

Validation of the Comprehensive ICF Core Set for Multiple Sclerosis: A Turkish clinical perspective

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ABSTRACT

Objectives: The aim of this study was to evaluate the results of the construct validity of the Comprehensive International Classification of Functioning, Disability and Health (ICF) Core Set for Multiple Sclerosis (MS) and to identify the impact of MS on specific health domains according to the ICF categories in Turkish individuals.

Patients and methods: Between December 2011 and December 2012, a total of 150 individuals with MS (69 males, 81 females; mean age: 39.8±8 years; range, 19 to 52 years) who were diagnosed by a neurologist at least six months previously were included. The Comprehensive ICF Core Set for MS was used to assess functioning, disability, and environmental factors in all participants. The Spearman correlation coefficient was used to determine construct validity of the ICF Core Set between the ICF components and disease-specific and general measurements.

Results: The most frequently coded impairments in the body functions component were b280 sensation of pain, b134 sleep functions, b1301 motivations, and b740 muscle endurance functions. The most frequently coded impairments in the body structures component were s110 structure of brain, s120 spinal cord and related structures and s750 structure of lower extremity. A significant problem was documented in 47 of the 53 categories of the activities and participation. Of the 38 categories in the environmental factors, 23 were identified as a facilitator, while 12 categories were identified as a barrier. All body function, structure, activities and participation and environmental factors categories showed a significant correlation with disease-specific and generic measures.

Conclusion: Based on these results, the ICF Core Set may help to determine major facilitators or barriers to functioning and disability and a targeted rehabilitation approach in patients with MS.

Keywords: Barriers, disability, ICF, multiple sclerosis.

One of the most prevalent causes of neurological dysfunction in young adults is multiple sclerosis (MS), a chronic demyelinating disease of the central nervous system.^[1] Symptoms of MS vary from person to person depending on the localization of the demyelination, and these may include fatigue, spasticity, weakness, pain, depression, bladder and bowel problems, visual problems, and cognitive and sexual dysfunction. Patients with MS not only deal with the disability

consequences of these symptom, but also struggle with an expanding spectrum of functional issues, limitations in daily social interaction, and an impaired quality of life.^[2,3]

The disability associated with neurological conditions is linked to impairments in body function and structure, performing daily activities and restriction in social participation modified by the environment in which individuals live, and personal

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factors. Multidisciplinary rehabilitation encompasses an individual's function, activity and participation in the context of both environmental and personal factors.^[4] Therefore, effective management of MS requires a more comprehensive perspective and language on functioning and disability between different disciplines.

To establish a universal language for functioning and disability, the International Classification of Functioning, Disability and Health (ICF) Core Set has been developed for specific conditions. Multidisciplinary evaluations can identify and describe a person's functioning and disability according to their contextual context using the ICF, which offers a complete viewpoint and universally accepted framework. The ICF Core Set works as a reference to assess functioning, facilitate establishment of rehabilitation goals, evaluate healthcare interventions, and gather in-depth data for team decision-making under particular circumstances.^[5]

The ICF Core Set for MS was developed at an international consensus meeting for the implementation of the ICF in clinical practice to direct interprofessional assessments in MS. The comprehensive ICF Core Set for MS contains 138 categories divided into four different components: body functions; body structures; activities and participation; and environmental factors.^[6]

There are few studies evaluating separately the components of the ICF Core Set in MS patients.^[7,8] However, to date, no study has used all the components of the ICF Core Set comprising body functions, activities and participation and environmental factors in patients with MS. In the present study, we aimed to evaluate the results of the construct validity of the Comprehensive ICF Core Set for MS and to identify the impact of MS on specific health domains according to ICF categories in Turkish individuals.

PATIENTS AND METHODS

This two-center, single-subject clinical study was conducted at Ankara Physical Therapy and Rehabilitation Hospital, Department of Physical Therapy and Rehabilitation and Ankara Training and Research Hospital, Department of Neurology between December 2011 and December 2012. A total of 150 individuals with MS (69 males, 81 females; mean age: 39.8±8 years; range, 19 to 52 years) were included. All participants were aged ≥18 years and diagnosed

with MS by a neurologist according to the McDonald criteria at least six months previously.^[9] Exclusion criteria were as follows: any concomitant neurological, orthopedic, or rheumatological disability; severe cognitive dysfunction according to the Mini-Mental State Examination (MMSE) <20; loss of visual acuity; and evident signs of an MS exacerbation in the past 30 days.

The baseline sociodemographic data (age, sex, employment status, education status, and medications) and disease characteristics (date of diagnosis, current type of MS, and comorbidities) were collected. An ICF-trained physician interviewed the participants using the ICF Core Set for MS. A single physician with training and experience in the ICF application areas and guiding principles conducted the interviews whose education related to ICF was supported by the Government of Türkiye in collaboration with the World Health Organization (WHO) in 2008.

Assessment

The Expanded Disability Status Scale (EDSS) was used to measure the disease severity. Based on the medical history and neurological examination, the rating consists of an ordinal rating system ranging from 0 (normal neurological status) to 10 (death due to MS) in 0.5 increment intervals, with a higher score indicating greater disability.^[10]

The Functional Independence Measure (FIM) was used to assess functional independence in daily living. Functional ability is evaluated by the FIM in six domains (i.e., self-care, sphincter control, transfers, locomotion, communication, and social cognition). It has 18 motor and cognitive abilities items, each of which is scored quantitatively on a scale from 1 (total dependency) to 7 (complete independence). The total FIM score ranges from 18 to 126.^[11] The validity and reliability study of the Turkish version of the FIM has been well documented.^[12] Quality of life was evaluated using the Short Form-36 (SF-36). Two summary scores are obtained: the physical component summary score (PCS) and the mental component summary score (MCS). A higher score on the standardized SF-36 scale indicates better health state, with a range of 0 to 100.^[13,14]

The Fatigue Severity Scale (FSS) was used to evaluate the intensity of fatigue and impact on daily function. It consists of nine items that are rated on a scale between 1 and 7. A total score is generated by averaging the item scores.^[15]

The severity of depression was assessed using the Beck Depression Inventory (BDI), which is a 21-item self-report scale.^[16] The validity of reliability of the Turkish version of the scale has been established.^[17]

The MMSE was used to evaluate cognitive functioning. Scores range from 0 to 30, with higher scores indicating higher overall cognitive function.^[18]

To evaluate balance abilities, the Berg Balance Scale (BBS) was utilized which evaluates the balance using 14 items with a total score of 56.^[19] The Turkish adaptation of the BBS has been performed.^[20]

The 6-Min Walking Test (6MWT) was used to assess both physical performance and walking function. In the test, the distance is measured which the subject walks on a 30 m flat surface in a period of 6 min.

The Comprehensive ICF Core Set for MS was used to assess functioning and disability, as well as environmental factors in all the study participants. It consists of 138 ICF categories with 123 categories at the second level and 15 at the third level of the classification. It is organized in four different components: 40 categories from body functions, seven from body structures, 53 from activities and participation, and 38 categories from environmental factors. To quantify the extent of a problem, a qualifier scale was used to evaluate the patient's problem in each of the ICF categories. There are five response options on the qualification scale body functions, body structures and activities and participation with response values ranging from 0 (no problem) to 4 (complete problem). There are nine response levels for the environmental factor component, ranging from -4 to +4. A specific

TABLE 1
Baseline sociodemographic and clinical features of participants (n=150)

	n	%	Mean±SD
Age (year)			39.8±8.0
Sex			
Male	69	46	
Female	81	54	
Duration of disease (month)			96.1±69.1
Disease subtype			
Relapsing-remitting	80	53.3	
Secondary-progressive	46	30.6	
Primary-progressive	22	14.7	
Progressive relapsing	2	1.3	
Marital status			
Married	122	81.3	
Not married	28	18.6	
Education period (year)			7.6±3.9
Employment status			
Employed	55	36.7	
Unemployed	71	47.4	
Disability pension/retirement pension	24	16	
Expanded disability status scale			4.0±2.1
Functional independence measure score			109.9±20.5
Fatigue severity scale score			4.1±1.4
Mini-mental state examination			26.3±3.7
6-min walking test			327.3±221.8
Berg balance scale			37.81±18.139
Beck depression inventory			22.5±13.6
SF-36			
Physical component summary			38.2±12.0
Mental component summary			41.5±11.5

SD: Standard deviation.

environmental component may have a negative impact on a patient's life (1 to 4), a positive impact (+1 to +4), or no impact at all (0). In case that a category cannot be selected or is not applicable, the additional qualifiers 8 and 9 are utilized.^[6]

The frequency and percentage of the individuals who had a problem in each specific category of ICF Core Set were assessed. For the categories of the ICF component environmental factors, the frequencies of persons reporting a specific category as a barrier, or a facilitator were reported.

Statistical analysis

Statistical analysis was performed using the IBM SPSS for Mac version 20.0 software (IBM Corp., Armonk, NY, USA). Data were presented in mean \pm standard deviation (SD) or median (min-max) for continuous variables and in number and frequency for categorical variables. The sample size was calculated with 5% margin of error and 80% confidence interval (CI), and it turned out to be 150. Comparison of the categorical variables was performed using the chi-square test. The Spearman correlation coefficient was used to determine construct validity of the ICF Core Set between the ICF components and clinical assessments. A *p* value of <0.05 was considered statistically significant.

RESULTS

The mean disease duration was 96.1 ± 69.1 (range, 12 to 155) months. The participants had different subtypes of disease: 80 (53.3%) had relapsing-remitting, 46 (30.6%) had secondary-progressive, 22 (14.7%) had primary-progressive, and two (1.3%) had progressive relapsing. The mean EDSS score was 4.0 ± 2.1 . The sociodemographic and disease characteristics of the participants are shown in Table 1.

Body functions and body structures component

In the body functions component, all categories were reported as a problem by more than 10% of the participants except b5105 (swallowing) and b5508 (thermoregulatory functions).

The most frequently coded impairments (in $\geq 70\%$ of the participants) were b280 sensation of pain, b134 sleep functions, b1301 motivations, b740 muscle endurance functions, b730 muscle power functions, b445 respiratory muscle functions, b210 seeing functions, b750 motor reflex functions, and b455 exercise tolerance functions.

In the body structures component, all categories were reported as a problem by more than 10% of the participants. The most frequently coded impairments (in $\geq 60\%$ of the participants) were s110 structure of brain, s120 spinal cord and related structures, s750 structure of lower extremity, and s610 structure of urinary system. All the component of body functions had a strong correlation with the SF-36, EDSS, FIM, FSS, 6MWT, and BBS. Table 2 presents the prevalence of deficits across the ICF categories of body function components and correlates these findings with clinical evaluations.

The activities and participation component

In the activities and participation component, a significant problem was documented in 47 of the 53 categories of the activities and participation by more than 10% of the participants. The most frequently (in $\geq 60\%$ of the participants) coded impairments were d160 focusing attention, d220 undertaking multiple tasks, d430 lifting and carrying objects, d450 walking, d455 moving around, d830 higher education, d845 acquiring, keeping and terminating a job, d850 remunerative employment, and d870 economic self-sufficiency. With the exception of d870 economic self-sufficiency, these categories had a strong correlation with the SF-36, EDSS, FIM, FSS, 6MWT, and BBS (Table 3).

The environmental factors component

Of the 38 categories in the environmental factors, 23 were identified as a facilitator by more than 10% of the participants. Twelve categories were identified as a barrier by more than 10% of the participants. The most frequently reported facilitator categories were e1101 drugs, e310 immediate family, e355 healthcare professionals, e570 social security services, systems, and policies, e580 health services, systems, and policies, e450 individual attitudes of healthcare professionals, and e460 societal attitudes. The most frequently reported barrier categories were e150 design, construction and building products and technology of buildings for public use, e2250 temperature, e2251 humidity, e2253 precipitation, e155 design, construction and building products and technology of buildings for private use, e515 architecture and construction services, systems, and policies, e540 transportation services, systems, and policies, and e590 labor and employment services, systems and policies. The frequency of impairments in the ICF categories of the environmental factors and the correlations with the clinical assessments are presented in Table 4.

TABLE 2
Frequency of impairments in the ICF categories of the component of body functions and structures and correlation between the ICF categories and clinical assessments

Body functions	No	%	SF-36 PCS	SF-36 MCS	EDSS	FIM	FSS	6MWT	BBS	MMSE	BDI
b114 Orientation functions	67	44.7	-0.560**	-0.312**	0.359**	-0.511**	0.517**	-0.497**	-0.387**	-0.734**	0.597**
b126 Temperament and personality functions	122	77.3	-0.409**	-0.624**	0.408**	-0.573**	0.113**	-0.522**	-0.482**	-0.453**	0.682**
b1300 Energy level	78	52	-0.261**	0.023	0.116	-0.141	0.403**	-0.155	-0.168	-0.213**	0.178*
b1301 Motivation	107	71.3	-0.534**	-0.358**	0.430**	-0.533**	-0.567**	-0.392**	-0.579**	-0.338**	0.533**
b1308 Energy and drive functions, other specified (fatigue)	61	40.7	0.040	-0.265**	0.059	-0.178*	0.321**	-0.326**	-0.189*	-0.309**	0.293**
b134 Sleep functions	129	86	-0.405**	-0.285**	0.504**	-0.445**	0.572**	-0.583**	-0.535**	-0.323**	0.501**
b140 Attention functions	95	63.4	-0.592**	-0.416**	0.480**	0.473**	0.604**	-0.579**	-0.461**	-0.639**	0.606**
b144 Memory functions	102	68	-0.441**	0.555**	0.522**	-0.658**	0.591**	-0.665**	-0.608**	-0.636**	0.735**
b152 Emotional functions	29	19.3	-0.199*	0.578**	0.376**	-0.554**	0.493**	-0.355**	-0.425**	-0.604**	0.569**
b156 Perceptual functions	60	40.1	-0.129	0.476**	-0.060	-0.204*	-0.135	0.007	-0.107	-0.185*	-0.363**
b164 Higher-level cognitive functions	46	30.6	-0.326**	0.648**	0.495**	-0.725**	0.580**	-0.523**	-0.594**	-0.653**	0.648**
b210 Seeing functions	106	70.7	-0.051	0.246**	0.082	-0.207*	0.108	-0.068	-0.025	-0.456**	0.272**
b235 Vestibular functions	55	36.6	-0.365**	0.459**	0.611**	-0.511**	0.371**	-0.552**	-0.561**	-0.310**	0.439**
b260 Proprioceptive function	28	18.8	-0.565**	0.243**	0.606**	-0.607**	0.415**	-0.619**	-0.568**	-0.504**	0.453**
b265 Touch function	70	46.7	-0.648**	0.628**	0.716**	-0.793**	0.587**	-0.772**	-0.771**	-0.574**	0.787**
b270 Sensory functions related to temperature and other stimuli	80	53.3	-0.561**	0.717**	0.669**	-0.802**	0.603**	-0.739**	-0.746**	-0.638**	0.783**
b280 Sensation of pain	136	90.6	-0.703**	0.577**	0.500**	-0.663**	0.565**	-0.709**	-0.575**	-0.540**	0.722**
b310 Voice functions	17	11.3	0.004	0.550**	0.143*	-0.364**	0.340**	-0.099	-0.230**	-0.482**	0.503**
b320 Articulation functions	20	13.3	0.031	0.590**	0.144*	-0.357**	0.365**	-0.146	-0.231**	-0.488**	0.527**
b330 Fluency and rhythm of speech functions	28	18.6	-0.104	0.604**	0.310**	-0.523**	0.406**	-0.301**	-0.392**	-0.539**	0.574**
b445 Respiratory muscle functions	127	84.7	-0.616**	0.655**	0.728**	-0.735**	0.601**	-0.728**	-0.791**	-0.604**	0.717**
b455 Exercise tolerance functions	132	88	-0.822**	0.542**	0.728**	-0.759**	0.773**	-0.869**	-0.831**	-0.457**	0.686**
b5104 Salivation	81	54	-0.644**	0.533**	0.449**	-0.644**	0.760**	-0.553**	-0.547**	-0.610**	0.564**
b5105 Swallowing	10	6.7	-0.312**	0.218**	0.424**	-0.435**	0.314**	-0.426**	-0.415**	-0.192*	0.219**
b525 Defecation functions	77	51.3	-0.519**	0.431**	0.696**	-0.774**	0.505**	-0.761**	-0.720**	-0.346**	0.565**
b5500 Body temperature	34	22.6	-0.153*	-0.154	0.235**	-0.235**	0.094	-0.228**	-0.234**	-0.130	0.192*
b5508 Thermoregulatory functions, other specified (sensitivity to heat)	30	20	-0.315**	-0.093	0.325**	-0.353**	0.139	-0.339**	-0.284**	-0.350**	0.297**
b5508 Thermoregulatory functions, other specified (sensitivity to cold)	10	6.7	-0.198*	-0.190*	0.263**	-0.154	0.059	-0.303**	-0.256**	0.310**	0.139

TABLE 2
Continued

Body functions	No	%	SF-36 PCS	SF-36 MCS	EDSS	FIM	FSS	6MWT	BBS	MMSE	BDI
b620	95	63.3	-0.693**	0.506**	0.908**	-0.834**	0.607**	-0.825**	-0.887**	-0.511**	0.599**
b640	89	58.6	-0.571**	0.589**	0.750**	-0.799**	0.724**	-0.802**	-0.857**	-0.461**	0.685**
b710	47	31.3	-0.194*	-0.151	0.311**	-0.277**	0.174*	-0.257**	-0.302**	-0.229**	0.061
b730	121	80.6	-0.742**	0.519**	0.919**	-0.788**	0.576**	-0.825**	-0.863**	-0.485**	0.589**
b735	83	54.7	-0.582**	0.598**	0.667**	-0.576**	0.710**	0.543**	-0.671**	-0.577**	0.653**
b740	129	86	-0.763**	0.239**	0.878**	-0.661**	0.602**	-0.789**	-0.792**	-0.346**	0.444**
b750	122	81.3	-0.500**	0.423**	0.673**	-0.719**	0.468**	-0.691**	-0.752**	-0.467**	0.542**
b760	78	52	-0.334**	0.623**	0.501**	-0.718**	0.499**	-0.513**	-0.566**	-0.531**	0.623**
b7650	40	26.7	-0.315**	0.539**	0.355**	-0.526**	0.401**	-0.424**	-0.417**	-0.648**	0.665**
b7651	64	42.7	-0.493**	0.665**	0.557**	-0.590**	0.450**	-0.626**	-0.611**	-0.366**	0.738**
b770	99	66	-0.732**	0.671**	0.888**	-0.922**	0.726**	-0.899**	-0.911**	-0.643**	0.741**
b780	72	48	-0.656**	0.403**	0.636**	-0.683**	0.552**	-0.737**	-0.672**	-0.582**	0.646**
s110	147	98	-0.491**	-0.418**	0.501**	-0.640**	0.477**	-0.627**	-0.615**	-0.435**	0.496**
s120	133	88.7	-0.163*	-0.269**	0.332**	-0.398**	0.187*	-0.328**	-0.280**	-0.416**	0.368**
s610	92	61.3	-0.170*	0.082	0.250**	-0.223**	0.246**	-0.247**	-0.258**	-0.043	0.003
s730	53	35.3	-0.363**	-0.219**	0.470**	-0.484**	0.376**	-0.445**	-0.443**	-0.288**	0.249**
s750	93	62	-0.416**	-0.227**	0.478**	-0.480**	0.406**	-0.496**	-0.460**	-0.269**	0.294**
s760	66	44	-0.305**	-0.207**	0.454**	-0.445**	0.360**	-0.467**	-0.443**	-0.285**	0.335**
s810	28	18.6	-0.387**	-0.165**	0.510**	-0.392**	0.420**	-0.464**	-0.473**	-0.206*	0.206*

ICF: International Classification of Functioning; SF-36: Short form-36; PCS: Physical component summary; MCS: Mental component summary; EDSS: Expanded disability status scale; FIM: Functional independence measure; FSS: Fatigue severity scale; 6MWT: 6-Min walking test; BBS: Berg balance scale; MMSE: Mini-mental state examination; BDI: Beck depression inventory.

TABLE 3
Frequency of impairments in the ICF categories of the component of activities and participation and correlation between the ICF categories and clinical assessments

Activities and participation	No	%	SF-36 PCS	SF-36 MCS	EDSS	FIM	FSS	6MWT	BBS	MMSE	BDI
d110 Watching	12	8	-0.109	-0.042	0.073	-0.154	0.104	-0.009	-0.096	-0.141	0.029
d155 Acquiring skills	37	24.7	-0.285**	-0.606**	0.495**	-0.642**	0.553**	-0.480**	-0.559**	-0.535**	0.679**
d160 Focusing attention	112	74.7	-0.503**	-0.473**	0.476**	-0.569**	0.519**	-0.629**	-0.495**	-0.412**	0.669**
d163 Thinking	58	38.6	-0.411**	-0.570**	0.610**	-0.662**	0.477**	-0.679**	-0.621**	-0.455**	0.663**
d166 Reading	6	4	-0.211**	-0.226**	0.336**	-0.345**	0.239**	-0.326**	-0.334**	-0.122	0.215**
d170 Writing	8	5.3	-0.034	-0.302**	-0.182*	-0.366**	-0.344**	-0.233**	-0.256**	0.061	0.326**
d175 Solving problems	79	52.7	-0.576**	-0.383**	0.450**	-0.553**	0.585**	-0.567**	-0.493**	-0.582**	0.603**
d177 Making decisions	69	46	-0.585**	-0.461**	0.627**	-0.714**	0.664**	-0.666**	-0.667**	-0.721**	0.700**
d210 Undertaking a single task	51	34	-0.534**	-0.526**	0.670**	-0.797**	0.569**	-0.649**	-0.683**	-0.749**	0.656**
d220 Undertaking multiple tasks	91	60.7	-0.677**	-0.409**	0.710**	-0.747**	0.636**	-0.760**	-0.783**	-0.617**	0.690**
d230 Carrying out daily routine	57	38	-0.533**	-0.623**	0.631**	-0.714**	0.536**	-0.677**	-0.706**	-0.474**	0.612**
d240 Handling stress and other psychological demands	81	54	-0.596**	-0.553**	0.636**	-0.747**	0.535**	-0.674**	-0.682**	-0.513**	0.693**
d330 Speaking	12	8	0.004	-0.550**	0.143	-0.364**	0.340**	-0.103	-0.230**	-0.482**	0.503**
d350 Conversation	30	20	-0.044	-0.649**	0.191*	-0.430**	0.447**	-0.235**	-0.318**	-0.492**	0.610**
d360 Using communication devices and techniques	0	0	-	-	-	-	-	-	-	-	-
d410 Changing basic body position	46	37.3	-0.770**	-0.352**	0.765**	-0.706**	0.539**	-0.771**	-0.777**	-0.345**	0.444**
d415 Maintaining a body position	72	48	-0.765**	-0.605**	0.873**	-0.906**	0.689**	-0.872**	-0.910**	-0.541**	0.664**
d420 Transferring oneself	63	42	-0.660**	-0.658**	0.813**	-0.911**	0.746**	-0.842**	-0.897**	-0.534**	0.679**
d430 Lifting and carrying objects	92	61.3	-0.709**	-0.561**	0.849**	-0.829**	0.635**	-0.786**	-0.859**	-0.450**	0.615**
d440 Fine hand use	31	20.7	-0.254**	-0.620**	0.454**	-0.648**	0.548**	-0.492**	-0.514**	-0.609**	0.621**
d445 Hand and arm use	50	33.3	-0.358**	-0.564**	0.616**	-0.729**	0.586**	-0.604**	-0.637**	-0.642**	0.620**
d450 Walking	99	66	-0.780**	-0.578**	0.827**	-0.892**	0.660**	-0.879**	-0.850**	-0.494**	0.630**
d455 Moving around	102	68	-0.769**	-0.539**	0.839**	-0.844**	0.621**	-0.806**	-0.839**	-0.499**	0.568**
d460 Moving around in different locations	81	54	-0.764**	-0.602**	0.870**	-0.918**	0.697**	-0.885**	-0.910**	-0.568**	0.667**
d465 Moving around using equipment	69	46	-0.655**	-0.325**	0.764**	-0.704**	0.528**	-0.733**	-0.766**	-0.199*	0.336**
d470 Using transportation	72	48	-0.728**	-0.636**	0.830**	-0.910**	0.713**	-0.845**	-0.895**	-0.598**	0.684**
d475 Driving	89	59.3	-0.291**	-0.518**	0.713**	-0.684**	0.448**	-0.718**	-0.662**	-0.494**	0.525**
d510 Washing oneself	47	28.7	-0.720**	-0.308**	0.789**	-0.708**	0.515**	-0.750**	-0.763**	-0.309**	0.389**

TABLE 3
Continued

Activities and participation	No	%	SF-36 PCS	SF-36 MCS	EDSS	FIM	FSS	6MWT	BBS	MMSE	BDI
d520 Caring for body parts	50	33.3	-0.699**	-0.584**	0.841**	-0.878**	0.691**	-0.830**	-0.864**	-0.554**	0.620**
d530 Toileting	29	19.3	-0.596**	-0.259**	0.685**	-0.682**	0.543**	-0.630**	-0.694**	-0.392**	0.298**
d540 Dressing	42	28	-0.640**	-0.369**	0.764**	-0.705**	0.570**	-0.686**	-0.773**	-0.250**	0.362**
d550 Eating	3	2	-0.127	-0.169*	0.237**	-0.235**	0.343**	-0.218**	-0.254**	-0.037	0.098
d560 Drinking	3	2	-0.121	-0.164*	0.235**	-0.248**	0.243**	-0.228**	-0.234**	-0.039	0.108
d570 Looking after one's health	16	10.6	-0.504**	-0.128**	0.578**	-0.586**	0.449**	-0.570**	-.564**	-0.380**	0.374**
d620 Acquisition of goods and services	53	35.3	-0.653**	-0.479**	0.702**	-0.762**	0.651**	-0.696**	-0.730**	-0.675**	0.575**
d630 Preparing meals	42	28	-0.564**	-0.585**	0.725**	-0.836**	0.726**	-0.667**	-0.776**	-0.683**	0.578**
d640 Doing housework	82	54.7	-0.730**	-0.623**	0.892**	-0.958**	0.767**	-0.877**	-0.938**	-0.622**	0.692**
d650 Caring for household objects	73	48.7	-0.724**	-0.679**	0.870**	-0.944**	0.755**	-0.853**	-0.924**	-0.623**	0.703**
d660 Assisting others	89	59.3	-0.708**	-0.695**	0.892**	-0.891**	0.727**	-0.861**	-0.907**	-0.571**	0.731**
d710 Basic interpersonal interactions	60	40	-0.378**	-0.482**	0.570**	-0.640**	0.508**	-0.568**	-0.553**	-0.639**	0.579**
d720 Complex interpersonal interactions	58	38.7	-0.335**	-0.496**	0.547**	-0.619**	0.506**	-0.535**	-0.533**	-0.611**	0.585**
d750 Informal social relationships	53	35.3	-0.353**	-0.427**	0.583**	-0.614**	0.428**	-0.542**	-0.525**	-0.599**	0.499**
d760 Family relationships	37	24.6	-0.356**	-0.575**	0.527**	-0.684**	0.588**	-0.514**	-0.575**	-0.634**	0.644**
d770 Intimate relationships	71	47.3	-0.363**	-0.694**	0.603**	-0.702**	0.560**	-0.640**	-0.700**	-0.469**	0.764**
d825 Vocational training	99	66	-0.303**	-0.167*	0.335**	-0.433**	0.244**	-0.372**	-0.412**	-0.508**	0.288**
d830 Higher education	121	80.7	-0.274**	-0.113	0.179*	-0.244**	0.189*	-0.299**	-0.252**	-0.484**	0.257**
d845 Acquiring, keeping and terminating a job	129	86	-0.348**	-0.221**	0.504**	-0.500**	0.201*	-.478**	-0.507**	-0.424**	0.290**
d850 Remunerative employment	127	84.7	-0.362**	-0.256**	0.462**	-0.482**	0.194**	-0.471**	-0.466**	-0.422**	0.296**
d860 Basic economic transactions	77	51.3	-0.161*	-0.413**	0.251**	-0.457**	0.256**	-0.315**	-0.316**	-0.507**	0.390**
d870 Economic self-sufficiency	110	73.3	-0.078	-0.078	0.159	-0.221**	0.020	-0.155	-0.140	-0.392**	0.059
d910 Community life	70	46.6	-0.418**	-0.656**	0.559**	-0.718**	0.599**	-0.642**	-0.652**	-0.496**	0.739**
d920 Recreation and leisure	49	32.7	-0.461**	-0.588**	0.655**	-0.706**	0.549**	-0.651**	-0.676**	-0.348**	0.625**
d930 Religion and spirituality	30	20	-0.205**	-0.550**	0.345**	-0.448**	0.358**	-0.416**	-0.416**	-0.242**	0.566**

ICF: International Classification of Functioning; SF-36: Short form-36; PCS: Physical component summary; MCS: Mental component summary; EDSS: Expanded disability status scale; FIM: Functional independence measure; FSS: Fatigue severity scale; 6MWT: 6-Min walking test; BBS: Berg balance scale; MMSE: Mini-mental state examination; BDI: Beck depression inventory.

TABLE 4
Frequency of impairments in the ICF categories of the component of environmental factors and correlation between the ICF categories and clinical assessments

Environmental factors	Barrier		Facilitator		SF-36 PCS	SF-36 MCS	EDSS	FIM	FSS	6MWT	BBS	MMSE	BDI
	No	%	No	%									
e1101	1	0.6	148	98.6	0.044	0.117	0.091	0.067	0.012	0.084	0.010	-0.026	-0.151
e1108	0	0	21	14	0.207*	0.190*	-0.047	0.030	-0.272**	0.034	0.050	0.112	-0.112
e115	0	0	90	60	-0.433**	-0.496**	0.518**	-0.637**	0.547**	-0.592**	-0.565**	-0.442**	0.490**
e120	0	0	80	53.3	-0.483**	-0.480**	0.711**	-0.752**	0.491**	-0.742**	-0.736**	-0.382**	0.513**
e125	0	0	76	50.6	-0.191*	-0.506**	0.431**	-0.625**	0.262**	-0.520**	-0.443**	-0.368**	0.468**
e135	0	0	10	6.6	0.367**	0.311**	-0.287**	0.252**	-0.038	-0.278**	0.241**	0.240**	-0.290**
e150	82	54.6	3	2	-0.537**	-0.687**	0.783**	-0.884**	0.634**	-0.796**	-0.840**	-0.670**	0.803**
e155	87	58	0	0	-0.622**	-0.721**	0.852**	-0.924**	0.758**	-0.823**	-0.922**	-0.681**	0.756**
e165	13	8.6	81	54	0.307**	-0.151	-0.104	-0.026	-0.088	0.090	0.131	0.015	0.076
e2250	120	80	5	3.3	-0.121	-0.285**	0.382**	-0.463**	-0.258**	-0.385**	-0.415**	-0.352**	0.269**
e2251	113	75.3	0	0	-0.318**	-0.356**	0.462**	-0.549**	0.413**	-0.520**	-0.516**	-0.544**	0.422**
e2253	131	87.3	0	0	-0.579**	-0.379**	0.664**	-0.700**	0.467**	-0.703**	-0.670**	-0.493**	0.531**
e310	4	2.6	125	83.3	-0.661**	-0.581**	0.650**	-0.674**	0.619**	-0.684**	-0.668**	-0.650**	0.667**
e315	9	6	52	34.6	-0.428**	-0.049	0.304**	-0.334**	0.293**	-0.353**	-0.334**	-0.155	0.059
e320	3	2	41	27.3	-0.191*	-0.017	0.209*	-0.242**	0.024	-0.190*	-0.236**	-0.129	-0.018
e325	6	4	28	18.6	-0.161*	0.116	-0.004	-0.037	0.136	-0.035	-0.094	0.025	-0.144
e330	11	7.3	35	23.3	-0.090	-0.041	0.072	-0.116	0.007	-0.118	-0.158	0.029	-0.009
e340	0	0	6	4	-0.293**	-0.053	0.232**	-0.172*	-0.005	-0.221**	-0.148	-0.303**	0.240**
e355	5	3.3	134	89.3	-0.599**	-0.202*	0.471**	-0.541**	0.438**	-0.484**	-0.552**	-0.406**	0.328**

TABLE 4
Continued

Environmental factors	Barrier		Facilitator		SF-36 PCS	SF-36 MCS	EDSS	FIM	FSS	6MWT	BBS	MMSE	BDI
	No	%	No	%									
e360	0	0	7	4.6	-0.275**	0.192*	-0.062	0.049	0.237**	-0.032	-0.018	-0.066	-0.010
e410	6	4	119	79.3	-0.606**	-0.521**	0.625**	-0.720**	0.585**	-0.643**	-0.667**	-0.607**	0.618**
e415	8	5.3	87	58	-0.438**	0.012	0.254**	-0.316**	0.302**	-0.313**	-0.302**	-0.152	0.015
e420	9	6	38	25.3	-0.311**	0.148	0.074	-0.134	0.166*	-0.131	-0.157	-0.139	-0.059
e425	7	4.6	26	17.3	-0.163*	0.114	-0.003	-0.035	0.141	-0.035	-0.095	0.026	-0.146
e430	8	5.3	39	26	-0.178*	0.065	-0.025	0.003	0.115	-0.061	-0.084	0.036	-0.019
e440	0	0	6	4	0.004	0.007	0.050	-0.087	-0.071	-0.004	-0.104	0.107	-0.148
e450	3	2	68	45.3	-0.476**	-0.038	0.309**	-0.280**	0.245**	-0.328**	-0.353**	-0.057	0.152
e460	48	32	48	32	-0.573**	-0.575**	0.784**	-0.784**	0.556**	-0.783**	-0.816**	-0.492**	0.709**
e515	77	51.3	0	0	-0.671**	-0.694**	0.858**	-0.950**	0.761**	-0.836**	-0.926**	-0.734**	
e525	72	48	6	4	-0.577**	-0.667**	0.730**	-0.885**	0.634**	-0.761**	-0.807**	-0.718**	
e540	89	59.3	11	7.3	-0.672**	-0.680**	0.813**	-0.907**	0.762**	-0.808**	-0.892**	-0.773**	
e550	57	38	13	8.6	-0.527**	-0.685**	0.706**	-0.884**	0.603**	-0.716**	-0.775**	-0.733**	
e555	7	4.6	43	28.6	-0.420**	-0.494**	0.513**	-0.564**	0.393**	-0.556**	-0.494**	-0.447**	
e570	2	1.3	114	76	-0.434**	-0.632**	0.650**	-0.683**	0.578**	-0.614**	-0.681**	-0.453**	
e575	10	6.6	93	62	-0.267**	-0.591**	0.468**	-0.596**	0.448**	-0.532**	-0.509**	-0.467**	
e580	8	5.3	137	91.3	-0.317**	-0.367**	0.537**	-0.571**	0.361**	-0.464**	-0.489**	-0.391**	
e585	18	12	0	0	-0.048	-0.624**	0.141	-0.415**	0.309**	-0.228**	-0.215**	-0.474**	
e590	63	42	0	0	-0.108	-0.733**	0.252**	-0.472**	0.338**	-0.372**	-0.338**	-0.403**	

ICF: International Classification of Functioning; SF-36: Short form-36; PCS: Physical component summary; MCS: Mental component summary; EDSS: Expanded disability status scale; FIM: Functional independence measure; FSS: Fatigue severity scale; 6MWT: 6-Min walking test; BBS: Berg balance scale; MMSE: Mini-mental state examination; BDI: Beck depression inventory.

DISCUSSION

The results of the present study demonstrated the most relevant ‘body functions’, ‘body structures’, ‘activities and participation’, as well as ‘environmental factors’ in participants with MS based on ICF. The most of body functions, structures, activities and participation and environmental factors categories showed a significant correlation with the SF-36, EDSS, FIM, FSS, 6MWT, and BBS.

In the body functions component, b280 sensation of pain, b134 sleep functions, b740 muscle endurance functions, b730 muscle power functions, b445 respiratory muscle functions, b210 seeing functions, b620 urination functions and b455 exercise tolerance functions were reported as a problem by most participants.

The most identified symptom in this study was b280 sensation of pain. Pain is a key and common symptom that significantly impairs quality of life in an individual with MS. It is estimated that pain is experienced by 29 to 86% of MS patients.^[21] In addition, it has been reported that MS patients experience higher pain intensity, have a higher need for analgesics and pain makes a greater impact on daily life.^[22] Therefore, clinicians should be more cautious in effective pain management for patients with MS.

In Chapter b7, neuromusculoskeletal and movement-related functions were reported as a problem in more than 70% of the individuals. Holper et al.^[7] revealed that more than 50% of patients identified a problem in gait and movement-related functions. These results provide evidence to support the present study results. Motor dysfunctions are the main problem associated with muscle weakness, walking impairment, balance problems, and spasticity in MS patients. An individualized exercise program should be considered a part of a rehabilitation program to achieve functional improvements.

Exercise is recommended for the MS patients to improve well-being, physical conditioning, decrease the severity of MS symptoms, improve the quality of life, and manage comorbidities.^[23] However, this group of patients may have lower exercise tolerance related to disability. Exercise tolerance is impaired by some barriers related to the disease such as pain, fatigue, mobility problems, motivation, and heat sensitivity.^[24] In the present study, more than 80% of the individuals reported a problem in b455 exercise tolerance functions. Individualized exercise programs for the MS patients should be designed according to

the severity of the disability, barriers, and functional capacity.

Khan and Pallant^[8] reported that 93% patients experienced a problem in urination functions, whereas this rate was more than 50% of the patients in the current study. One of the most detrimental issues to MS patients’ quality of life is lower urinary tract dysfunction.^[25] The management of lower urinary tract dysfunction requires a multidisciplinary approach. Therefore, the treatment options should be managed with the consensus of different healthcare professionals.

The categories related with the ICF component of “body structures” were identified by the MS patients as problems in the structure of the brain (s110), spinal cord and related structures (s120), and the urinary system (s610). The categories of body structures reflect the underlying health conditions and long-term effects of impairments. Therefore, this finding is not surprising, as MS damages the cells of the brain, cerebellum, and spinal cord affecting motor function and movement of the body. These findings are also consistent with previous studies.^[7,26]

In the activities and participation component, Chapter d4 mobility, d8 major life areas and d1 learning and applying knowledge were reported as a main problem by most patients. Employment is a major part of life. Loss of employment, premature retirement, and moving to a lower position are frequent problems for the MS patients.^[27] In the present study, d850 remunerative employment, d870 economic self-sufficiency, d845 acquiring, keeping and terminating a job were the most frequently reported problems. Related to these findings, limitation in employment status was seen as a major restricted area by this population. These results are consistent with the findings of previous studies.^[7,8,28] Healthcare providers and rehabilitation counselors should support employment issues and social life taking the disability degree, comorbidities, cognitive status, and work environment into consideration.

In the environmental component, the most frequently reported facilitators were e310 immediate family, e355 healthcare professionals, e410 individual attitudes of immediate family members, e570 social security services, systems, and policies, e580 health services, systems, and policies, and e1101 drugs. Immediate family members are an important source of support in caring for patients with MS, meeting their needs for personal hygiene, nutrition, medication, and transport. In addition, family relationships and responsibilities are strong in collectivist cultures such

as the Turkish society.^[29,30] To establish effective and comprehensive care for MS individuals, the healthcare team should involve their family members in clinical decision-making.

Climate (e2250, 2251 and e2253), design, construction and building products and technology of buildings (e150, e155), architecture and construction services, systems and policies (e515) and transportation services, systems and policies (e540) were reported as barriers by the most of the study participants. Patients with MS are particularly vulnerable to climate changes and perhaps seasonality. High ecological temperatures cause a higher core body temperature and aggravate MS-related fatigue, signs and symptoms, mobility limitations, heat-related morbidity, and the risk of falls in this population.^[31,32] This has an impact on social participation, activity limitation, physical well-being, and quality of life. In a similar study by Khan et al.,^[33] climate was seen to be a major problem according to the patient-reported disabilities of Guillain-Barré syndrome survivors and individuals with MS. In individuals with disabilities, transportation is also a major environmental barrier to being able to access equipment. The current study results revealed that more than half the sample (59.3%) reported transportation as a barrier. Patients with disability living in a rural area may encounter barriers in public transportation such as absence of accessible parking spots, ramps to buildings, and the required space for a wheelchair.^[34] Identification and modification of the environmental factors can improve quality of life and participation in social life for this population. Therefore, the rehabilitation planners, government agencies, policymakers, social and healthcare services, and family members should collaborate to support meeting the needs of patients with disability.

In the present study, the body functions, body structures, activities and participation and environmental factors categories of the ICF Comprehensive Core Set for MS were found to be significantly correlated with disease-specific and generic measures including EDSS, FIM, SF-36, 6MWT, and BDI. These results indicate that ICF categories can contribute to disease-specific and generic measures by assessing disability, functioning, and health in the MS patients.

Nonetheless, this study has some limitations. First, it was conducted in two tertiary care centers involving a small number of participants. Therefore, the results may not reflect the general Turkish patients with MS. Second, the present study included

patients with MS who had EDSS scores between 2.9 and 6.1 and did not have severe disability. Patients with a high EDSS score experience many major problems; therefore, the predominance of patients with a low disability score may have influenced the results.

In conclusion, our study results present the commonly reported problems of Turkish patients with MS according to the ICF Core Set. Based on these results, the ICF Core Set may help to determine major facilitators or barriers to functioning and disability and a targeted rehabilitation approach in patients with MS. The ICF Core Set may also help to guide the management of treatment and goals in multidisciplinary assessments of MS.

Ethics Committee Approval: The study protocol was approved by the Ankara Physical Medicine and Rehabilitation Hospital Ethics Committee (date: 20.04.2011, no: B.10.4.İSM.4.06.23.34.904.02). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Patient Consent for Publication: A written informed consent was obtained from each patient.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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