Prevalence and Associated Factors of Functional Disability in Activities of Daily Living and Instrumental Activities among Institutionalized Tunisian Elderly

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Authors' contributions

Article Information

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ABSTRACT

Aim: We conducted this study to assess the functional disability of institutionalized elders and to identify its associated factors.
Place and Duration of the Study: This study was conducted during a period of 3 months from the first January to 31 March 2015 in the long-stay institutions of older persons in the region of the Tunisian Center.
Type of the Study: It is a cross sectional study.
Methodology: This study conducted among 110 Tunisian insutionalized elderly to assess the functional disability using the Katz Index of disability in Activities of Daily Living and the Lawton Instrumental Activities of Daily Living scale.

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Results: Among the institutionalized elderly, 57.3% were ADL dependent and 85.4% were IADL dependent. In the multivariate analysis, female gender, age, self-perceived health status, motor disability and cognitive deficit were independent factors associated with ADL disability among institutionalized elderly. Independent factors associated with IADL disability were female gender, age, having friends outside the institution, having visits and receiving a family financial support.
Conclusion: Disability is affected by a number of non-modifiable and modifiable predisposing factors which should be the most targets of preventive interventions.

1. INTRODUCTION

The process of demographic aging of population is one of the most topical social economic problems of modern times, needing particular attention and rational use of resources. If in the past, it was typical to the developed countries only, now, it has become a global problem of unprecedented scales [1].

Globally, the number of persons aged 60 or over is expected to more than triple by 2100, increasing from 841 million in 2013 to 2 billion in 2050, approximating 21% of the world's population [2].

Researchers and policymakers have been concerned that increased longevity and the aging process will result in not only a larger elderly population but also a higher prevalence of disability. Greater longevity could mean more years of disability and higher long-term care and other medical costs if medical interventions are able to prolong life but not health and disability [3].

Disability is defined as difficulty or dependency in carrying out activities essential to independent living, such tasks needed for self-care and living independently in a home, and other activities important to one's quality of life [4]. Functional disability is often assessed using the Katz Index of disability in Activities of Daily Living and the Lawton Instrumental Activities of Daily Living scale [4].

Disability can be seen as the gap between personal capability and environmental demands. It is not a personal characteristic, but a social phenomenon that depends on the interaction between individuals and their environment [4,5].

Among the elderly aged 60 years and older, persons living with disabilities were overrepresented with 43.4% in lower income countries and 29.5% in higher income countries in 2011 [6].

This increase in functional disability, which cause institutionalization and a clear impact on the socio-sanitary system, is a serious social, medical, and economic concern [7]. Studies of the prevalence, causes, and effects of disability among the elderly population are crucial for a comprehensive understanding of its dynamic process. This may help in defining appropriate public health policy and planning interventions targeting modifiable factors in order to alter the course of disability and to promote successful aging [7,8]. Several community-based studies have reported the prevalence of disability and its associated factors in the elderly and it has been shown that the pathway of disability has a complex nature [7-12]. In their systemic review, Tas et al. [8] have found that higher age, cognitive impairment, vision impairment, and poor self-rated health are prognostic factors of disability. Other studies have shown that sociodemographic characteristics including age, female gender, education level have a significant impact on functional capacity levels [7-12]. The length of institutionalization and having a chronic condition or long-term health problem were among the factors that have been found to be associated with disability in institutionalized elderly in the study of Mattos et al. [12]. A strong association between functional disability and depressive symptoms in older people has also been reported in the literature [13].

Most of these studies were conducted in Western countries, however little is known on disability in Tunisia.

Tunisia, a North African country of eleven million inhabitants is not spread of the phenomenon of the aging of the population. In 2014, 11.7% of the population was aged 60 years and over and by 2041, this rate would raise to 23%. The age-related health problems are in consequence expected to increase [14]. To our knowledge,

there is no documented Tunisian study on disability.

In this context, we conducted this study to determine the prevalence of the functional disability among institutionalized elderly in the Center of Tunisia and to identify its associated factors.

2. MATERIALS AND METHODS

2.1 Study Design

It is a multicenter cross sectional study conducted during a period of 3 months from the first January to 31 March 2015 in the long-stay institutions of older persons in the region of the Tunisian Center.

2.2 Population Study

In Tunisia, the institutions, known under the name of Centers for the protection of older persons, receive elderly who presented in a voluntary way or addressed by the social worker, by friends or members of their family. Institutionalization is justified by the lack of material resources and/or family support. These long-stay institutions which are in number of eleven are under the supervision of the Ministry of Social Affairs and the Ministry of Health. Three of them are located in the region of the Tunisian Center: Sousse, Kairouan and Kasserine which were included in the present study.

The definition of elder used in this study was chosen according to the Tunisian law n°94-114 of October 31, 1994, relative to the protection of older persons which considers as elderly person any person over the age of 60 years.

We have included in this study all the elderly aged 60 years or older residing in these centers. Individuals who had conditions that did not allow them to respond to the questionnaire such us disabling psychiatric disorders, language disorders or a severe deafness recognized on the medical record and who had been institutionalized for less than 30 days at the date of the interview were excluded from our study.

2.3 Data Collection and Variables Definition

Data collection was carried out by a pretested questionnaire composed by five parts as following: the socio-demographic and institutional characteristics, the social support, the health status and life satisfaction of institution residents, the Katz Index of Independence in Activities of Daily Living (ADL) and the Lawton Instrumental Activities of Daily Living scale (IADL) scales to assess functional capacity, the Mini-Mental State Examination (MMSE) to assess cognition and finally the 15-item Geriatric Depression Scale (GDS) to evaluate the presence of depressive symptoms.

-   The sociodemographic data included age, sex, marital status, urban or rural origin, education level, having an income, having children or/and siblings.
-   The institutional data were location and length of institutionalization.
-   The health status data were self-perceived health status and medical history.
-   The social support included having friends outside the institution, having visits and having family financial support.
-   Concerning the satisfaction of the institution conditions, participants responded by yes if they were satisfied and by no if they were not.
-   The activities of daily living (ADL) measured the difficulty in performance on six activities: feeding, bathing, dressing, using toilet, transferring and incontinence. The Instrumental Activities of Daily Living (IADL) assessed how independent the individual is when performing these eight activities: cooking, buying groceries, operating a telephone, taking medications, housekeeping, laundry, cleaning the house, and managing personal finances. A score of 0 (when no performing the correspondent activity) or 1 (when performing the correspondent activity) is attributed to each item. If none of the ADL/IADL activities is impaired, the individual is classified as "*independent*"; if one or two activities are impaired, he or she is classified as "*moderately dependent*" and finally "*severely dependent*" refers to elderly who have three or more activities impaired [12,15,16].
-   The screening of depressive symptoms among the elderly population living in institutions was carried out by the 15-item geriatric depression scale (GDS) [17,18] which has been translated and validated in Arabic by different teams [19,20]. This instrument is a shorter version of the GDS 30 [21] where it has retained items most

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correlated to the depressive sympto-matology. This tool perfectly validated and awarding extremely simple strongly predicts the prognosis in term of morbidity and mortality. The response to the questions of the (GDS-15) is dichotomous by yes or not. A score of 0 to 4 is considered normal and means the absence of depressive symptoms, a score of 5 to 10 suggests the existence of a mild depression and a score higher than 10 evokes the existence of severe depressive symptoms.

- To evaluate cogniti*on*, a grid adapted to the Tunisian population and inspired of the Mini Mental State Examination (MMSE) has been performed after translation in Arabic and validation. This gird tests five areas of cognitive function including orientation, registration, attention and calculation, recall, and language by assessing the understanding of a Tunisian proverb [22].

A face-to-face interview was conducted in the three institutions by a trained investigator. Data were also collected from the medical records of the institutionalized elderly and/or from the professionals in the institution.

2.4 Statistical Analysis

Data capture and analysis were performed by the SPSS 18.0 (Statistical Package Social Science for Windows). The variables of interest (ADL and IADL) were categorized in functional disability and disability. In the univariate analysis, to determine factors associated with functional incapacity, the chi square test was used to compare categorical variables and the Student t test was used to compare means for independent samples.

To identify the determinants of functional incapacity, binary logistic regression has been carried out. The threshold chosen for the introduction of variables in the model was 0.2.

A 2-tailed p value of <0.05 was considered the threshold for statistical significance.

3. RESULTS

3.1 Characteristics of the Population Study

Among the 147 institutionalized elderly individuals in the three institutions, 110 participants met the inclusion criteria and were distributed as follow: 50 in Sousse (45.5%), 35 in Kairouan (31.8%) and 25 in Kasserine (22.7%). Sixty-seven of them (60.9%) were male. Their mean age was 76.54 ± 9.26 years. The Table 1 shows the characteristics of the population study.

3.2 Prevalence and Associated Factors of ADL and IADL Disability

In the assessment of the functional capacity among the institutionalized elderly, 57.3% of cases were ADL dependent and 85.4% were IADL dependent. Among the participants, 39.1% had a cognitive deficit according to the MMSE and 79.1% had depressive symptoms assessed by the GDS scale (Table 2).

Tables 3, 4 and 5 show the univariate and multivariate analysis of factors associated with ADL and IAD.

In reference with female gender, in the univariate analysis, both ADL and IADL dependencies were higher among women. Female gender was an independent factor associated to IADL (adjusted OR =21.57, 95%CI [1.67-277.84], p=.01).

Higher age was independently associated with both ADL (adjusted OR =1.06, 95%CI [1.002-1.13], p=.042) and IADL (adjusted OR =1.22, 95%CI [1.07-1.32], p=.01).

Regarding the self-perceived health status, participants who perceived their health status as bad were more likely to be ADL dependent (adjusted OR =5.48, 95%CI [1.55-19.40], p=.008).

Participants having motor disability were more likely to be ADL disable (adjusted OR =11.42, 95%CI [3.61-36.07], p=.001).

Cognitive deficit was also an independent factor associated to ADL disability (adjusted OR =3.21, 95%CI [1.11-9.29], p=.031).

In term of social support, institutionalized elderly who had visits in the institution (adjusted OR =.12, 95%CI [.017-.85], p=.034), who had friends (adjusted OR =.13, 95%CI [.02-.90], p=.039) and who were financially supported by their family (adjusted OR =.15, 95%CI [.002-.28], p=.001) were less likely to be IADL disable.

4. DISCUSSION

Functional disability is very common among elderly patients in a variety of clinical settings [23].

Table 1. Characteristics of the study population: Socio-demographics, health status and social support

Variables		Number (n)	Percentage (%)
Socio-demographic and institutional characteristics			
City of the institution	Sousse	50	45.5
	Kairouan	35	31.8
	Kasserine	25	22.7
Length of the institutionalization	≤ 5 years	73	66.4
	> 5 years	37	33.6
Gender	Male	67	60.9
	Female	43	39.1
Origin	Urban	37	33.6
	Rural	73	66.4
Education level	Illiterate	74	67.3
	Primary	26	23.7
	Secondary	5	4.5
	University	5	4.5
Marital Status	Single	48	43.6
	Widow(er)	32	29.1
	Divorced	25	22.7
	Married	5	4.6
Having children	Yes	30	27.3
Having siblings	Yes	72	65.5
Having an income	Yes	76	69.1
Social support			
Family financial support	Yes	11	10.0
Having friends outside the institution	Yes	48	43.6
Having visits in the institution	Yes	53	48.2
Health status			
Self-perceived health status	Very bad/bad	35	31.8
	Moderate	27	24.6
	Good/very good	48	43.6
Tobacco use	Yes	27	24.5
Diabetes	Yes	26	23.6
Hypertension	Yes	63	57.3
Motor disability	Yes	44	40.0
Hearing disorders	Yes	18	16.4
Vision disorders	Yes	47	42.7
Co-morbidities	Yes	60	54.5
Satisfaction of the institution conditions	Yes	76	69.1

A variety of validated and reliable scales of physical function are available that vary in simplicity and sensitivity [24].

According to the International Classification of Functioning, Disability and Health (ICF), the ADL-scales refer to those activities essential for an independent life and IADL-scales refer to tasks implying enough capacity as to make decisions as well as a greater interaction with the environment [10].

In the literature, prevalence of functional disability in elders varied between studies. This may be related to the differences in the study settings and the instrument used for functional assessment. Higher proportions of functional disability were found in elderly living in institutions. Lee and Choi [25] found that 81% of elderly people living in institutions in Korea were dependent while only 62% of elderly people living at home were disabled according to the ADL scale.

In our study, the prevalence of ADL disability was 57.3%. It is less than that reported by Doumit et al. [26] in Lebanon (64.5%) and Molaschi M et al. [27] in Italy (94.3%). IADL disability was

found among 85.6% of participants, higher than that reported by Mattos et al. [12] in Brazilian institutions (81.2%).

The determinants of disability are heterogeneous and vary across different settings [9]. Research on disability in old age has identified non-modifiable risk factors such as age, gender and genetics, and modifiable risk factors such as age-related diseases, impairments, functional limitations, unhealthy behaviors, as well as social and environmental obstacles [28].

Our result is consistent with the literature where age, a non-modifiable predisposing risk factors, was associated with functional disability in the elderly residing in institutions [12,25].

According to the World Health Organization, the number of people aged 65 or older is projected to grow from an estimated 524 million in 2010 to nearly 1.5 billion in 2050, with most of the increase in developing countries. That is, the prevalence of disability is increasing as life expectancy increases [29].

In our study, gender was an independent factor associated to both ADL and IADL disabilities. Our results are consistent with previous studies [6,7,12,27]. However according to his systemic review focusing on the effect of gender on the incidence of functional disability in aged persons, Rodrigues et al. [11] concluded that studies that used crude analyses observed a different incidence of functional disability between the genders in the elderly, while studies that adjusted their analyses for socio-demographic, socioeconomic, and health factors observed no

difference between the genders in the incidence of functional disability.

We did not find a significant association between marital status and disability. According to their literature review based on eight cohorts, Tas et al. [8] concluded that evidence for marital status as prognostic factors for disability was limited.

In relation with length of institutionalization, Helvik et al. [30] found that longer institutionalization was associated with a greater reliance in achieving life activities, while Mattos et al. [12] found a high prevalence of disability among those who had stayed at the institution less than a year. In our study, the length of institutionalization was not associated with disability.

Self-perceived health status was associated with disability in our study, it can be considered as a modifiable risk factor. Similarly, Hu et al. [31] reported that self-perceived health status was significantly associated with ADL disability. Matusiak et al. [32] conducted among 300 elderly subjects including 100 living in institutions in Poland and revealed associations between ADL and IADL scores and self-perceived health in the elderly especially institutionalized.

With respect to social support, the ADL dependent group had fewer friends outside the institution compared to the IADL dependent only group. Mattos [12] pointed out that demographic, psychosocial, and socio-cultural variables are mediators in the relationship between health condition and functional ability.

Table 2. Assessment of ADL and IADL disability, Cognition (MMSE) and Depressive symptoms (GDS)

		Number (n)	Percentage (%)
ADL disability	Indisability	47	42.7
	Moderate disability	31	28.2
	Severe disability	32	29.1
IADL disability	Indisability	16	14.6
	Moderate disability	26	23.6
	Severe disability	68	61.8
Depression	No depressive symptoms	23	20.9
	Mild depressive symptoms	74	67.3
	Severe depressive symptoms	13	11.8
Cognition	No cognitive deficit	67	60.9
	Cognitive deficit	43	39.1

Table 3. Factors associated with the functional disability (univariate analysis)

Variables		ADL disability			IADL disability		
		Yes n (%)	No n (%)	*p*	Yes n (%)	No n (%)	*p*
Socio-demographic and institutional characteristics							
Length of the institutionalization	≤ 5 years	42 (57.5)	31 (42.5)	.93	60 (82.2)	13 (17.8)	.17
	> 5 years	21 (56.8)	16 (43.2)		34 (91.9)	3 (8.1)	
Gender	Male	33 (49.3)	34 (50.7)	.034	52 (77.6)	15 (22.4)	.004
	Female	30 (69.8)	13 (30 .2)		42 (97.7)	1 (2.3)	
Origin	Urban	36 (49.3)	37 (50.7)	.01	59 (80.8)	14 (19.2)	.05
	Rural	27 (73.0)	10 (27.0)		35 (94.6)	2 (5.4)	
Education level	Illiterate	49 (66.2)	25 (33.8)	.007	71 (95.9)	3 (4.1)	.0001
	Literate	14 (38.9)	22 (61.1)		23 (63.9)	13 (36.1)	
Marital Status	Married	25 (52 .1)	23 (47.9)	.33	43 (89.6)	5 (10.4)	.28
	unmarried	38 (61.3)	24 (38.7)		51 (82.3)	11 (17.7)	
Having children	Yes	15 (50.0)	15 (50.0)	.34	22 (73.3)	8 (26.7)	.057
	No	48 (60.0)	32 (40.0)		72 (90.0)	8 (10.0)	
Having siblings	Yes	37 (51.4)	35 (48.6)	.008	57 (79.2)	15 (20.8)	.01
	No	26 (68.4)	12 (31.6)		37 (97.4)	1 (2.6)	
Having an income	Yes	46 (60.5)	30 (39.5)	.30	64 (84.2)	12 (15.8)	.79
	No	17 (50.0)	17 (50.0)		30 (88.2)	4 (11.8)	
Social support							
Family financial support	Yes	1 (9.1)	10 (90.9)	.002	4 (36.4)	7 (63.6)	.0001
	No	62 (62.6)	37 (37.4)		90 (90.9)	9 (9.1)	
Having visits in the institution	Yes	27 (50.9)	26 (49.1)	.19	46 (86.8)	7 (13.2)	.70
	No	36 (63.2)	21 (36.8)		48 (84.8)	9 (15.8)	
Having friends outside the institution	Yes	26 (54.2)	22 (45.8)	.56	38 (79.2)	10 (20.8)	.10
	No	37 (59.7)	25 (40.3)		56 (90.3)	6 (9.7)	
Health status							
Self-perceived health status	Very bad-bad	29 (82.9)	6 (17.1)	.001	33 (94 .3)	2 (5.7)	.002
	Moderate	14 (51.9)	13 (48.1)		23 (85.2)	4 (14.8)	
	Good-very good	20 (41.7)	28 (58.3)		38 (79.2)	10 (20.8)	
Tobacco use	Yes	11 (40.7)	16 (59.3)	.04	20 (74.1)	7 (25.9)	.065
	No	52 (62.7)	31 (37.3)		74 (89.2)	9 (10.8)	
Diabetes	Yes	16 (61.5)	10 (38.5)	.61	22 (84.6)	4 (15.4)	.99
	No	47 (56)	37 (44)		72 (85.7)	12 (14.3)	
Hypertension	Yes	39 (61.9)	24 (38.1)	.25	55 (87.3)	8 (12.7)	.52
	No	24 (51.1)	23 (48.9)		39 (83.0)	8 (17.0)	
Motor disability	Yes	36 (81.8)	8 (18.2)	$<10^{-3}$	40 (90.9)	4 (9.1)	.18
	No	27 (40 .9)	39 (59.1)		54 (81.8)	12 (18 .2)	
Hearing disorders	Yes	9 (50.0)	9 (50.0)	.49	16 (88.9)	2 (11.1)	.99
	No	54 (58.7)	38 (41.3)		78 (84.8)	14 (15.2)	
Vision disorders	Yes	30 (63.8)	17 (36.2)	.23	42 (89.4)	5 (10.6)	.31
	No	33 (52.4)	30 (47.6)		52 (82.5)	11 (17.5)	
Co-morbidities	Yes	38 (63.3)	22 (36.7)	.15	52 (86.7)	8 (13.3)	.69
	No	25 (25.0)	25 (50.0)		42 (84.0)	8 (16.0)	
Satisfaction of the institution conditions	Yes	37 (48.7)	39 (51.3)	.006	62 (81.6)	14 (18.4)	.08
	No	26 (76.5)	8 (23.5)		32 (94.1)	2 (5.9)	
Depressive symptoms (GDS)	Yes	54 (62.1)	33 (37.9)	.048	74 (85.1)	13 (14.9)	.99
	No	9 (39.1)	14 (60.9)		20 (87.0)	3 (130)	
Cognitive deficit	Yes	32 (74.4)	11 (25.6)	.004	42 (97.7)	1 (2.3)	.004
	No	31 (46.3)	36 (53.7)		52 (77.6)	15 (22.4)	

Table 4. Binary logistic regression for independent factors associated with ADL disability

	OR$_a$	95% CI	p
Female gender	2.74	[.94-7.96]	.064
Age	1.06	[1.002-1.13]	.042
Self-perceived health status*			.031
Bad/very bad self perceived health status	5.48	[1.55-19.40]	.008
Moderate self perceived health status	1.72	[.52-5.66]	.36
Motor disability	11.42	[3.61-36.07]	.0001
Cognitive deficit	3.21	[1.11-9.29]	.031

The category "Good/very good" of the variable self-perceived health status was chosen as reference
ORa: Adjusted odds ratio; 95% CI: 95% confident interval

Table 5. Binary logistic regression for independent factors associated with IADL disability

	OR$_a$	95% CI	p
Female gender	21.57	[1.67-277.84]	.019
Age	1.22	[1.07-1.38]	.002
Having visits	.12	[.017-.85]	.034
Having friends	.13	[0.02-0.90]	.039
Family financial support	.015	[.002-.28]	.001

ORa: Adjusted odds ratio; 95% CI: 95% confident interval

In our study, smoking, diabetes, hypertension vision, hearing impairment and co-morbidities were not statistically associated with functional disability. In his systemic review, Tas et al. [8] concluded that some evidence was found for no association at different levels for smoking, alcohol use, and the presence of chronic diseases which in general could play a role in the incidence of disability. However, Mattos et al. [12] found that having a chronic condition or long-term health problem, is independently associated with functional impairments in elderly.

In our study, depression was significantly associated with ADL disability. Depression is recognized as a major factor that promotes the onset of disability and increases the functional decline [13,33]. However according to Conradsson et al. [34] a change in functional capacity or disability in ADL does not appear to be associated with a change in depressive symptoms among older people living in residential care facilities.

Our results showed that a cognitive deficit was independently associated with ADL disability. This is in agreement with previous researches which found that cognitive status is an accurate indicator of disability in older adults [35].

In our study, having friends outside the institution, having visits and receiving a family financial support were independent factors associated to IADL disability. Our finding coincides with the study by lee et al. [25], which found that persons with less family support, tended to show higher levels of disability. Recent findings suggest the importance of family and friendship for healthy aging and confirm that loss of functions in older people may be lessened by informal and formal support [36].

Our study has limitations. The high level of illiterate participants did not allow us to use an auto-administered questionnaire, and in consequence a declaration bias can be introduced. Despite limitations, our study has strength consisting mainly in studying the whole institutions of the Tunisian center which contribute to improve validity of our model and precision in our results. Moreover, to our knowledge, there was no documented study conducted in Tunisia on such population characterized by its social, physical and mental vulnerability and therefore in need to higher attention from both care providers and society. Further research evaluating preventive actions on elderly at risk of disability should be the next step of this study.

5. CONCLUSION

Disability is affected by a number of modifiable and non-modifiable predisposing factors. Among them, age, female gender, perceiving a bad health status and a lack of social support, appeared to be the most important risk factors of disability among elderly in our study.

Because elderly population continues to increase, and in consequence disability would be expected to increase, prevention of functional disability of the elderly population which requires the integration of multidisciplinary efforts should

be a strategic component of public health policies. Modifiable determinants of disability should be the most important targets for preventive interventions.

ETHICAL CONSIDERATIONS

This study was conducted with respect of the anonymity, confidentiality and human being integrity of the participants.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Kinklaze R, Metreveli S. Statistical analysis of demographic aging of the population Procedia Soc Behav Sci. 2014;156: 174-7.
2. United Nations, Department of Economic and Social Affairs, Population Division, World Population Prospects: The 2012 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP. 227.
3. Spillman BC. Changes in elderly disability rates and the implications for health care utilization and cost. Milbank Q. 2004;82(1): 157-94.
4. Fried LP, Ferrucci L, Darer J, et al. Untangling the concepts of disability, frailty, and comorbidity: Implications for improved targeting and care. J Gerontol A Biol Sci Med Sci. 2004;59:255-63.
5. Rautioa N, Adamsonb J, Heikkinena E, Ebrahim S. Associations of socio-economic position and disability among older women in Britain and Jyväskylä, Finland. Arch Gerontol Geriat. 2006;42(2): 141-55.
6. Alves LC, Leite Ida C, Machado CJ. Factors associated with functional disability of elderly in Brazil: A multilevel analysis. Rev Saude Publica. 2010;44(3): 468-78.
7. Yoshida D, Ninomiya T, Doi Y, Hata J, Fukuhara M, Ikeda F, Mukai N, Kiyohara Y. Prevalence and causes of functional disability in an elderly general population of Japanese: The Hisayama study. J Epidemiol. 2012;22(3): 222-9.
8. Tas U, Verhagen AP, Bierma-Zeinstra SM, Odding E, Koes BW. Prognostic factors of disability in older people: A systematic review. Br J Gen Pract. 2007;57(537):319-23.
9. Rose AM, Hennis AJ, Hambleton IR. Sex and the city: Differences in disease- and disability-free life years, and active community participation of elderly men and women in 7 cities in Latin America and the Caribbean. BMC Public Health. 2008;8: 127.
10. Millán-Calenti JC, Tubío J, Pita-Fernández S, González-Abraldes I, Lorenzo T, Fernández-Arruty T, et al. Prevalence of functional disability in activities of daily living (ADL), instrumental activities of daily living (IADL) and associated factors, as predictors of morbidity and mortality. Arch Gerontol Geriatr. 2010;50: 306-10.
11. Rodrigues MAP, Facchini LA, Thume E, Maia F. Gender and incidence of functional disability in the elderly: A systematic review. Cad Saude Publica. 2009; 28(Supl 3):S464-S476.
12. Mattos IE, do Carmo CN, Santiago LM, Luz LL. Factors associated with functional incapacity in elders living in long stay institutions in Brazil: A cross-sectional study. BMC Geriatr. 2014;14:47.
13. Ormel J, Rijsdijk FV, Sullivan M, van Sonderen E, Kempen GI. Temporal and reciprocal relationship between IADL/ADL disability and depressive symptoms in late life. J Gerontol B Psychol Sci Soc Sci. 2002;57:338-47.
14. Office National de la famille et de la population. Projection et perspectives de la population : quel avenir pour la Tunisie. [Cited 2016 Feb 10] Available:http://www.onfp.nat.tn/cercles/TR4/dossier/dos_fr.pdf (French)
15. Katz S, Akpom CA. A measure of primary sociobiological functions. Int J Health Serv. 1976;6:493-508.
16. Lawton MP, Brody EM. Assessment of older people: Self-maintaining and instrumental activities of daily living. Gerontologist. 1969;9:179-86.
17. Bhamani MA, Khan MM, Karim MS, Mir MU. Depression and its association with functional status and physical activity in the elderly in Karachi, Pakistan. Asian J Psychiatr. 2015;14:46-51.
18. Lacoste L, Trivalle C. Echelles d'évaluation de la dépression en consultation gérontologique. Neurologie Psychiatrie Geriatrie. 2005;5(26):44-51. French

19. Chahine LM, Bijlsma A, Hospers APN, Chemali Z. Dementia and depression among nursing home residents in Lebanon: A pilot study. Int J Geriatr Psychiatry. 2007;22(4):283-5.

20. Chaaya M, Sibai A-M, Roueiheb ZE, Chemaitelly H, Chahine LM, Al-Amin H, Mahfoud Z. Validation of the Arabic version of the short Geriatric Depression Scale (GDS-15). Int Psycho Geriatr. 2008; 20(3): 571-81

21. Yesavage JA, Brink TL, Rose TL, Lum O, Huang V, Adey M, Leirer VO. Development and validation of a geriatric depression screening scale: A preliminary report. J Psychiatr Res. 1983-1982;17(1): 37-49.

22. Chtioui M, Hammami S, Mrabet A, Gahha L, Hajem S. Adaptation d'un outil d'évaluation cognitive pour le dépistage de la démence chez les personnes âgées du gouvernorat de Monastir. L'Encéphale. 2010;36:128. French

23. Warshaw GA, Moore JT, Friedman SW, Currie CT, Kennie DC, Kane WJ, Mears PA. Functional disability in the hospitalized elderly. JAMA. 1982;248:847-50.

24. Applegate WB, Blass JP, Williams TF. Instruments for the Functional Assessment of Older Patients. N Engl J Med. 1990;322: 1207-14.

25. Lee Y, Choi K. Functional disability of older persons in long-term care facilities in Korea. Arch Gerontol Geriatr. 2002;34(2): 93‑106.

26. Doumit JH, Nasser RN, Hanna DR. Nutritional and health status among nursing home residents in Lebanon: Comparison across gender in a national cross sectional study. BMC Public Health. 2014;14:629.

27. Molaschi M, Ponzetto M, Ferrario E, Scarafiotti C, Fabris F. Health and functional status in elderly patients living in nursing homes. Arch Gerontol Geriatr. 1995;21(3):267-76.

28. World Health Organization. Organization WH, others. What are the main risk factors for disability in old age and how can disability be prevented? 2003. [Cited 2016 Feb 10] Available:http://www.euro.who.int/__data/assets/pdf_file/0008/74708/E82970.pdf

29. World Health Organization. Global Health and Aging; 2011. [Cited 2016 Mar 12] Available:http://www.who.int/ageing/publications/global_health.pdf

30. Helvik AS, Engedal K, Benth JS, Selbæk G. A 52 month follow-up of functional decline in nursing home residents - degree of dementia contributes. BMC Geriatr. 2014;14:45.

31. Hu YN, Hu GC, Hsu CY, Hsieh SF, Li CC. Assessment of individual activities of daily living and its association with self-rated health in elderly people of Taiwan. Int J Gerontol. 2012;6(2):117‑21.

32. Dobrzyn-Matusiak D, Marcisz C, Bąk E, Kulik H, Marcisz E. Physical and mental health aspects of elderly in social care in Poland. Clin Interv Aging. 2014;9:1793-1802.

33. Katon WJ. Epidemiology and treatment of depression in patients with chronic medical illness. Dialogues Clin Neurosci. 2011; 13(1):7-23.

34. Conradsson M, Littbrand H, Boström G, Lindelöf N, Gustafson Y, Rosendahl E. Is a change in functional capacity or disability in activities of daily living associated with a change in mental health among older people living in residential care facilities? Clin Interv Aging. 2013;8:1561-8.

35. Sauvaget C, Yamada M, Fujiwara S, Sasaki H, Mimori Y. Dementia as a predictor of functional disability: A four-year follow-up study. Gerontology. 2002; 48(4):226-33.

36. Melchiorre MG, Chiatti C, Lamura G, Torres-Gonzales F, Stankunas M, Lindert J, Ioannidi-Kapolou E, Barros H, Macassa G, Soares JF. Social support, socio-economic status, health and abuse among older people in seven European countries. PLoS One. 2013;8(1):e54856.