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Iranian version of 4AT, an Instrument for rapid delirium screening for later life

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ABSTRACT

About 14–56 percent of hospitalized older adults were affected by cognitive impairment. To identify the psychometric properties of the 4AT screening instrument for delirium. Prospective and cross-sectional study with the 4AT and reference standard DSM-5. About 164 hospitalized men (with a mean age about 69.3±1.47 for ages ranging between 65 to 93) were sampled with the cluster-ratio sampling method. The eight daily caring centers in Ahwaz city in southwestern Iran in the mid-2015. After replying to the 4AT, DSM-5 criteria were acquired as reference standard diagnosis during 45 minutes by another psychiatrics who were blind to the scores. The coefficients of Cronbach's alpha (.89), convergent (.85), divergent (-.05), and criterion validity (.91) were estimated (ρ<.01). The 1-factor model was well appropriate for the data by the fit index techniques for adjusting the scale as well as areas under the ROC. The results indicated that the 4AT is well-adjusted and its usefulness for the relevant studies as well.

1. Introduction

Delirium and cognitive impairment is an acute neuropsychiatric syndrome of, respectively, increasing in later life, which are important within hospitalized elderly people and public health problems around the globe (Ely et al., 2001; Inouye, 2006). About 14–56 per cent of all hospitalized older adults approximately were affected by cognitive impairment and one in four hospitalized elder patients by the several outcomes of it as well (EDA-EDS, 2014; Fong et al., 2009). Some adverse outcomes are conjoined to delirium i.e. elevated costs, increased length of stay, long-term cognitive and functional decline, increased risk of institutionalization, higher mortality, and patient and carer distress (Schofield, 2010; Eeles et al., 2012; O'Regan, 2014).

Some symptoms of delirium are i.e. diminished awareness of his/her situation and location, speaking unclearly, daydreams that continue once awake, auditory hallucination, agitation and restlessness, xenophobia, drowsiness and lethargy, sleeping during the day and awaking at the night, rapid mood swings between anxious to depressed status, confusion and agitation at the evenings (Young and Inouye, 2007; Freter, 2005; Priner, 2008).

Risk factors for delirium as Fong, Tulebaev, and Inouye (2009) acclaim, "are in two modifiable and non-modifiable amongst elderly people, which are:

Potentially modifiable risk factors: sensory impairment (hearing or vision), immobilization (catheters or restraints), medications (e.g. sedative hypnotics, narcotics, anticholinergic drugs, corticosteroids, polypharmacy, withdrawal of alcohol or other drugs), acute neurological diseases (e.g. acute stroke typically right parietal, intracranial hemorrhage, meningitis, Encephalitis), intercurrent illness (e.g. infections, iatrogenic complications, severe acute illness, anemia, dehydration, poor nutritional status, fracture or trauma, HIV infection), metabolic derangement, surgery, environment (e.g. admission to an intensive care unit), pain, emotional distress, sustained sleep deprivation

Non-modifiable risk factors: dementia or cognitive impairment, advancing age (>65 years), history of delirium, stroke, neurological disease, falls or gait disorder, multiple comorbidities, male sex, chronic renal or hepatic disease" (Fong et al., 2009).

Delirium in the new version of Diagnostic and Statistical Manual of Mental Disorders (DSM-5,

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2013) in "Neurocognitive Disorders" section has five criteria. First of all, trouble in attention and awareness; the second, developing over a short period of time for example hours to days; third, trouble in cognition i.e. in memory, orientation, language, and perception; the fourth, evolving neurocognitive disorder. Finally, existing direct physiological consequence of another medical condition, drug and/or inhalant abuse or withdrawal, or being exposed to toxic substances (EDA-EDS, 2014). Additionally, some main causes of delirium and cognitive impairment which are classification of it too. They include substance intoxication, substance withdrawal, medication induced delirium, delirium due to medical operations, due to multiple etiologies, acute, persistent, hyperactive, hypoactive, and mixed level of activity as well (EDA-EDS, 2014).

Furthermore, DSM-5 recently has mentioned the prevalence of delirium in critical data. For example about 1-2 per cent in the normal community involve in the impairment condition whereas this measure number preferably should be zero. The hospitalized people are about 6 to 56 per cent. Other data include: patient received surgery: 15-53 per cent, ICUs' patient: 70 to 87 per cent, older adults in nursing homes: 60 per cent, and as end-of-life symptom more than 83 per cent (EDA-EDS, 2014; Fong et al., 2009).

Effects of cognition impairment and delirium could be enhanced by sufficient identification of delirium (Bellelli et al., 2014). Sometimes, it is hard for physicians, nurses, and other health service providers to diagnose patients' delirium and cognitive syndrome (Liang, 2015; Jaiswal et al., 2015; Ettema et al., 2014; Kalisvaart, 2006). When the patient specifically needs the emergency services and time is a critical factor, diagnosis of these conditions is vital (Kalisvaart, 2006). Delirium is one of the top three conditions for which quality of care needs to improve and an important independent factor of hospitalization, mortality, amounts of nursing homes placement, and declining functional and cognitive levels (Fong et al., 2009; Asadollahi et al., 2011; Naughton, 2005; Inouye, 1998). Attaining knowledge regarding delirium and cognitive impairment will help the caregivers and health providers to achieve the ultimate goal of a dignified and healthy ageing in middle-aged and elderly individuals (Morandi et al., 2008). It also helps to maintain the highest levels of health and quality of life (McCusker et al., 2002; Fann et al., 2007). While ignorance about delirium persists, having an implementation turns out to be a necessity (Adamis et al., 2015), which is helpful in the clinical treatment as well (McCusker et al., 2003).

The valuable detection is important. However, about 50–75 per cent of delirium is undetected in acute hospitals. Notwithstanding its importance, delirium continues to be misdiagnosed, detecting late, or ignored more than 60 per cent of hospitalized patients (Neufeld, 2013; Han, 2013). The 4 'A's Test (Bellelli et al, 2014) is a new coming diagnosis instrument for delirium. It also incorporates two simple cognitive screening items. It was developed because, though many reliable and valid delirium screening tools exist, none appeared to have all the following features important in routine, non-specialist care (Jackson et al., 2013; Shenkin, 2014; Chester, 2012). Those are i.e. brevity (generally <2 min), no special training required, simple to administer (including in people with visual or hearing impairment), does not require physical responses, allows for assessment of 'untestable' patients (those who cannot undergo cognitive testing or interview because of severe drowsiness or agitation) and incorporates general cognitive screening to avoid the need for separate tools for delirium and other causes of cognitive impairment (Chester, 2012; Breitbart et al., 1997; Bergerson, 2001). Several piloting research have endured the 4AT, and is already in use in multiple hospitals in the UK and internationally (Bellelli et al., 2014).

Here the study was investigated to the standards of the 4AT amongst older adult males to accuracy of it against a reference standard in the populations of older hospitalized patients and introduce a relevant criterion to Iranian geriatricians, psychiatrics, and gerontologists.

2. Materials and methods

About 164 men with age range of 65 to 93 were sampled with the cluster-ratio sampling method from the eight nursing homes and daily caring centers in Ahwaz city of Khuzestan province in the southwest Iran (N= 293 aged persons in the centers). The aged samples replied to the four items of 4AT. It is an instrument for attempts to clarify and screening for cognitive impairment and delirium (Bellelli et al., 2014). The inventory have been more pervasive simple instrument to screen in busy nursing and caring settings where there is limited time for older adult patient interviews and new in nursing. It is commonly applied in routine clinical practice in the UK (Bellelli et al., 2014; Liang, 2015). The 4AT as a new instrument is widely used and is also being evaluated in practice in several clinical units globally. The key features of 4AT are brevity, no special training required, allow for assessment of 'untestable' patients, and incorporate brief cognitive test items. It is screening of adults over the age of 65. The time to administer is <2 minute. The 4AT questionnaire mainly consists of a 4-item simple question i.e. alertness, AMT4 (abbreviated mental test-4), attention, and acute change or fluctuating course regarding delirium that was investigated first by MacLullich (Bellelli et al, 2014) in the UK after several waves of testing and developed by others. The most recent version (4AT V.1.2) was published on October 30, 2014. The 4AT (2014) as used in this research is available at www.the4AT.com, along with the most recent version of the guidance notes (see Annex of Bellelli et al. (2014).

The item 1 to 3 in screening scale has three response options. The 4AT is scored from zero to 12. Following is how to scoring the 4AT in details:

A score of 1-3: suggests cognitive impairment and more detailed cognitive testing and informant history-taking are required. It rated solely on observation of the patient at the time of assessment.

A score 4: requires information from one or more source(s), e.g. your own knowledge of the patient, other staff who know the patient (e.g. ward nurses), GP letter, case notes, caregivers. The tester should take account of communication difficulties (hearing impairment, dysphasia, lack of common language) when carrying out the test and interpreting the score.

A score of ≥4: suggests possible delirium but is not diagnostic: more detailed assessment of mental status may be required to reach a diagnosis such as DSM-5, 2013.

Translating instrument: The 4AT was translated into Persian from its English version by three instructors and an English language expert. The four translated versions were compared by the authors, and the researchers developed a common Persian text from them. Afterwards, the Persian version of the 4AT was translated back into English by an English language expert who had not seen the original English text and by a linguist. The English statements of the scale that had been translated from Persian into English were compared with the original version, and any necessary revisions were made as well.

Reference Test of Screening Delirium: According to DSM-5 (2013), the expert nurses and psychologists under supervision of authors and two psychiatrics attained the screening delirium and cognition impairment of all older adults in each center during 45 min. The reference standard assessment was done a day before the 4AT assessment, without awareness of the conducting 4AT score. Finally, about 164 elderly patients with delirium were chosen. The patient interaction to the examiners began with the introduction of the assistant's name and role, followed by asking the patient's name and address, and orientation to time, place, and person. Furthermore, assistants verified following note in combination against the DSM-5: sleep-wake cycle disturbances, psychomotor abnormalities, perceptual disturbances, short- and long-term memory disturbances, psychotic symptoms, and depressed mood.

Setting and Participants: From eight nursing homes and daily caring centers in Ahwaz city (N= 293 aged persons in the centers), about 164 men with patients with delirium according to the standard diagnostic cases in DSM-5 were sampled in the mid-2015 (From April 8 to May 25). They responded to the Iranian version of the 4AT. The mean age of the samples was 69.3±1.47 (range 65-93) years old.

Statistical Analyses: The results were analyzed with IBM-SPSS 22. The test accuracy was calculated using goodness-of-fit indexes and receiver operating characteristic (ROC) curves to yield sensitivity, specificity, positive and negative likelihood ratios, and area under the ROC curve (AUROC), along with 95 per cent confidence intervals (CI) as well.

Ethics Committee Approval: The institutional review board of the Ethics Committee of the Jundishapur University of Medical Science approved the study. The authors have acquired directly the informed consent from elderly patients.

3. Results

The coefficients of Cronbach's alpha (α=.89), convergent validity (.85), divergent validity (-.05), and criterion validity (.91) were estimated, which were significant at ρ<.01. The exploratory factor analysis demonstrated that the 4-items of 4AT for middle-aged and older adult samples are organized into two factors, which clarify 97 per cent of the scale's variance. Second-order confirmatory factor analysis pointed out that the factors were well matched up onto a principal factor. According to the Table 1, the rotated factor matrix pattern of Varimax for the 4AT's subscale questions was considered. Those questions with factor loadings above .85 were selected.

Table 1: Varimax rotated factors matrix of the 4AT*

N0. of Item	Item	Mean	SD	Components Factor 1
1	Alertness	.46	.43	.89
2	AMT4 (abbreviated mental test-4)	.26	.45	.94
3	Attention	.36	.48	.93
4	Acute change or fluctuating course	.37	.38	.86

When a cut-off point of 1 ("positive" replies≥1) was used, the 4AT scale depicted higher sensitivity (93.2%). Using this same cut-off point, 4AT specificity was 85.6 per cent (Table 2).

The ROC curve endorsed the findings since the cut-off point 0/1 was the closest to the upper left corner of the graph (Fig. 1).

The Persian version of the 4AT questionnaire proposed in this study and showed constructive indicators of validity (sensitivity=93.2 per cent and specificity=85.6 per cent), when used in health caring system. In this background, the cut-off point 0/1 for screening cognitive impairment was the best among these samples (one positive response).

Table 2: The 4AT psychometric properties for different cut-off points amongst samples

Scores	Sensitivity [a]	Specificity [b]	Positive Predictive Value [c]	Negative Predictive Value [d]	AUROC[e]
0	--	--	--	--	--
1	95.2	71.6	35.2	97.3	.927
2	93.1	84.2	42.1	98.2	.921
3	61.3	92.8	54.3	98.7	.893
≥4	34.7	97.2	69.4	96.1	.898

[a] Sensitivity: true positive replies, [b] Specificity: true negative replies, [c] Positive Predictive Value: true positive replies, [d] Negative Predictive Value: true negative replies, [e] AUROC: area under the curve.

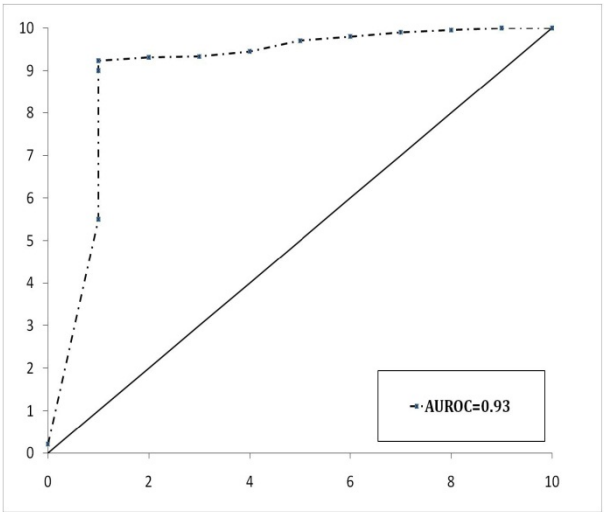

Fig. 1: ROC Curve for the 4AT outcomes' sensitivity and 1-specificity in 0/1 cut-off points, area under curve= .93, ρ< .001, n=164

The cut-off point 1/2 (in higher specificity=90.1 per cent) was rejected for two reasons: first of all, the 0/1 cut-off point presented the best performing ROC curve and the second, since the screening instrument needs the cut-off point with the highest sensitivity (the least false-negative answers) (Bellelli et al., 2014; Lees, 2013).

Regarding the fit index techniques, the 1-factor model was appropriate for the data and adjusting the scale. The indexes of the model's goodness of fit refer to the integrity of the 1-factor model with data. The $\chi 2$ to degrees of freedom is less than 2 in efficient models. It is closer to zero and will be closer. The root mean square error of approximation (RMSEA) and standardized root mean residual (SRMR) must be less than .05 that indicate to good models. The model pointed out the goodness of fit of the model in the study like relevant papers (AGFI=.96, TLI=.94, GFI=.92, RMSEA=.003, IFI=.91, NFI=.95, CFI=.92) (Table 3).

Table 3: The goodness of fit indexes model

Indexes	$\chi 2$	df	$\chi 2$/df	AGFI	TLI	GFI	RMSEA	IFI	NFI	CFI
Value	242.25	163	1.49	.96	.94	.92	.003	.91	.95	.92

As closer measure to 1 in the normed fit index (NFI), Tucker-Lewis index (TLI), the comparative fit index (CFI), goodness-of-fit statistic (GFI), the incremental fit index (IFI), and the adjusted goodness of fit index (AGFI), they refer to the goodness and fit of model. They were more than .90 (see Table 3).

4. Discussions and conclusion

The epidemic rate of delirium and cognitive impairments in the normal aged community is about one to two per cent, but in the hospitalized settings and nursing systems its rate spreads to the 14–24 per cent (Inouye, 2006). The measure ascending to 57 per cent when more-specialized older adults are considered such as seniors who are in postoperative, intensive care, sub-acute and palliative-care settings. About 15 to 53 per cent of surgical older patients were suffered by postoperative delirium, and 70–87 per cent of ICU admitted patients over the age of 65 years as well (EDA-EDS, 2014; Fong, 2009).

The aim of the study was to look for the relevant instrument regarding being symptoms of delirium and cognitive impairments within older adult men in the Iranian social context, even the issue still is challengeable (Bellilli, 2014; Liang, 2015; Jaiswal, 2015). The delirium screening scale, 4AT (2011-2013) was used and evaluated. The results stated to the well-adjusted reliability and validity of 4AT and usefulness of it in the relevant studies as well. Therefore, future researchers should not limit themselves only to the DSM-5 criteria (Asadollahi et al., 2013; Asadollahi et al., 2011); because its items would not appear to be clearly related to cultural values. Additionally, it is suggested that in future studies, the female and minorities elderly samples, which are compatible with Iran's native culture, be conducted and evaluated too (Asadollahi et al., 2011). Even though some papers assert the 4AT and delirium screening inventories could not effectively able to screen more than important especial groups (Bellilli, 2014; Collins et al., 2010), also out of neurocognitive disorders and being exposed to toxic substances (Pisani et al., 2003).

Regarding the findings of the study, the 4AT is appropriate for validity and reliability in the aged hospitalized men in Iranian society and it can be employed to measure delirium and cognitive impairment. It is applicable by physicians and nurses in emergency health system as well as to the geriatrics in their diagnosis for cognitive impairment amongst the elderly.

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Authors' Contributions

LFS contributed to the design, MS, ME, ZH, & SAH have performed the interviews, and wrote the draft. SMH & AI have acquisition data and interpretation of results and discussion. AA analyzed the data, and critically revised and approved the final manuscript.

Conflict of Interest

The authors declare that they have no competing interests.

Ethical Considerations

Ethical matters, e.g. plagiarism, uninformed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc., have been totally observed by the authors.

Patient Consent

Written and verbal consent of patients was obtained before participating the study.

Authors' Note

The opinions expressed by the authors contributing to this article do not necessarily reflect the official position of the SUMS & MUMS or the institutions with which the authors are affiliated.

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