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Psychometric Properties of Forman Alzheimer's Disease Scale (FADS)

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The purpose to develop psychometric properties of the Forman Alzheimer's disease scale (FADS) is to screen-out patients with dementia in Pakistan. Through non-probability purposive sampling technique, a sample of Alzheimer's patients (N = 320) with age range of 47-87 years (M = 66.10; SD = 6.21) was taken in this study. The patients, who had dementia other than Alzheimer's disease and vascular type dementia, were excluded from the study. Information from the primary caregivers of the patients was obtained through a demographic sheet and a questionnaire. Data analysis was done by using SPSS software version 26. The factor structure of the scale was explored by using exploratory factor analysis. Preliminary analysis indicated two factors for the scale that is psychometrically valid to use with patients with dementia. The two factors are named as Cognitive deficits and activities in daily living and Neuropsychiatric symptoms. Pearson Product Moment Correlation was used to measure the correlation of age and Forman Alzheimer's disease scale. Results revealed (r = .28, p < .001) positive correlation of disease with age.

Keywords. Dementia, alzheimer's disease, the forman alzheimer's disease scale

Dementia is characterized by general cognitive decline whereas Alzheimer's Disease (AD) is a peculiar type of dementia. It is estimated that majority of the dementia cases are caused by AD. Vascular dementia, Parkinson's disease, dementia with Lewy's bodies, frontotemporal dementia, and severe brain injury are all causes of dementia, but AD is considered as the most common cause (Sahyouni et al., 2017). According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), AD comes into the

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classification of neurodegenerative disorders. The main criterion of AD includes gradual progression and insidious onset of impairment in the cognitive domain. There is decline in the memory and learning of the patient and all other possibilities are ruled out to make a diagnosis of AD (American Psychiatric Association, 2013).

Genetic risk factors contribute to the incidence of AD. As age at onset classify AD into two distinct categories: early and late onset of AD. Early-onset AD is accounted for 4-6% of the total AD cases whereas majority of the cases are late-onset of AD. Research indicated 70% of the risk of developing AD is contributed towards genes (Giri et al., 2016). Another important risk factor for AD is cardiovascular diseases (Santos et al., 2017; De Bruijn & Ikram, 2014). The coronary heart disease's hypothesis suggested the association between artery disease and high risk of AD.

Various brain imaging techniques are being used to identify abnormalities in the brain structure. Structural imaging techniques such as Magnetic Resonance imaging (MRI) and Computerized Tomography (CT) provide comprehensive information about the structure and volume of the brain. Working of the brain cells is determined by Functional imaging techniques. PET scan is often used for this purpose (Alzheimer's Association, 2019). Moreover, a complete medical and neuropsychological evaluation can shed light on the likelihood of AD as a diagnosis, though formal diagnosis is not made until post-mortem brain autopsy shows plaques and tangles (Jatoi et al. 2020).

According to an estimate of World Health Organization (WHO), more than 60 percent of the dementia patients live in low-and middle-income countries (Dementia, 2023). In Pakistan, low priority has given to dementia in the healthcare system. People have limited knowledge about the disease and available public healthcare options (Balouch et al., 2021). Family caregivers in Pakistan also do not have access to necessary information and resources to manage the condition of the patient (Zaidi et al., 2019).

Pakistan has an estimated two hundred thousand patients with dementia. In Pakistan, life expectancy has been increased, so the lifetime prevalence of dementia is also increased in individuals who are above 60 years of age (Thaver & Ahmad, 2018). There is a dire need of neuroscientific research in Pakistan because of the rapid growth of the elderly population in the country (Alzheimer's Disease International, 2019; Adamson et al. 2020).

AD is now considered a public health crisis and it has been gaining the attention of national leaders worldwide. There is need to

take multiple approaches to diagnose, treat and prevent AD, only this could lead to reduction in the devastation caused by AD. To understand the disease better, awareness should be provided at national level. But there is lack of financial support and new researchers find fewer incentives to focus on AD (Alzheimer's Association, 2019). There is lack of infrastructure in the country for management of Dementia and a few research works is done so far.

For diagnosis of AD, rating scales are needed. These scales can help in proper assessment, staging and monitoring of symptoms of AD. Studies suggested that early detection and proper care can improve well-being of patients and their caregivers (Kenigsberg et al., 2016). In Pakistan, no published randomized controlled trial and longitudinal study for Alzheimer's disease have been conducted, highlighting the need of research work in this domain (Khan et al., 2014). There is no psychometric validated and translated tool in Pakistan to screen out those patients who have developed symptoms of AD.

Present research is addressing the development of scale and this is specifically developed to assess the severity level of the disease. Information of the patient's disease can be taken from his or her caregivers. As previously developed tools are not available in native language and they do not provide data about the severity level of patient's disease and problems related daily functioning. One such example is Mini-Mental Status Examination. Another drawback of MMSE is that it could not be administered on those patients who are unable to read, write and lack basic school education. Moreover, access to MRI and procurement of CT scanning in Pakistan is limited and demand significant costs. Therefore, the current study would be helpful for developing psychometric properties of an indigenous tool that could be used by practitioners in the field of neurology and neuropsychiatry.

Objectives

1. To establish the psychometric properties of The Forman Alzheimer's Disease Scale (FADS) for the Alzheimer's patients.
2. To see the demographics (including age, gender, education level, types of medical illnesses, and duration of symptoms) related differences on The Forman Alzheimer's Disease Scale (FADS) for the Alzheimer's patients.

Method

Sample

Through non-probability purposive sampling strategy, a sample of 320 patients with Alzheimer's disease and Vascular dementia (M = 66.10; SD = 6.21) was recruited. The data was obtained with the help of their primary caregivers. The sample was five times of total scale items (Hair et al., 2009). Data was collected from different public hospitals of the Lahore city.

Inclusion and Exclusion Criteria

Primary caregivers were recruited. Both male and female caregivers were recruited. The caregivers who had complete awareness of patient's illness were recruited. Those patients who had diagnosis of other types of dementia (Frontotemporal, Lewy's bodies) were excluded from this study.

Measures

Demographic Sheet

Demographic information sheet was provided to caregivers of patients with AD. Questions related to the age of patient, gender, education, monthly income, socioeconomic status, marital status, health status, any comorbid medical or psychiatric condition, age at onset of first symptom, and duration between diagnoses to treatment enrollment were asked from the caregivers.

The Forman Alzheimer 's disease Scale

The scale has 31 items that were related to symptoms of AD. The scale was 5-point Likert scoring system where 1 indicated '*never*' and 5 indicated '*always*'. The items were related to all stages of AD. The items for early-stage AD includes disorientation in familiar surroundings, judgment problems, tendency to lose things, remembering events, and inability to manage finance. While items related to middle stage AD includes difficulty in recognition, wandering, repeating statements, anger, paranoia, and hallucinations. The end stage of AD was consisted of items that includes no orientation of place, person and objects, inability to communicate and losing ability to swallowing. Total score range is 31 – 155. There was no reverse scored item in the scale.

Forman Vascular Dementia Scale

The scale has 32 items that were related to symptoms of Vascular Dementia. The scale was 5-point likert scoring system where 1 indicated '*never*' and 5 indicated '*always*'. Total score range is 32 – 160. There was no reverse scored item in the scale. The items of the scale included the symptoms such as physical stroke, confusion, disorientation, poor balance, difficulty in walking, and paralysis of one side of the body.

Demographic Characteristics of the Sample

Table 1: *Frequencies and Percentages of the Demographic Characteristics of the Patients (N = 320)*

	Alzheimer's' Patients	
Demographic Variables	*n*	*%*
Age 47 – 87 years (*M* = 66.10; *SD* = 6.21)		
Gender		
Males	172	53.8
Females	148	46.3
Education		
Primary	67	20.9
Middle	90	28.1
Matric	117	36.6
Intermediate	31	9.7
BA/BSc	14	4.4
PhD	1	3
Monthly Income		
Less than 40K	59	18.4
40K to 59K	47	14.7
60K to 79K	66	20.6
80K to 99K	43	13.4
1 lac to 1.5 lac	60	18.8
More than 1.5 lac	45	14.1
Marital status		
Unmarried	9	2.8
Married	311	97.2
Smoking		
No	203	63.4
Yes	117	36.6
Medical history		
No illness	25	7.8
Hypertension	103	32.2
Blood pressure	44	13.8
Diabetes	51	15.9
Hepatitis	37	11.6
Tuberculosis	4	1.3
Stroke	56	17.5

Continued…

Demographic Variables	Alzheimer's' Patients	
	n	*%*
Psychiatric history		
No illness	241	75.3
Anxiety	26	8.1
Depression	27	8.4
Anxiety and Depression Both	26	8.1
Cause of Dementia		
Alzheimer's disease	142	44.4
Vascular Dementia	178	55.6
Symptom duration		
Less than a year	62	19.4
More than 1 year	94	29.4
More than 2 years	56	17.5
More than 3 years	82	25.6
4 years and more	26	8.1

Table 1 shows that the minimum and maximum age of the participants was between 47-87 years (M = 66.10 years, SD = 6.21). Results show that the majority of the participants were male (n = 172, % = 53.8). A large number of participants had education level of matriculation (n = 117, % = 36.6). Majority of the participants had vascular dementia (n = 178, % = 55.6), and they had a disease onset of one year (n = 94, % = 29.4).

Procedure

The study was approved by Institutional Review Board (IRB) of Forman Christian College University, Lahore. Permission for data collection was obtained from respective authorities. Participants were informed about their role in the study and informed consent was obtained. The purpose of study was elaborated to the participants. It was informed that participation in the study would be on voluntarily basis. So, if they want to leave the study, they had right to do so. Participants were informed about confidentiality of the information obtained from them. It was informed that nobody except researcher and her supervisor would have access to collected data. Data was collected by using structured questionnaires, which were administered manually by using printed questionnaires. Questionnaires were provided to caregivers of patients with AD.

Results

Statistical Package for Social Sciences-Version 26 (SPSS-26) was used for data analysis. In this research, two scales related to dementia and a demographic sheet were used. Preliminary analyses

were done to investigate the demographic characteristics. One-way analysis of variance (ANOVA) was used to compare the means among groups and factors of the Forman Alzheimer's Disease Scale (FADS). Correlation among items of the scale and factors were investigated and psychometric properties of the scale were explored.

Factor Analysis of the Forman Alzheimer's Disease Scale (FADS)

The factor analysis was carried out on 26 items of FADS. To find out the internal structure or underlying factors of the scale, the exploratory factor analysis with the principal component was done on the data.

Table 2: *Factors of Forman Alzheimer's Disorder Scale (FADS) with Oblimin Rotation (N = 320)*

Sr. No	Items No.	F1	F2
1	4	**.79**	.38
2	8	**.79**	.61
3	9	**.77**	.61
4	15	**.75**	.35
5	16	**.72**	.54
6	14	**.68**	.49
7	3	**.67**	.25
8	5	**.67**	.38
9	18	**.62**	.27
10	17	**.58**	.26
11	13	**.55**	.53
12	6	**.54**	.18
13	7	**.51**	.29
14	26	.31	**.77**
15	27	.52	**.77**
16	26	.31	**.77**
17	24	.41	**.75**
18	29	.42	**.73**
19	28	.31	**.70**
20	23	.28	**.70**
21	22	.55	**.58**
22	21	.54	**.58**
23	1	.33	**.53**
24	2	.37	**.53**
25	20	.47	**.48**
26	31	.29	**.43**
Eigenvalues		9.22	4.19
% of Variance		35.47	16.13
Cumulative %		35.47	51.60

Note. Items with .30 or above loadings are boldface.

The basic idea behind using Eigen's value rule is to retain the factors which have a value of greater than 1.0. This rule is commonly used to extract the factors of a scale (Kaiser, 1960). Table 2 shows the structure of the factors of FADS with oblimin rotation. The items which loaded on each factor significantly are boldface. All the 26 items were retained in two factors. The details of the factors are further provided.

Factor 1 Cognitive Deficits and Activities of Daily Living

The items (3,4,5,6,7,8,9,13,14,15,16,17,18) related to forgetfulness, inability to recognize significant others, difficulty in reading and writing, inability to maintain personal hygiene, appetite problems and difficulty in movements, are included in this factor.

Factor 2 Neuropsychiatric Symptoms

This factor includes items (1,2,20,21,22,23,24,25,26,27,28,29,31 related to hallucinations, paranoid, sleep issues, repeating events and questions, depression, anger, apathy and irritability.

Discriminant Validity

The discriminant validity of FADS was found out by comparing the total score of FADS of clinical sample with non-clinical sample. This data was obtained from those people who have no physical and psychiatric illness. The scale was also administered to non-clinical sample of 67 participants. This was done only to ensure that two constructs are unrelated as the participants have different characteristics, so it was observed that there was negative correlation of scores between clinical and non-clinical sample (r = -.09, p = .42).

Convergent Validity

This validity was calculated by measuring the correlations between total scores of FADS and another scale, the Forman Vascular Dementia Scale (FVDS). These two tools were administered on the same participants and the details of the tool is mentioned above. It was observed that there was significant correlation between the scores of two scales (r = .47, p < .01).

Relationship between Age and Forman Alzheimer's Disease Scale (FADS) and its Subscales

Table 3: *Correlation Between* Age and Forman Alzheimer's Disease Scale (FADS) and its Subscales *(N = 320)*

Sr.	Variables	*M*	*SD*	1	2	3	4
1	Age	66.10	6.21	-			
2	Factor 1	66.07	10.60	31*	-		
3	Factor 2	49.33	9.51	20*	.63*	-	.
4	Total FADS	114.42	18.61	.28*	.91*	89*	-

Note. FADS = Forman Alzheimer's Disease Scale; Factor 1 = Cognitive deficits and activities of daily living; Factor 2 = Neuropsychiatric symptoms.
*$p <$ .001.

The Table 3 indicated that mean age of the sample was (M = 66.10; SD = 6.21). Analysis indicated that age has positive correlation with factor 1 (r = .31, p < .001). There was a significant positive correlation with total scores of FADS (r = .28, p < .001).

For the gender differences results presented in Table 4 shows the significant differences on the total scores of FADS for males and females. The effect size was medium for total scores of FADS and for factor 2 while a small effect size was observed for factor 1.

Table 4: *Gender Differences Among Males and Female Patients on the Scores of Total and Two Factors of FADS (N = 320)*

FADS	Male Patients (n = 172)		Female Patients (n = 148)				Cohen's *d*
	M	*SD*	*M*	*SD*	*t(318)*	*p*	
FADS Total	110.84	19.02	118.59	17.26	-2.39	.017	0.4
Factor 1	64.76	10.94	67.58	10.01	-4.41	.000	0.3
Factor 2	47.22	9.62	51.79	8.79	-3.82	.000	0.5

Note. FADS = Forman Alzheimer's Disease Scale; Factor 1= Cognitive deficits and activities of daily living; Factor 2 = Neuropsychiatric symptoms.

To study the education related differences, One Way Analysis of Variance (ANOVA) was applied to see differences on FADS and its subscales across the following five Categories of education level. Results are presented in Table 5.

Table 5: *One Way Analysis of Variance (ANOVA) of Total and Two Factors of FADS Across the Five Categories of Education Level (N = 320)*

	Primary (*n* = 67)	Middle (*n* = 90)	Matric (*n* = 117)	Inter (*n* = 31)	BA/BSc (*n* = 14)		
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*	*p*
FADS Total	111.1 (19.26)	107.71 (17.59)	118.9 (18.42)	120.97 (15.31)	120.39 (15.22)	5.57	.000
Factor 1	66.0 (11.60)	64.19 (10.57)	67.70 (10.19)	66.32 (9.17)	64.39 (9.17)	1.20	.30
Factor 2	46.3 7(8.88)	44.88 (8.55)	52.02 (9.47)	55.06 (6.90)	56.71 (4.95)	13.17	.000

Note. FADS = Forman Alzheimer's Disease Scale; Factor 1= Cognitive deficits and activities of daily living; Factor 2 = Neuropsychiatric symptoms.

Results in Table 5 showed, significant difference was found among the five groups of education level, scores of total and factor 2 of FADS. Post-hoc analysis using the Tukey's HSD test demonstrated that Group 4 (Intermediate education level) and Group 5 (Graduation education level) were not statistically different from each other but both groups were statistically different from Group 1 Group 2 and Group 3. These results indicated the differences among various groups, based on their education level.

Table 6: *One Way Analysis of Variance (ANOVA) of Total and Two Factors of FADS Across the Five Categories of Medical Illnesses (N = 320)*

	Hypertension (*n* = 103)	Blood pressure (*n* = 44)	Diabetes (*n* = 51)	Hepatitis (*n* = 87)	Tuberculosis (*n* = 27)	
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*
FADS Total	118.56 (17.96)	123.91 (14.46)	117.35 (17.01)	107.49 (16.13)	102.75 (26.13)	9.93*
Factor 1	67.58 (9.88)	69.34 (8.90)	67.67 (9.55)	64.08 (11.16)	63.50 (16.82)	1.27*
Factor 2	51.83 (9.73)	54.89 (7.59)	50.55 (8.71)	45.08 (6.09)	40.0 (10.10)	1.24*

Note. Factor 1 = Cognitive deficits and activities of daily living; Factor 2 = Neuropsychiatric symptoms.

*$p < .001$.

Results in Table 6 demonstrated that there are statistically significant differences among the category of medical illnesses, factors, and total scores of FADS, F (5, 314) = 9.93, p < .001). Post-hoc analysis using the Tukey's test indicated the difference in Group 2 as compared to other groups.

Table 7: *One Way Analysis of Variance (ANOVA) of Total and Two Factors of FADS Across the Five Categories of Symptom Onset*

	<1 year (n = 62)	>2 year (n = 94)	>3 year (n = 56)	>4 year (n = 82)	>5 year (n = 26)	
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*F*
FADS Total	121.51 (15.80)	119.73 (18.37)	114.14 (17.32)	105.48 (18.52)	107.15 (15.35)	4.28*
Factor 1	68.30 (9.08)	67.63 (10.40)	66.0 (10.19)	63.18 (11.45)	64.35 (11.15)	26.42*
Factor 2	53.74 (8.60)	52.76 (9.31)	48.98 (8.73)	43.72 (8.43)	44.88 (6.12)	15.26*

Note. Factor 1= Cognitive deficits and activities of daily living; Factor 2 = Neuropsychiatric symptoms.

*p < .001.

Results presented in Table 7 showed the significant differences among the all groups for symptoms duration. The overall difference among five groups and total scores of FADS was significant F (5, 314) = 4.28, p < .001. Posthoc results indicate that Group 1 showed higher score among all the groups for FDS total and its subscales.

Discussion

Dementia, as a clinical syndrome is specified by gradual deficits in memory, language, executive and spatial functioning. One of the risk factors for dementia is old age, and it was observed that this disease is more prevalent in those who are 65 years or above (Alzheimer's Association, 2020; Guerreiro et al., 2018). The results of present study also indicated the findings similar with previous studies as the mean age of the patients was found 66 years.

In the present study, the total scores of females on the FADS were higher as compared to males. These results are similar with a previous study that suggested the high risk of AD and its rapid progression among females as compared to males (Alzheimer's Association, 2019; Aggarwal & Mielke, 2023; Podcasy & Epperson, 2016).

The relationship between education and AD has been focus for many researchers and it was widely examined in the past decade. Cross-sectional and controlled studies indicated an inverse relationship between education level and AD and gave the explanation of cognitive reserves in those who had high education level (Zahodne et al. 2019). The study results are consistent with the present findings as inverse relationship was found between high education level of patients and scores on FADS.

The exploratory factor analysis conducted in this study has two domains; cognitive deficits and activities of daily living and neuropsychiatric symptoms. A previous study indicated the similar results by concluding that AD is characterized by deficits in memory, speech, language, reasoning, planning and other cognitive abilities (Breijyeh & Karaman, 2020). Studies also indicated that AD includes symptoms such as apathy, psychosis, hallucinations, depression, anger, irritability, anxiety, appetite and sleep disturbances (Lanctot et al. 2017). In the current study, the explored factors include such items that can screen out these symptoms and their severity in the patients having AD.

In this study, the onset of AD symptoms was found significant with the total scores of AD, but those who had symptom duration of less than a year had high scores on the scale. This is not consistent with the previous findings that indicated strong association between long symptom duration and severity of AD (Alzheimer's Association, 2019). There might be a reason that in Pakistan, people do not get diagnosis on time and there is lack of resources for early detection of AD so patients may have undiagnosed long history of the disease.

In Pakistan, the co-occurrence of Type 2 Diabetes Mellitus and AD is observed frequent, and it is considered as major health concern. Due to the complications of Type 2 Diabetes, the risk of developing AD doubles. A cross-sectional study results indicated a strong association between AD and Type 2 Diabetes in patients belonging from Pakistan (Noreen et al. 2018). The current study findings are similar with other research findings as statistically significant differences were observed in patients with AD and other medical illness such as diabetes, and cardiovascular diseases.

Low socio-economic status was considered as a risk factor for AD as low income was linked with limited access to health care services (Wang et al., 2023). The present study also confirmed these results as post-hoc analyses showed that there is inverse relationship among high income groups and total scores of scales. It showed that

those who were financially stable had more access to medical care services and were able to manage their condition.

Strengths and Limitations

This study developed a psychometric valid and reliable scale that could be used for screening purposes for the patients with dementia. Moreover, this tool can be used to differentiate with other types of dementia. This tool can help to assess the severity level of the disease. The tool has items related to each stage of AD. Moreover, the present research was conducted on a larger sample size that is representative of the targeted population. This tool can be used in detection of early-stage dementia as the early diagnosis would help patients and caregivers to make future arrangements.

The sample of this study was consisted of the patients who came to public hospitals of Lahore. The sample for this study was recruited from urban hospitals of Lahore city. So, the study lacks generalizability to the patients belonging to other localities of Pakistan. Test-retest reliability was not measured because of unavailability of the patients.

Future Implications

Confirmatory factor analysis could be done in future research. Test-retest reliability could be assessed in the future. Other screening tools for AD could be used to assess the divergent validity of the scale. Further research is needed to measure the validity of scale in the community, in rural areas and in the primary health care system.

Conclusion

It was reported by Adamson et al. (2020) that Pakistan has an estimate population of one million people living with dementia. As a lower-middle income country, Pakistan has limited resources in terms of specialized clinical staff, research, educational goals and awareness in the field of Neurology. There is need to develop such databases that could help to bring the country on international forums for dementia and it could strengthen the capacity for innovative research (Khan et al., 2014). There is a need to provide awareness of the disease on national level to manage the growing burden of dementia in the country. There must be specific guidelines to diagnose and treat the disease. Community support services should be provided to the patients and their caregivers to manage the distress of the disease. There is need to create a national plan that could focus on needs of the

patients according to progression and severity of the disease (Adamson et al. 2020). Counseling must be provided to the patients and their caregivers to decide how to deal with the changes brought about by the disease. Moreover, patients and their caregivers must be educated about progression of disease, its course, symptoms and available treatments.

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