

## Relationship between Disability Severity and Activity of Daily Living in People with Multiple Sclerosis

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### ABSTRACT

**Introduction:** Multiple sclerosis (MS) is one of the most common disabling diseases in young adults. Common manifestations include fatigue, bladder and bowel disorders, pain, mobility problems, and cognitive impairment. These symptoms seriously affect the activity of daily living (ADL) of people with MS. The purpose of this study to investigate relationship between disability severity and ADL in people with MS.

**Material and Methods:** A total of 112 people with MS enrolled in this study. These people were evaluated by Barthel index, Mini Mental Status Examination, the Extended Disability Status Scale for ADL, cognitive ability and severity of disability.

**Results:** In linear regression analysis, independence in ADL is the best of predictor (69%) of disability severity in people with MS. The Pearson correlation test between the severity of disability and independence in ADL showed a significant relationship.

**Conclusion:** Independence in performing ADL can predict disability severity in people with MS.

**Keywords:** Activity of daily living; Multiple sclerosis; Disability severity

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### Introduction

Multiple sclerosis (MS) is a progressive disease involving the central nervous system leading to inflammation and demyelination in the form of plaques in different areas of brain and spinal cord (1). Mainly young people and those who are in their active stage of life are affected by this disease (2) so that it is known as one the main causes of disability of young people in western countries (1). The outbreak has been reported differently in various populations; the outbreak in Tehran has increased from 5.9 (per 100,000) in 2009 to 73 in 2011 (3, 4). This disease is a more common in women than men. Studies also have shown that there is more prevalence in Caucasians of Northern Europe (5).

This disease is described by various symptoms including mobility deficit, cognitive disorders, visual abnormalities, weakness, fatigue, speech impairments, and emotional symptoms (1). Physical and mental disabilities caused by the disease have a significant

impact on performance and participation of individuals in different spheres of life. For instance, the disease is associated with a decrease in ability of individual for performing activities of daily living (ADL) (1). Researches also show that many of negative symptoms of the disease can be observed in evaluating the performance of ADL (6).

One indicator of evaluating disability level of patients with MS is Expanded Disability Status Scale (EDSS). The level of disability has been considered from 0 to 10 based on this scale; the patients with a higher score have various problems, especially in the field of mobility and using their upper limbs (7). Basic skills such as bathing, eating, make-up, dressing, control of stool and urine, using the toilet or tub, moving from bed to chair, going up and down the stairs and mobility in everyday life are known as ADL. Independency in carrying out these activities is associated with the rate of disability in patients with

MS, which means that the ability of patients with severe disability is reduced in independency for ADL (8). Mansson studied the ADL of 44 patients with MS with severe disability (6-8.5); he reported that about half of patients were dependent in ADL (8). This finding is consistent with studies of Tulay et al. (6) which stated that patients with severe and moderate disability and those with more time they have passed the diagnosis are less able to perform ADL.

Since independency in ADL is associated with health factors, independency of patients in these activities is known as the main outcome of medical, rehabilitation and supportive programs for patients with MS (9). Several studies with a descending view have evaluated different factors such as mobility, urinary-fecal control, upper extremity skills and various other factors to determine the rate of disability in patients with MS. Ghandi et al. (10) and Feys et al. (11) in their studies reported the effect of rate of disability on hand skills in patients with MS; they added that hand skills can predict disability status in patients with MS. Cohen et al. (12) and Paltamaa et al. (13) in their studies noted the role of mobility in predicting the rate of disability in patients with MS; patients with mobility deficits had more severity of disability. However, there was a clear shortage in evidence which had reviewed the effects of limitations in performing activities and the rate of disability. The purpose of this study with an ascending view was to find which of ADL activities can predict the rate of disability in patients with MS. According to this prediction, health specialists can gain required information related to the activities that patients face problem in different levels of disability. They also can have an appropriate and timely referral of patients to the rehabilitation. This awareness can also help the rehabilitation team in planning therapeutic goals for these patient.

## Materials and methods

This study was performed in the form of cross-sectional. The samples of the study were selected from the patients with MS referring to Neurology Clinic in Tehran since September to November 2014. All of the subjects were entered into the study by convenience sampling method. 112 patients with MS were selected from 143 individuals who had entering criteria including Mini-Mental Status Examination (MMSE) (score: 23) and having no neurologic and orthopedic disease together and exclusion criteria was no cooperation in this study. Required information of the research was explained to the patients before perform the study and consent form was obtained consciously. It should be noted that this study was approved by Ethics code 93/d/105/5398 in Ethics Committee of the School of Rehabilitation, Iran University of Medical Sciences.

## MMSE

It is one of the most common screening tools for cognitive impairments which evaluate different cognitive functions including attention, calculation, language, ability to follow commands, orientation, registration and retrieval of information in subjects, and provide an overall assessment from their cognitive status. Standardization test was done by Foroughan et al., (14) in Iran and Cronbach's alpha coefficient, its' feature and sensitivity were reported, respectively, 78%, 84% and 90%.

## EDSS

A neurologist diagnosed MS disease and determined the rate of disability using EDSS. The mentioned scale was created by Kurtzke in 1983 which has shown disability in 8 systems. These systems are visual, sensory, urinary-fecal, brain, brain stem, cerebellum, and pyramidal ways. EDSS is ranked between 0 and 10 and has an increase of half of a unit. The patients with a lower score (0-3.5) mostly show signs and symptoms on neurological examinations; while patients with score 4 and higher have more disability rate specially in the field of mobility. Patients in this study were divided into three groups based on EDSS score (mild: 0-3.5, medium: 4-5.5, severe: 6-8.5) (7).

## Barthel index

This questionnaire was used to determine the level of ADL. This questionnaire was proposed by Barthel in 1969 to evaluate ADL and its reliability and validity have been proven in several studies. This index has 10 components including eating, bathing, make-up, stool and urine control, using the toilet or tub, moving from bed to chair and moving up and down the stairs. Each component has its own score from 0 to 5 or 10 to 15 and the total score is 100. Making up and bathing have 0 and 5 score, stool-urine control, using toilet or tub, eating, dressing and going up and down the stairs are at 5, 0 and 10 score level. Mobility and moving from the bed to the chair are scored at four levels of 10, 5, 0 and 15. Based on Barthel et al., classification, the score 0-59 is unable, 60-84 have less independency, 85-94 have medium independency, 95-99 have relative independency, and 100 are independent. Disability border is considered 60 in patients (15, 16). Evaluation of validity and reliability of Barthel index was conducted by Oveisgharan et al., (17) in Isfahan Cardiovascular Research Center, Iran on patients with stroke; Cronbach's alpha coefficient, test-retest reliability and the translation of this questionnaire was distributed among testers and calculations were 0.935, 0.989 and 0.994, respectively. The questionnaire was completed by a therapist who was already familiar with its questions.

Data analysis was performed using the software SPSS (version 17; SPSS Inc., Chicago, IL., USA). When the normal distribution was determined based on

Kolmogorov–Smirnov test, Pearson test was applied to assess the relationship between variables and also linear regression was used to predict the factors determining the severity of disability.

## Results

In this study, 74% of patients with MS under the study were female and 65% were married out of 112 participants. The average  $\pm$  of standard deviation of the population in terms of age was  $36.45 \pm 9.96$  years, duration after diagnosis of neurologist was  $7.24 \pm 5.93$  years, and MMSE score was  $27.48 \pm 2.06$ . In terms of severity of disability, 73.2% of participants were mild (0-3.5); in this group, patients were at level of complete or relative independency in terms of ADL independency (Table 1). Based on Barthel Index in ADL independency, 62.5% of participants had complete independency in Barthel activities, while it was relative in 6.2%, medium in 10.7%, minor in 8.9%, and 11.6% were unable to do activities.

**Table 1.** Statistical indicator Barthel index score in disability groups (EDSS) (n = 112)

	Statistical indicator	N (%)	Mean $\pm$ SD
Disability level (EDSS)	0-3.5	82 (73.2)	98.41 $\pm$ 3.75
	4-5.5	18 (16.1)	80.55 $\pm$ 16.70
	6-8.5	12(10.7)	52.08 $\pm$ 13.22
	Total	112	90.58 $\pm$ 17.09

SD: Standard deviation; EDSS: Expanded Disability Status Scale

As table 2 shows, in weak disability group (0-3.5), the participants were independent at some levels for doing all ADL activities (except one in bathing), but they were completely independent in make-up and moving from bed to chair. None of the study population with disability rate of 4-8.5 was able to use toilet of tub independently. All participants were able to perform some levels of independency in two activities of dressing and undressing and eating. None of the subjects in the mild to moderate group of disability (0-5.5) was at complete level of disability.

**Table 2.** Frequency of independence in ADL in the disability groups

Activity	Disability groups		
	0-3.5 N (%) 82 (100%)	4-5.5 N (%) 18 (100%)	6-8.5 N (%) 12 (100%)
Bowel control			
Independent	79 (96.3)	14 (77.8)	7 (58.3)
Supervision	3 (3.7)	3 (16.6)	4 (33.3)
Disable	0 (0)	1 (5.6)	1 (8.4)
Urine control			
Independent	72 (87.8)	10 (56)	3 (25)
Supervision	10 (2.2)	7 (38.4)	6 (50)
Disable	0 (0)	1 (5.6)	3 (25)
Make-up			
Independent	82 (100)	17 (94.4)	7 (58.3)
Disable	0 (0)	1 (5.6)	5 (41.7)
Using the toilet or tub			
Independent	1 (1.2)	0 (0)	0 (0)
Supervision	81 (98.8)	17 (94.4)	8 (66.7)
Disable	0 (0)	1 (5.6)	4 (33.3)
Eating			
Independent	81 (98.8)	16 (88.8)	10 (84)
Supervision	1 (1.2)	2 (11.2)	2 (16)
Disable	0 (0)	0 (0)	0 (0)
Moving from bed to chair			
Independent	82 (100)	10 (56)	2 (16)
Supervision	0 (0)	8 (44)	10 (84)
Disable	0 (0)	0 (0)	0 (0)
Mobility			
Independent	80 (97.6)	7 (38.4)	0 (0)
Supervision	2 (2.4)	11 (61.6)	10 (84)
Disable	0 (0)	0 (0)	2 (16)
Dressing			
Independent	81 (98.8)	15 (83.4)	4 (33.3)
Supervision	1 (1.2)	3 (16.6)	8 (66.7)
Disable	0 (0)	0 (0)	0 (0)
Moving up and down the stairs			
Independent	79 (96.3)	6 (33.6)	0 (0)
Supervision	3 (3.7)	4 (22.4)	1 (8.4)
Disable	0 (0)	8 (44)	11 (91.6)
Bathing			
Independent	81 (98.8)	14 (77.8)	6 (50)
Disable	1 (1.2)	4 (22.2)	6 (50)

**Table 3.** Relationship between variables

Variable	Age	Duration of disease	Barthel index	EDSS	MMSE
EDSS	0.302**	0.427**	-0.830**	1	-0.508**
MMSE	-0.425**	-0.365**	0.463**	-0.508**	1
Age	1	-0.510**	0.269**	0.302**	-0.425**
Duration of disease	-0.510**	1	-0.437**	0.472**	-0.365**
Barthel index	-0.269**	-0.437**	1	-0.830**	0.463**

\*\*P < 0.001, r = Pearson coefficient. EDSS: Expanded Disability Status Scale, MMSE: Mini Mental Status Examination

Initially, the rate of disability was considered as independent variable and independency in ADL, age, disease duration after diagnosis and score of MMSE were considered as predictor variables using linear regression analysis. Although these variables were able to predict 72% of changes in the rate of disability, the two variables of independency in ADL and MMSE were fitted (respectively,  $P < 0.001$  and  $P = 0.030$ ). To obtain more accurate information, the results of stepwise multivariate regression analysis showed that 71% of changes in rate of disability of the studying population is predictable with rate of independency in ADL and rate of cognitive level of MMSE; independency in ADL can determine 69% of the rate of disability in patients with MS by itself. Thus, ultimate model of linear regression (Barthel index) is  $Y$  (predicting EDSS) =  $12.9 - 0.104$ .

Since distribution of the data in this study based on Kolmogorov–Smirnov  $P < 0.050$  followed a normal distribution, the relation of disability rate (EDSS score), age, cognitive status (MMSE score), disease duration after diagnosis of a neurologist, and independency in ADL was examined using Pearson correlation analysis. The results are reported in table 3.

## Discussion

This study aimed to evaluate the relation between the rate of disability and ADL in patients with MS. As mentioned in finding section, age, disease duration after diagnosis, independency in ADL and MMSE score were studied as predictor factors for disability rate in patients with MS. However, only independency in ADL and MMSE score are not able to predict the disability rate in people with MS and the variable of independency in ADL could be the best predictor (69%) of the rate of disability in patients. One limitation of this study was different population distribution in three groups of minor, moderate and severe level of disability; this could reduce the ability of predicting disability rate according to ADL. It is proposed to reduce this level of difference in future studies. Furthermore, MMSE variable was ignored due to the large number of patients with minor rate of disability and homogeneity of the study population. This finding is consistent with Cohen et al. research (12) in which he used 42-ADL Inventory Questionnaire for 43 patients with MS and proposed 5 areas of mobility, communications, personal care, household activities, and social relationships as

predictor variables for the rate of disability. He reported that independency in these areas especially mobility can predict the rate of disability in patients with MS. This study also shows the correlation of EDSS score with independency in ADL consistent with Cohen et al. research (12) which reports this correlation especially with mobility field.

Several studies have investigated the independency in ADL in people with MS since now, but there are few studies which have described ADL one by one. Since findings of the study can be important and especially useful in clinical experiences and planning objectives for people with MS, we have tried to check ADL in the subjects of this study one by one.

One of the most common complaints of people with MS is fecal-urinary problems which have been reported in 75% of MS patients and include some disorders such as urinary frequency, urinary incontinence, constipation, diarrhea, and fecal incontinence (18). Hennessey et al. (18) reported in his study on 221 patients with MS that urinary-fecal problem in patients is more by increasing the level of disability and EDSS score. 89% of subjects were independent in controlling stool and 75% were independent in controlling urine. According to Hennessey et al. research, distribution percent of independency in people with MS in stool-urine control is reduced by increasing the rate of disability and EDSS score. As shown in table 2, subjects had more difficulty in controlling urine.

In this study, more than 90% of the subjects were independent at all three levels of weak, moderate and severe disability in make-up, and bathing activities; but, as can be seen in table 2, distribution percent of independency in people with MS is reduced for performing these activities by increasing the rate of disability at moderate and severe level. This failure in bathing can be due to mobility and balance problems which affect patients' ability to do this activity. Upper extremity problems such as pain and immobility of shoulder and wrist and finger spasticity have disrupted the make-up activity mainly in subjects with severe disability level.

More than 94% of studying subjects needed help for using toilet or tub and the main problem posed by patients was particularly in the balance for sitting and standing up from the toilet or tub. There was no study and evidence to review this activity in people with MS.

As indicated in table 2, in this study, none of the

subjects was unable to perform activities of eating, dressing and undressing and moving from bed to chair. Typically patients with MS are independent in ADL at the beginning of the disease, but over time and occurring more symptoms experienced by patients, patients' disabilities will be increased gradually, and they will be dependent even in activities such as eating, dressing, and mobility (13). This study is consistent with the study of Oveisgharan et al., 2015 (6) which reported that the patients whose diagnosis is above 10 years, their ability of performing ADL is reduced; it shows a significant relationship between duration of disease after diagnosis and independency in ADL. In this study, 95.5% of patients with MS were independent in dressing and this may be due to the smaller number of patients with severe disability level. The performance of patients with MS in dressing and undressing is in relation with upper extremity function. Several studies have been done on upper extremity function including Ghandi et al. (10) study in 2015 on people with MS. He reported that the performance of these people especially in fine skills is in relation with the severity level of disability and patients with moderate and severe disability level faced problem in fine skills of upper extremity. Hence, it is predicted that these people face trouble in things such fastening buttons.

Based on the classification of function, disability and health, activity is defined as performing a task or action in which limitations lead to restrictions in participation and participation in this model refers to engage in all aspects of life (7). Based on this model, activity is known as going up and down the stairs, moving from bed to chair and other ADL. Limitation in mobility is created due to different reasons including weakness, spasticity, and problem in balance and following this limitation in mobility, people's participation will be reduced in many activities such as leisure, professional, and social activities (7). In this study, the distribution percent of independency in patients' mobility and going up and down the stairs is reduced by increasing their rate of disability (EDSS > 4); it is so that none of patients with severe rate of disability had complete independency in mobility and going up and down the stairs.

On the sidelines of this study as mentioned in the results, there was a relation between MMSE score over time of the disease diagnosis and independency of ADL. In many contexts, deficiency in attention, concentration, memory, information processing speed, tongue, planning, and organization are noted as common cognitive disorders in these patients (19). This study is consistent with Amato et al. (20) study in 2001 in which he reviewed 50 patients with MS and reported that cognitive abilities in mild and moderate patients is 26% at the beginning of the diagnosis and 49% after 4 years and reach to 56% 10 years after diagnosis. Furthermore, in line with this study, the patients who have lower MMSE

score are more dependent on their ADL.

One of the limitations of this study was a lack of the patients with severe disability and selecting based on their visit to the clinic. A cross-sectional study was another limitation of this research; hence, it cannot show the changes of EDSS and MMSE scores that occur over time from diagnosis. Thus, it is suggested to conduct more longitudinal studies in this regard.

In summing up the findings of this study, there was a significant relationship between independency in ADL and EDSS score and patients with moderate and severe rate of disability have the lower ability in performing these activities. This is while independency in ADL can predict severity of disability in people with MS.

## Conclusion

A symptom of MS has a significant impact on performance and participation of individuals in different spheres of life. For instance, the disease is associated with a decrease inability of individual for performing ADL. The purpose of this study to investigate relationship between disability severity and ADL in people with MS that results showed that Independence in performing ADL can predict disability severity in people with MS.

## Conflict of Interests

Authors have no conflict of interests.

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