between 0.76 (agitation/aggression) and 0.82 (apathy), and for frequency between 0.73 (hallucination) and 0.80 (euphoria), revealing a high level of internal consistency.

Inter-rater reliability between two trained psychiatrists, who interviewed the study samples, was determined by calculating the intra-class correlation coefficient. The results revealed that except for "euphoria", which had low reliability compared to other domains (but which showed significance), it varied between 0.0.85 and 0.99 for frequency, 0.0.81 and 0.99 for the severity of the symptoms and 0.85 and 0.98 for (severity $\times$ frequency) index. The correlation coefficients between two raters in all 12 domains were significant (Table 2). Test-retest reliability for each domain and total score was assessed within two weeks of initial assessment. The Pearson's correlation coefficient analyses for frequency of symptoms after two weeks were 0.53–0.96, and for severity after two weeks were 0.44–0.88; the (frequency $\times$ severity) index was 0.51–0.95. The correlation coefficient was significant for all 12 domains ($P < 0.001$) (Table 2).

Validity

Concurrent validity was performed by comparing the scores of 50 study subjects on the relevant domains of NPI, PANSS and GDS. Delusion, hallucination, agitation/aggression, anxiety, apathy/indifference, disinhibition, irritability/lability and motor behavioral disturbances were compared on PANSS and NPI items. The index of "frequency $\times$ severity" was only considered for this comparison. The results showed a significant Pearson correlation coefficient between items (Table 3), however, the correlation of agitation/aggression, irritability, lability, and motor aberrant behavior were mild to moderate. The score of depression/dysphoria subscale of NPI (frequency $\times$ severity) was correlated ($r = 0.6$) with total score on the GDS ($P = 0.000$).

Discriminant validity was evaluated by using t-test student statistics to compare the NPI scores between case and control subjects. The control group sample is described in the methods section and Table 1.

For the items of delusion, hallucination, depression, anxiety, apathy/indifference, disinhibition, motor disturbances, night-time behavior and appetite, the scores of control subjects were zero and the differences were significant between the two groups ($P < 0.000$) The symptoms of agitation/aggression, anxiety, irritability/lability and euphoria were seen among control subjects but less severe than study subjects ($P < 0.000$) (Table 4).

Table 2. Inter-rater and test-retest reliability for the NPI domains

	FREQUENCY	SEVERITY	BETWEEN RATER RELIABILITY			TEST-RETEST RELIABILITY		
NPI DOMAINS	MEAN (SD)	MEAN (SD)	FREQUENCY	SEVERITY	FREQUENCY × SEVERITY	FREQUENCY	SEVERITY	FREQUENCY × SEVERITY
Delusion	1.6 (1.7)	1 (1.2)	0.95*	0.92*	0.91*	0.88*	0.8*	0.81*
Hallucination	1.2 (1.6)	0.8 (1)	0.99*	0.99*	0.98*	0.82*	0.8*	0.75*
Agitation/aggression	1.6 (1.7)	1 (1.1)	0.92*	0.92*	0.92*	0.54*	0.5*	0.51*
Depression/dysphoria	1.2 (1.5)	0.8 (1)	0.89*	0.95*	0.91*	0.86*	0.80*	0.79*
Anxiety	1.5 (1.6)	0.9 (1)	0.85*	0.81*	0.85*	0.88*	0.86*	0.83*
Euphoria	0.1 (0.6)	0.05 (0.3)	0.72*	0.74*	0.59*	0.90*	0.88*	0.86*
Apathy/indifference	2.5 (1.7)	1.6 (1.1)	0.85*	0.83*	0.87*	0.9*	00.9*	0.76*
Disinhibition	0.7 (1)	0.5 (0.7)	0.94*	0.87*	0.93*	0.53*	0.44*	0.53*
Irritability/lability	1.4 (1.6)	1 (1.1)	0.96*	0.91*	0.90*	0.73*	0.81*	0.71*
Aberrant motor behavior	1.9 (1.9)	1.3 (1.3)	0.94*	0.97*	0.92*	0.84*	0.83*	0.81*
Nightmare behavior	1.4 (1.8)	1 (1.3)	0.93*	0.92*	0.93*	0.96*	0.88*	0.95*
Appetite/eating	0.8 (1.5)	0.6 (1.1)	0.93*	0.91*	0.91*	0.73*	0.69*	0.76*
Total score	16.1 (10.1)	10.7 (0.3)	0.99*	0.99*	0.98*	0.88*	0.82*	0.86*

*Significance <0.001.
NPI = Neuropsychiatric Inventory.

Table 3. Concurrent validity of NPI domains

	PANSS	
NPI CORRELATION	FREQUENCY × SEVERITY	SIG
Delusion	0.9	$P < 0.001$
Hallucination	0.9	$P < 0.001$
Elation/euphoria[a]	0.9	$P < 0.001$
Agitation/aggression[b]	0.4–0.7	$P < 0.01$
Anxiety	0.8	$P < 0.001$
Apathy/indifference[c]	0.6–0.7	$P < 0.001$
Disinhibition[d]	0.6	$P < 0.001$
Irritability/lability[e]	0.3–0.5	$P < 0.001$
Motor aberrant behavior[f]	0.4	$P < 0.01$

[a] Elation/ euphoria from NPI with grandiosity in PANSS.
[b] Agitation/aggression of NPI with anger/violence/excitement of PANSS.
[c] Apathy/indifference from NPI with emotional withdrawal and Passive/ apathetic social withdrawal in PANSS.
[d] Disinhibition of NPI with poor impulse control of PANSS.
[e] Irritability/ lability from NPI with excitement from PANSS.
[f] Motor aberrant behavior in NPI with mannerism and posturing in PANSS.
NPI = Neuropsychiatric Inventory; PANSS = Positive and Negative Symptoms Scale.

Table 4. Discriminant validity of NPI domains

ITEMS		CONTROL GROUP MEAN (SD)	STUDY GROUP MEAN (SD)	t	df	P VALUE
Agitation/aggression	frequency	0.12 (0.43)	1.6 (1.7)	5.9	55.5	0.000
	severity	0.1 (0.36	1.04 (1.12)	5.6	59.6	0.000
	S × F	0.16 (0.66)	3.3 (4.3)	5.2	51.3	0.000
Anxiety	frequency	0.04 (0.2)	1.5 (1.6)	6.3	48.4	0.000
	severity	0.06 (0.32)	0.95 (1.07)	5.57	55.0	0.000
	S × F	0.06 (0.32)	2.9 (3.7)	5.4	47.7	0.000
Irritability/lability	frequency	0.1 (0.42)	1.48 (1.59)	5.9	55.9	0.000
	severity	0.08 (0.34)	3.2 (0.4)	5.9	58.4	0.000
	S × F	0.14 (0.64)	3.2 (4)	5.3	51.5	0.000
Euphoria	frequency	0.04 (0.19)	1.5 (1.6)	6.3	48.4	0.000
	severity	0.06 (0.32)	0.95 (1.07)	5.57	55.0	0.000
	S × F	0.06 (0.32)	2.9 (3.7)	5.4	47.7	0.000

Relationship of NPI items with MMSE and age

In the concurrent study sample the mean score of MMSE was 11.3 (SD = 7.5) and in the control group it was 29.4 (SD = 1). When the MMSE scores were categorized into severe (0–9), moderate (10–19) and normal, the study sample of the first group was divided into 44%, 32% and 24% in each group respectively; however, all of the control sample were in the normal class.

Out of 12 items of the NPI (severity × frequency), the scores of the MMSE showed a significant negative relationship with five items: apathy ($r = -0.4$, $p < 0.005$), night-time behavior ($r = -0.35$, $p < 0.01$), agitation ($r = -0.34$, $P = 0.01$), aberrant motor behavior ($r = -0.56$, $P = 0.000$) and total NPI score ($r = -0.49$, $P = 0.000$). Hallucination showed a trend and a weak negative relationship with the severity of dementia ($r = -0.29$, $P = 0.06$). There was no significant relationship between NPI items and MMSE with age.

Discussion

Behavioral and psychological symptoms of dementia have been poorly studied in developing countries (Shah *et al.*, 2005). The aim of this study was the evaluation of the psychometric properties of the Farsi version of Neuropsychiatric Inventory (F-NPI) as an instrument for promoting local and cross-cultural research on the neuropsychiatric symptoms of individuals with dementia.

Our study showed that internal consistency, test-retest and inter- rater reliability, and concurrent

validity of the F-NPI are all acceptable, with the values being somewhere between moderate to excellent. This finding has been proved in other more recent studies implemented in Asian (Choi *et al.*, 2000 Leung *et al.*, 2001; Fuh *et al.*, 2005) and non-Asian (Camozzato *et al.*, 2008) countries. The concurrent validity of most behavioral domains (delusion, hallucination, restlessness, anxiety, apathy/indifference, disinhibition, irritability/lability, motor disturbances and depression) showed satisfactory results when compared with PANSS and GDS. The results of this study also revealed that the F-NPI is able to discriminate with respect to the frequency and severity of psychopathology, and therefore can be used in clinical studies to quantify behavioral changes in dementia.

The profile of behavioral disturbances was similar to other study results. The severity of dementia was correlated with the higher mean score of NPI in the current study, which was not concordant with a study carried out in Turkey (Yener, 2009). About 50% of the study subjects in this study had MMSE scores equal to or less than 10 indicating severe dementia in the study subjects at the screening level.

The most prevalent symptoms were "apathy/indifference" and "aberrant motor behavior" and the least one was "euphoria". These findings were also confirmed by other studies (Kaufer *et al.*, 2000; Choi *et al.*, 2000; Fuh *et al.*, 2005; Camozzato *et al.*, 2008).

Limitations

Lack of public awareness of dementia, as a pathological feature of aging, has resulted in very late referral of affected people to medical and social support service centers in Iran. Therefore, our sample, which was taken from IAA, had low MMSE scores and were in advanced stages of dementia. This might have influenced their neuropsychiatric symptom profiles. Although the PANSS as a semi-structured interview was translated and is used extensively in Iran, the short form (11 items, used in this study) needs to be validated in this culture.

Conclusion

The Farsi version of NPI showed satisfactory indexes of reliability and validity. It is a suitable instrument for use in clinical evaluation and research on neuropsychiatric symptoms among individuals with dementia.

Conflict of interest

None.

Description of authors' roles

S.K. Malakouti designed and carried out the study, supervised the data collection, and wrote the paper. L. Panaghi designed the study, carried out the statistical analysis and assisted with writing the paper. M. Foroughan designed the study, and assisted with writing the paper. M. Heidari and L.K. Habibi conducted the interview. T. Zandi designed the study and assisted with writing the paper. M. Salehi assisted with data collection.

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References

Abbasi, S. H. *et al.* (2010). The effect of mirtazapine add-on therapy to risperidone in the treatment of schizophrenia: a double-blind randomized placebo-controlled trial. *Schizophrenia Research*, 116, 101–106.

Akhondzadeh, S., Rezaei, F., Larijani, B., Nejatisafa, A. A., Kashani, L. and Abbasi, S. H. (2006). Correlation between testosterone, gonadotropins and prolactin and severity of negative symptoms in male patients with chronic schizophrenia. *Schizophrenia Research*, 84, 405–415.

Amini, H., Alimadadi, Z., Nejatisafa, A., Sharifi, V. and Ahmadi-Abhari, S. A. (2009). Quality of life in a group of patient with bipolar disorder and some of their clinical characteristics. *Iranian Journal of Psychiatry and Clinical Psychology*, 15, 175–182.

Ansari, N. N., Naghdi, S., Hasson, S., Valizadeh, L. and Jalaie, S. (2010). Validation of a Mini-Mental State Examination (MMSE) for the Persian population: a pilot study. *Applied Neuropsychology*, 17, 190–195.

Boada, M., Tarraga, L., Modinos, G., Lopez, O. L. and Cummings, J. L. (2005). Neuropsychiatric Inventory-Nursing Home version (NPI-NH): Spanish validation. *Neurologia*, 20, 665–673.

Camozzato, A. L. *et al.* (2008). Reliability of the Brazilian Portuguese version of the Neuropsychiatric Inventory (NPI) for patients with Alzheimer's disease and their caregivers. *International Psychogeriatrics*, 20, 383–393.

Choi, S. H., D. L., Kwon, H. M., Yoon, S. J., Jeong, J. H. and Ha, C-K. (2000). The Korean version of the

Neuropsychiatric Inventory: a scoring tool for neuropsychiatric disturbance in dementia patients. *Journal of Korean Medical Science*, 15, 609–615.

Conn, D. and Thorpe, L. (2007). Assessment of behavioral and psychological symptoms associated with dementia. *Canadian Journal of Neurological Sciences*, 34, S67–71.

Conner, D. J., Sabbagh, M. N. and Cummings, J. L. (2008). Comment on administration and scoring of the Neuropsychiatric Inventory (NPI) in clinical trials. *Alzheimer's & Dementia*, 4, 390–394.

Cummings, J. L., Mega, M., Gray, K., Rosenberg-Thompson, S., Carusi, D. A. and Gornbein, J. (1994). The Neuropsychiatric Inventory: comprehensive assessment of psychopathology in dementia. *Neurology*, 44, 2308–2314.

Folstein, M. F., Fostein, S. E. and McHugh, P. R. (1975). "Mini-mental state": a practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, 12, 189–198.

Foroughan, M., Jafari, Z., Shirinbayan, P., Ghaem Magham Farahni, Z. and Rahgozar, M. (2008). Standardization of Mini-Mental State Examination among Iranian elderly in Tehran. *Cognitive Sciences*, 10, 29–37 [in Farsi].

Fuh, J. L., Liu, C. K., Mega, M. S., Wang, S. J. and Cummings, J. L. (2001). Behavioral disorders and caregivers' reaction in Taiwanese patients with Alzheimer's disease. *International Psychogeriatrics*, 13, 121–128.

Fuh, J. L., Wang, S. J. and Cummings, J. L. (2005). Neuropsychiatric profiles in patients with Alzheimer's disease and vascular dementia. *Journal of Neurology, Neurosurgery and Psychiatry*, 76, 1337–1341.

Hope, T., Keene, J., Fairburn, C. G., Jacoby, R. and McShane, R. (1999). Natural history of behavioral changes and psychiatric symptoms in Alzheimer's disease: a longitudinal study. *British Journal of Psychiatry*, 174, 39–44.

Kang, S. J., Choi, S. H., Lee, B. H., Jeong, Y., Hahm, D. S., Han, I. W. and Cummings, J. L. (2004). Caregiver-Administered Neuropsychiatric Inventory (CGA-NPI). *Journal of Geriatric Psychiatry and Neurology*, 17, 32–35.

Kaufer, D. I. *et al.* (1998). Assessing the impact of neuropsychiatric symptoms in Alzheimer's disease: the Neuropsychiatric Inventory Caregiver Distress Scale. *Journal of the American Geriatrics Society*, 46, 210–215.

Kaufer, D. I. *et al.* (2000). Validation of the NPI-Q: a brief clinical form of the Neuropsychiatric Inventory. *Journal of Neuropsychiatry and Clinical Neuroscience*, 12, 233–239.

Leung, V. P., Lam, L. C., Chiu, H. F., Cummings, J. L. and Chen, Q. L. (2001). Validation study of Chinese version of the Neuropsychiatric Inventory (CNPI). *International Journal of Geriatric Psychiatry*, 16, 789–793.

Malakouti, S. K., Fatollahi, P., Mirabzadeh, A., Salavati, M. and Zandi, T. (2006). Reliability, validity and factor structure of the GDS-15 in Iranian elderly. *International Journal of Geriatric Psychiatry*, 21, 588–593.

Malakouti, S. K. *et al.* (2009). Case-management for patients with schizophrenia in Iran: a comparative study of the clinical outcomes of mental health workers and consumers' family members as case managers. *Community Mental Health Journal*, 45, 447–452. doi: 10.1007/s10597-009-9197-4.

Noorbala, A. A., Akhondzadeh, S., Davari-Ashtiani, R. and Amini-Nooshabadi, H. (1999). Piracetam in the treatment of schizophrenia: implications for the glutamate hypothesis of schizophrenia. *Journal of Clinical Pharmacotherapy*, 24, 369–374.

Schulz, R. and O' Brien, A. T. (1995). Psychiatric and physical morbidity effects of dementia caregiving: prevalence, correlates, and causes. *Gerontologist*, 35, 771–791.

Selbaek, G., Kirkevold, O., Sommer, O. H. and Engedal, K. (2008). The reliability and validity of the Norwegian version of the Neuropsychiatric Inventory–Nursing Home version (NPI-NH). *International Psychogeriatrics*, 20, 375–382.

Shah, A., Dalvi, M. and Thompson, T. (2005). Behavioral and psychological signs and symptoms of dementia across cultures: current status and the future. *International Journal of Geriatric Psychiatry*, 20, 1187–1195.

Sheikh, J. and Yesavage, J. (1986). Geriatric Depression Scale: recent findings and development of a short version. In T. Brink T. (ed.), *Clinical Gerontology: A Guide to Assessment and Intervention*. New York: Howarth Press.

Wood, S. *et al.* (2000). The use of Neuropsychiatric Inventory in nursing home residents: characterization and measurement. *American Journal of Geriatric Psychiatry*, 8, 75–83.

Yener, G. G and the Turkuaz Alzheimer Working Group (2009). The neuropsychiatric inventory scores change across the Mini-Mental State Examination range in patients with Alzheimer's disease: a multisite study in Turkey. *Cognitive Behavioral Neurology*, 22, 264–269.