Original Contribution/Clinical Investigation

Validation of Arabic Version of Saint-Louis-University-Mental-Status (SLUMS) - Examination and Prevalence of Cognitive Impairment in Community Dwelling Egyptian Older Adults

Hossameldin Mohamed Mohamed Abdelrahman *(1)*
Maha Mohamed El Gaafary *(2)*

(1) Dr. Hossameldin Mohamed Mohamed Abdelrahman, MD Geriatric Medicine, Lecturer of Geriatric Medicine, Geriatric and Gerontology Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt.
(2) Dr. Maha Mohamed El Gaafary,MD Community medicine and Public Health Professor of Community medicine and Public Health Community, Environmental and Occupational medicine Department, Faculty of Medicine, Ain-Shams University, Cairo, Egypt

Correspondence:
Dr. Hossameldin Mohamed Mohamed Abdelrahman
MD Geriatric Medicine, Lecturer of Geriatric Medicine, Geriatric and Gerontology Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt.
Email: *hossamabdelrahman@hotmail.com*

ABSTRACT

Background: Cognitive impairment should be accurately assessed in the elderly. The presence of a valid Arabic version of the SLUMS Examination would allow better diagnosis of cognitive impairment as it considers different educational levels prevalent in the Egyptian community.

Aim: To assess the reliability and validity of the Arabic version of Saint-Louis-University-Mental-Status (SLUMS) Examination for cognitive impairment and to estimate the prevalence of cognitive impairment among community dwelling Egyptian older adults.

Materials and methods: This study was conducted in two phases: phase I, during which reliability and validity of the Arabic version of SLUMS Examination was assessed; then phase II, where the prevalence of cognitive impairment among community dwelling Egyptian elders was estimated using the Arabic version of SLUMS Examination .

Results: The phase I of the study was conducted on 90 elderly group for testing validity and reliability of the SLUMS tool. A statistically significant agreement was evident between SLUMS Examination and Mini Mental State Examination MMSE (Kappa 0. 826, P <0.001). Sensitivity of SLUMS Examination was 94% (31/33) while Specificity was 96% (55/57). SLUMS Examination was also found to be reliable by test-retest. (McNemar P>0.05, Kappa 0.806 P<0.001). The internal consistency of the Arabic version of SLUMS Examination on the main items of cognitive function showed a Cronbach's alpha of 0.723 with a significant item-to-item and item-to-total correlation. The phase II of the study was conducted on 284 elderly. 51.4% of them demonstrated mild neuro-cognitive disorder and 5.6% were demented. Age showed a significant relationship with cognitive function level (P<0.001). Education level, employment and depression showed significant differences between elders with normal cognitive function and the demented (P<0.001, P=0.003 and P <0.001 respectively).

Conclusion: The Arabic version of SLUMS-Examination was found to be a valid and reliable screening tool for cognitive impairment in elderly. Almost half of the community dwelling Egyptian elderly showed mild neuro-cognitive disorder and a minority were demented. Older age, less education, unemployment and evidence of depression were found to be significantly associated with cognitive impairment. The Arabic version of SLUMS-Examination should be included in the routine assessment of cognitive impairment in Egyptian elders.

Key words: Cognitive impairment, Egyptian older adults, Arabic version of SLUMS-Examination

Introduction

Cognition is the process of thinking, learning, and remembering. Cognitive impairment is not uncommon in late life and may be due to the normal process of ageing or associated with physical or mental disorders. [1] It is characterized by memory disturbances, which occur frequently among the elderly. [2]

The most common disease causing cognitive impairment in the elderly is dementia. There are many causes of dementia. Primary dementia like Alzheimer's disease (AD) is the commonest cause of dementia. Secondary causes of dementia include thyroid disorders and deficiency of vitamin B12. Early detection of dementia (primary or secondary) is of extreme importance as treatment at an early stage yields encouraging results. [1]

The prevalence of degenerative dementias and other conditions associated with AD is increasing due to the rapid ageing of the population. The prevalence is below 1% among people aged 60-64 years, but it shows an almost exponential increase with age. In western countries, the prevalence ranges from 24%-33% for people aged 85 years or older. It has been reported that Chinese dementia patients make up 40% of all dementia patients in the Asia-Pacific region and 25% of dementia patients globally. [3] There are 6-7 million Chinese people with dementia, with an incidence of 5-7% among people over 65 years of age. Dementia patients experience not only a serious decline in individual quality of life but also impose a heavy economic burden on their families and society. [4]

Dementia increases in prevalence with age, with a doubling of prevalence every 5 years. It is a progressive disease process affecting families, caregivers, health and social care providers. Cognitive impairment is an important part of the diagnostic criteria for dementia. [5]

The discovery of the long preclinical phase of AD of up to 7 years [6] led to enhanced interest and research efforts in order to establish early diagnostic indices of dementia. [7] In providing potential treatment options for delaying or, ideally, preventing further cognitive decline, the definition of high-risk populations is of utmost importance. [8]

Mild cognitive impairment (MCI) is associated with an increased risk of developing dementia: patients develop dementia at a rate of 10-15% ? year compared with healthy controls who develop dementia at a rate of 1-2% ? year. [9]

However, data on the prevalence and incidence of MCI as well as the conversion rate to dementia varies greatly according to the different definitional criteria applied. The rates of conversion to dementia reported in the literature for example vary from 1 to 25% / year. [10]

The prevalence of MCI increases with age. The prevalence is 10% in those aged 70-79 years and 25% in those aged 80-89 years. [11]

Cognitive impairment is costly. People with cognitive impairment report more than three times as many hospital stays as individuals who are hospitalized for some other condition. In 2009, AD and related dementias alone were estimated to be the third most expensive disease to treat in the United States. The average Medicaid nursing facility expenditure per state in 2010 for individuals with AD is estimated at $647 millions, not including home- and community-based care or prescription drug costs. [12]

More than 16 million people in the United States are living with cognitive impairment. [13] But the impact of cognitive impairment at the state level is not well understood. Five states addressed this shortcoming by assessing the impact of cognitive impairment on their residents. This knowledge is vital to developing or maintaining effective policies and programs to address the needs of people living with cognitive impairment in a state. Age is the greatest risk factor for cognitive impairment, and as the Baby Boomer generation passes age 65, the number of people living with cognitive impairment is expected to jump dramatically. An estimated 5.1 million Americans aged 65 years or older may currently have AD, the most well-known form of cognitive impairment; this number may rise to 13.2 million by 2050. [14]

The Mini Mental State Examination (MMSE) [15] is widely used in practice as a screening tool for dementia. The MMSE has limitations, however, especially with regard to its use in more educated patients and as a screen for mild neuro-cognitive disorder. [16] The Saint Louis University Mental Status Examination (SLUMS) was developed to address this limitation. The SLUMS is a 30-point, 11-item, clinician-administered scale that is similar in format to the MMSE. [17] The SLUMS, however, supplements the MMSE with enhanced tasks corresponding to attention, numeric calculation, immediate and delayed recall, animal naming, digit span, clock drawing, figure recognition/size differentiation, and immediate recall of facts from a paragraph. In particular, the clock drawing test is designed to assess impairment in executive function, one of the earliest forms of cognition affected in mild neuro-cognitive disorder and dementia. The SLUMS also eliminates some tasks that appear on the MMSE, including repetition and construction. By enhancing the SLUMS relative to the MMSE, it was predicted that the SLUMS would be more sensitive and specific than the MMSE, particularly for diagnosis of mild neuro-cognitive disorder. [18]

Tariq et al., 2006 [19] found that the SLUMS and MMSE both could be used as screening tools to detect dementia. SLUMS also recognized a group of patients with mild neuro-cognitive disorder, which the MMSE failed to recognize as defined by DSM IV criteria. The sensitivity and specificity appeared similar for both SLUMS and MMSE in detecting dementia, but the SLUMS appeared to be possibly better than the MMSE for differentiating mild neuro-cognitive disorder from normal cognitive functioning.

So the aim of this study was to assess the reliability and validity of the Arabic version of SLUMS Examination for cognitive impairment screening, as it adjusts for different levels of education frequently encountered among the Egyptian population, and to estimate the prevalence of cognitive impairment among community dwelling Egyptian older adults using this validated tool.

Participants and Methods

This study was conducted in two phases: Phase I; in which reliability and validity of the Arabic version of SLUMS Examination was assessed, then Phase II; in which the prevalence of cognitive impairment among community dwelling Egyptian older adults was estimated using the Arabic version of SLUMS Examination tool.

Phase I: Testing validity and reliability of SLUMS:

Study setting and sample:
A cross-sectional study was conducted on 90 elder participants (60 years old and above) (37 males and 53 females). Elders were recruited from Egyptian social clubs in Cairo city.

Data collection:
Socio-demographic data, namely age, gender, marital status and education status were recorded for all participants and an oral informed consent was obtained.

SLUMS Examination. [19]
Translation:
The SLUMS Examination was translated into Arabic language and back translated into the original language, with no significant difference between the original and the back translated forms, but a few words were changed to more convenient Arabic words adapted to the Egyptian culture.

The SLUMS is a 30-point, 11-items, clinician-administered scale that is similar in format to the MMSE. [17] The SLUMS, however, supplements the MMSE with enhanced tasks corresponding to attention, numeric calculation, immediate and delayed recall, animal naming, digit span, clock drawing, figure recognition/size differentiation, and immediate recall of facts from a paragraph. In particular, the clock drawing test is designed to assess impairment in executive function, one of the earliest forms of cognition affected in mild neuro-cognitive disorder and dementia. [18]

The SLUMS is a one-page screening test administered in 10 minutes to identify elderly people with cognitive impairment. The total possible score is 30. Interpretation of the score depends on the level of education; High school education: Normal: 27-30; Mild neuro-cognitive disorder: 21-26; Dementia: 1-20. Less than high school education: Normal: 25-30; Mild neuro-cognitive disorder: 20-24; Dementia: 1-19. [19]

Mild neuro-cognitive disorder is equivalent to MCI. MCI has been recently added as the diagnosis of mild neuro-cognitive disorder in the 5th edition of The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) [20]

Validation:
All subjects were screened for the presence of cognitive impairment by using the Arabic version of MMSE previously validated. [21]

The Arabic version of SLUMS Examination was validated in our study in reference to the MMSE that was administered to all the participants to assess their cognitive function. [15]

The MMSE comprises 30 questions with 10 devoted to orientation (five for time and five for place). Three items required registration of new information (repeating three words). Five questions addressed attention and calculation. Mental control questions required the patient to make five serial subtractions of 7 from 100 or spell a word backwards and three recall items (remembering the three registration items). Eight items assessed language skills (two naming items, repeating phrase, following a three-step command, reading and following a written command and writing a sentence), and one construction question (copying a figure consisting of two overlapping pentagons).

According to the score of MMSE, the subjects were classified into normal cognitive function, MCI and dementia (mild to moderate and severe).

Reliability Testing
Test-retest reliability data were collected after an average of 15 days as all 90 older adults were evaluated again using the Arabic version of SLUMS Examination.

Phase II: Determination of the prevalence of impaired cognitive function using the Arabic SLUMS:

A cross-sectional study was conducted to estimate the prevalence of cognitive impairment in community dwelling Egyptian elder subjects.

Two hundred and 84 (284) old elders (60 years old and above) 135 males and 149 females were recruited from four Egyptian social clubs in Cairo city, over a period of 3 months.

Data collection:
Socio-demographic data including age, gender, marital status, living arrangement, employment and education status were recorded for all participants and informed consent was obtained. Geriatric Depression Scale 15 items (GDS 15) was administered to all participating elders. [22] as well as the Arabic version of SLUMS-Examination.

Statistical Analysis:
Data collected was revised and introduced to a PC for statistical management and analysis. Categorical data is described as using frequency distribution (number and percentage) while quantitative data is described as using mean and standard deviation. One way ANOVA was used to test differences in the tool categories for continuous variables. Cronbach alpha was used to test internal consistency of the Saint Louis items as well as inter-items correlation. Paired t test was used to test reliability and changes in the different items of the Saint Louis instrument. McNemar Bowker and Kappa statistics were used to test agreement between Saint Louis and MMSE tools of cognitive impairment assessment. Kendall tau-b was used to test correlation between ordinal data. All p values were set at 0.05 and all statistical manipulation and analyses were performed using the 15th version of SPSS.

Results

The phase I of the study was conducted on 90 older adults for testing validity and reliability of the SLUMS tool. Table 1 shows the demographic characteristics of the tested elders: their mean age was 67.3 ± 5.02 (range: 60 - 80). The sample included 37 (41.1%) males and 53 (58.9%) females. Among the 90 elder participants; 42 (46.7%) were married, 38 (42.2%) widowed, 6 (6.7%) divorced and 4 (4.4%) were single.

29 (32.2%) did not complete their high school education while 61(67.8%) terminated their high school education and some achieved higher education.

Table 2 shows significant agreement between the yield of Saint-Louis-University-Mental-Status-SLUMS Examination and Mini Mental State Examination MMSE (Kappa 0. 826, P <0.001).

Compared to MMSE as a gold standard, sensitivity of Saint-Louis-University-Mental-Status-SLUMS Examination was 94% (31/33) while specificity was 96% (55/57).

Table 3 shows significant reliability (Test-retest) of Saint-Louis-University-Mental-Status-SLUMS Examination (McNemar P>0.05, Kappa 0.806 P<0.001).

The internal consistency of the Arabic version of Saint-Louis-University-Mental-Status-SLUMS Examination on the main items of cognitive function showed a Cronbach's alpha of 0.723 with a significant item-to-items and item-to-total correlation.

The phase II of the study was conducted on 284 elders. 51.4 % of elders demonstrated mild neuro-cognitive disorder and 5.6% were demented. Table 4 shows their demographic characteristics: the mean age was 66.19 ± 4.56 (range: 60 - 82). The sample included 135 (47.5%) males and 149 (52.5%) females. Among the investigated elders 144 (50.7%) were married, 111 (39.1%) widowed, 21 (7.4%) divorced and 8 (2.8%) single. Thirty (30 = 10.6%) of the interviewed elder were illiterates, 81 (28.5%) had less than high school education and 173 (60.9%) achieved a high school education and more.

Figure 1 illustrates the prevalence of cognitive impairment in the older adults sample; 122 (43%) demonstrated normal cognitive function, 146 (51.4%) showed mild neuro-cognitive disorder and 16 (5.6%) had dementia.

Table 5 shows the relationship between patients' demographics and cognitive function. Mean age of the normal cognitive function older adults was 63.5 ± 3.07, while in demented cases was 72.9 ± 4.5, (P: <0.001). None of sex, marital status and living arrangement showed a significant relationship with cognitive function level, (P: 0. 146, P: 0.186, P: 0.10), while education level, employment and depression showed significant differences between older adults with normal cognitive function and demented cases, (P values: <0.001, 0.003 and <0.001 respectively).

Table 1: Patients' demographic characteristics in Phase I

Variables	Statistics
Number	90
Age	
Mean ± SD	67.3 ± 5.02
Min- Max	60 - 80
Sex: *N (%)*	
Male	37 (41.1)
Female	53 (58.9)
Marital status: *N (%)*	
Married	42 (46.7)
Widow	38 (42.2)
Divorced	6 (6.7)
Single	4 (4.4)
Education: *N (%)*	
Less than High school education	29 (32.2)
High school education and more	61 (67.8)

Table 2: Correlation between SLUMS and MMSE

		MMSE		
		Normal	MCI	Dementia
SLUMS-Examination	Normal	55	2	0
	Mild neuro-cognitive disorder	2	22	3
	Dementia	0	1	5
McNemar-Bowker Test		P value 0.607 NS		
Measure of Agreement Kappa		0.826 P value <0.001		

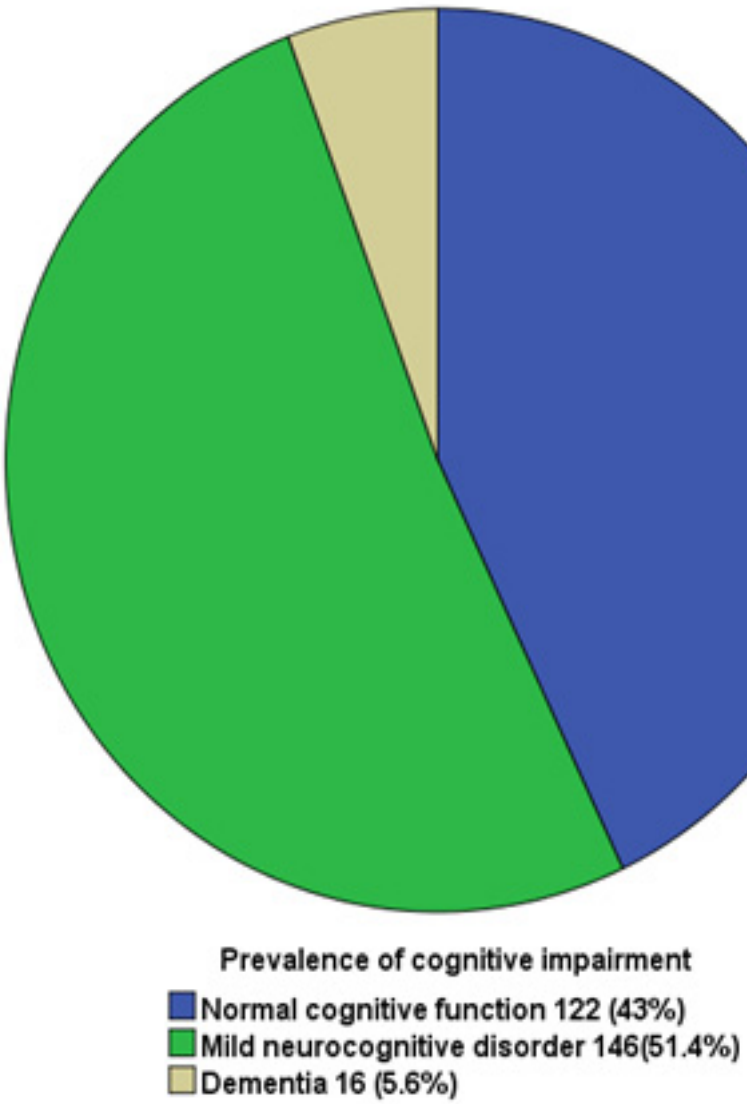
Table 3: Reliability (Test-retest) of Saint-Louis-University-Mental-Status-SLUMS-Examination

		SLUMS (Retest)		
		Normal	Mild neuro-cognitive disorder	Dementia
SLUMS (Test)	Normal	53	4	0
	Mild neuro-cognitive disorder	0	25	2
	Dementia	0	3	3
McNemar-Bowker Test			P value 0.122	
Measure of Agreement Kappa			0. 806 P value <0.001	

Table 4: Patients' demographic characteristics in Phase II

Variables	Statistics
Number	284
Age	
Mean & SD	66.19 ± 4.56
Min - Max	60 - 82
Sex: N (%)	
Male	135 (47.5)
Female	149 (52.5)
Marital status: N (%)	
Married	144 (50.7)
Widow	111 (39.1)
Divorced	21 (7.4)
Single	8 (2.8)
Education: N (%)	
Illiterate	30 (10.6)
Less than High school education	81 (28.5)
High school education and more	173 (60.9)
Living arrangement: N (%)	
Living with family members	151(53.2)
Living non family members	46(16.2)
Living alone	87(30.6)
Occupation : N (%)	
Employed	108(38)
Unemployed	176(62)
GDS 15: N (%)	
Not depressed	143(50.4)
Depressed	141(49.4)

Figure 1



Discussion

In the present study, the Arabic version of SLUMS Examination demonstrated significant agreement with MMSE with high sensitivity (94%) and specificity (96%), adequate test-retest reliability and internal consistency.

The prevalence of mild neuro-cognitive disorder in community dwelling Egyptian older adults of the current study was 51.4% and dementia was 5.6%.

The prevalence of cognitive impairment in community dwelling older adults varied in different studies depending on characteristics of sample (e.g. rural versus urban areas) and the tool used for screening of cognitive impairment. For example the study conducted by Lee and Shinkai, 2005 [23] in which they used the MMSE to estimate the prevalence of cognitive impairment among Korean people > 65 years of age, they found that the prevalence was 17.0%.

A cross-sectional study was carried out by Deepak et al., 2013 [24] between January 2010 and July 2010, in urban and rural areas of Shimla district of Himachal Pradesh in India. Four hundred elderly people were included in the study. The prevalence of cognitive impairment was found to be 3.5%. It was higher in rural (2.3%) than in the urban population (1.3%).

Also Unverzagt et al., 2001 [25] conducted a study on 2212 community-dwelling African American residents of Indianapolis, aged 65 and older and found that the overall rate of cognitive impairment among community-dwelling elderly was 23.4%.

Janice and Graham, 1997 [26] performed the Canadian Study of Health and Aging that gathered population representation information about elderly Canadians aged 65 and over from 36 cities and surrounding areas in five regions. In each region, the sample size was 1800 people in the community and 250 people in institutions. Patients in the community were screened for cognitive impairment by means of the modified mini-mental state examination. The prevalence of cognitive impairment no dementia [CIND] was 16.8%, which was more than all types of dementia combined (8.0%). They reported that the prevalence of all types of cognitive impairment, including dementias, increased with age.

Also we found that cognitive impairment increased significantly with increasing age. This finding is in agreement with Hardy and Higgins, 1992 [27] who examined the causes of cognitive impairment and found that aging was the predominant risk factor for MCI.

Table 5: Relationship between Patients demographic characteristics with Cognitive function

	Normal	Mild neuro-cognitive disorder	Dementia	
Age				F 82.7
Mean ± SD	63.5 ± 3.07	67.6 ± 4.22	72.9 ± 4.5	P <0.001
Sex: *N (%)*				
Male	65 (48.1)	65 (48.1)	5 (3.7)	X^2 3.847
Female	57 (38.3)	81 (54.4)	11 (7.4)	P 0.146
Marital status: *N (%)*				
Married	59 (41.0)	78 (54.2)	7 (4.9)	
Widow	48 (43.2)	56 (50.5)	7 (6.3)	X^2 8.78
Divorced	11 (52.4)	10 (47.6)	0 (0.0)	P 0.186
Single	4 (50.0)	2 (25.0)	2 (25.0)	
Education: *N (%)* Illiterate				
Less than High school education	2 (6.7)	25 (83.3)	3 (10.0)	X^2 42.06
High school education and more	25 (30.9)	45 (55.6)	11 (13.6)	P <0.001
	95 (54.9)	76 (43.9)	2 (1.2)	
Living arrangement: *N (%)*				
Living with family members				
Living non family members				
Living alone	72(47.6)	75(49.6)	4(0.02)	
	15(32.6)	27(58.6)	4(0.08)	X^2 7.77 P 0.10
	35(40.2)	44(50.5)	8(0.09)	
Employment: *N (%)*				
Employed	71(65.7)	37 (34.25)	0 (0)	X^2 40.84
Unemployed	51(28.97)	109 (61.9)	16 (0.09)	P <0.001
GDS 15: *N (%)*				
Not depressed	75(52.4)	63(44)	5(0.34)	X^2 40.84
Depressed	47(33.3)	83(58.8)	11(0.78)	P 0.003

Again, Huang et al.,2008 [28] stated that previous studies showed the prevalence of MCI to be higher in people 75 years of age and older than among those who were younger than 75 years.

The age-cognitive function relationship is consistent in both rural and urban areas as mentioned by Park et al., 2013 [29] who stated that the mean score of MMSE in both the urban and rural strata decreased with increasing age.

Controversially, other results revealed no significant relationship between age and MCI. [30] Differences could be attributed to the selected population or the tool used in cognitive function assessment.

As regards gender, although 7.4% of females were demented compared to only 3.7% in males, this difference was not statistically significant. Regarding this issue we disagreed with Greta et al., 2005, [31] and with Park et al., 2013 [29] and with Constanc et al., 2010 [32] as all of them had found that female gender was significantly associated with cognitive impairment. This could be explained by our smaller sample size.

Also our study found that low education was associated with cognitive impairment. This was supported by Fratiglioni and Wang, 2007 [33] who found that education was strongly related to the risk of developing dementia. They added that this effect was prominent in the Korean population compared with that in other countries. They explained that this was due to the generally lower education level among elderly Koreans and the consequent lifelong lack of exposure to stimulating environments and accessibility to health services. Stewart et al., 2003 [34] added that lower education level could hinder the early development of brain function, and affect the absolute levels of cognitive function.

Everson-Rose et al., 2003 [35] and Fratiglioni and Wang, 2007 [33] explained this as the intellectual challenges might increase the brain reserve and delay development of dementia.

Regarding the same issue, Park et al., 2013 [29] stated that more years of schooling were associated with a decreased probability of cognitive impairment, and Bosma et al.,2003, [36] who conducted a 3-year follow-up study, found that older persons with a lower educational level experienced more decline in cognitive function; including information processing speed, memory, and general cognitive function according to the Mini-Mental State Examination, compared to persons with a higher educational level.

As regards employment we found cognitive impairment more prevalent in unemployed elders. Cognitive impairment would interfere with employment and Occupation or employment may act the same as education in improving the cognitive function of the brain. Regarding this issue we agreed with Park et al., 2013 [29] who found that employment status was associated with a decreased probability of cognitive impairment.

Regarding the relationship between cognitive impairment and depression we found that cognitive impairment was more prevalent in depressed patients. So we agreed with Gao et al., 2012 [37] who examined whether depression was a risk factor for onset of dementia including Alzheimer's disease (AD), vascular dementia (VD) and any dementia, and MCI by using a quantitative meta-analysis of longitudinal studies. The quantitative meta-analysis showed that depression was a major risk factor for incidence of dementia (including AD, VD, and any dementia) and MCI.

Again in the study of Park et al., 2013 [29] they found that high GDS-15 scores were significantly associated with increased cognitive impairment.

Conclusion

The Arabic version of SLUMS-Examination was found to be a valid and reliable screening tool for cognitive impairment assessment. Almost half of the community dwelling Egyptian elders showed mild neuro-cognitive disorder and a minority were demented and are increasing with age, less education, unemployment and presence of depression. So, application of the Arabic version of SLUMS-Examination in routine assessment of Egyptian elders is mandatory.

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