The Open Journal of Occupational Therapy

Volume 5
Issue 4 *Fall 2017*

Article 4

October 2017

Development of the Daily Living Questionnaire (DLQ): A Factor Analysis Study

Sara Rosenblum
university of Haifa - Israel, rosens@research.haifa.ac.il

Naomi Josman
University of Haifa - Israel, naomij@research.haifa.ac.il

Joan Toglia
Mercy College - USA, jtoglia@mercy.edu

Recommended Citation

Rosenblum, S., Josman, N., & Toglia, J. (2017). Development of the Daily Living Questionnaire (DLQ): A Factor Analysis Study. *The Open Journal of Occupational Therapy, 5*(4). https://doi.org/10.15453/2168-6408.1326

Development of the Daily Living Questionnaire (DLQ): A Factor Analysis Study

Abstract

Background: Performance of daily activities and participation in life events involves higher-level cognitive abilities. The purpose of this study was to develop a self-report scale for detecting everyday difficulties in activities/participation tied with higher-level cognitive deficiency and to examine its reliability and validity.

Method: The Daily Living Questionnaire's (DLQ) content and face validity were established. Internal consistency following an exploratory factor analysis, as well as construct validity, were initiated with a convenience sample of 194 healthy adults, aged 18 to 85 years, and 34 adults diagnosed with Multiple Sclerosis (MS).

Results: The four factors received in Part A, activities and participation, explained 56.77% of the DLQ's total variance, while the cumulative percentage of variance comprised of the three factors of Part B, cognitive symptoms or impairments, was 57.47%. High levels of internal consistency were demonstrated for both parts (.94 and .97, respectively). Construct validity was confirmed. While no significant gender differences were found, significant differences were found both between age groups and between participants with MS and controls.

Implications: Initial results suggest that the DLQ is a valid tool for detecting difficulties in daily activities/participation related to cognitive impairments among adults.

Keywords

activities, participation, cognitive impairments, assessment, executive functions

Credentials Display

Sara Rosenblum, PhD, OT; Naomi Josman, PhD, OT; Joan Toglia, PhD, OTR/L, FAOTA

DOI: 10.15453/2168-6408.1326

Almost all daily activities require some level of executive functioning, such as planning, organization of thought or space, and problem solving. Executive functions (EF) are also necessary in order to consider and implement strategies for cognitive difficulties, such as using a timer or a daily planner to compensate for cognitive challenges (Toglia, Rodger, & Polatajko, 2012). EF are highly vulnerable to brain injury and disease. Symptoms of executive dysfunction are most apparent in multitasking situations or in novel, unpredictable, and unstructured situations. When EF are compromised, even basic cognitive activities become difficult to perform, significantly reducing a person's ability to function successfully and navigate daily routines (Kizony, Demayo-Dayan, Sinoff, & Josman, 2011). Thus, cognitive abilities are one of the core elements needed for active participation in daily life (Eriksson, Tham, & Kottorp, 2013). Consequently, there is a need for a measure of activities and participation that is sensitive to higher-level cognitive deficits and that adequately reflects the complexities of daily life tasks for persons who may be working, going to school, or running a household.

This need is also highlighted in the World Health Organization (WHO) *International Classification of Functioning, Disability and Health* (ICF) (WHO, 2001). The ICF provides a multidimensional framework for outcome assessment and suggests that outcomes should include measures of activity limitations and participation restrictions, as well as measures of impairment at the level of body functions (Dixon, Johnston, McQueen, & Court-Brown, 2008). Although cognitive abilities play a significant role in each of the factors identified in the ICF framework, the direct evaluation of cognitive abilities during activities is underrepresented in evaluations that assess functioning (De Vriendt et al., 2012).

Many cognitive tests assess performance in specific mental domains, such as attention, memory, information processing, and executive functioning. Such assessments provide critical information regarding a client's abilities and impairments in the area being assessed. However, the evidence shows that evaluation of cognitive abilities alone does not necessarily provide accurate information regarding a client's ability to perform and accordingly participate in daily tasks, such as managing a household, maintaining a job, enjoying leisure activities, or socializing with family members or friends (Burgess et al., 2006). This is important since daily activities are performed in the context of the physical and social environment and can facilitate or hinder performance (Cicerone et al., 2011). Unfortunately, many cognitive assessments do not incorporate these contextual factors. On the one hand, neuropsychological test batteries tend to be long, cumbersome, and require expert administration and interpretation (Barkley & Murphy, 2011). On the other hand, several standardized, performance-based tests (e.g., the Executive Function Performance Test-EFPT; Baum et al., 2008) evaluate the impact of EF on performance. Performance-based methods of assessment involve observation of a limited number of simulated activities at one point in time; however, they provide important information on how the person goes about doing a

task. Performance-based methods have been criticized because they usually occur outside the typical environmental context. In addition, performance on a particular day can be affected by fatigue, anxiety, motivation, or mood (Schmitter-Edgecombe, Parsey, & Cook, 2011).

Self-report measures capture the person's broad perspective of his or her functioning across activities or situations and in different everyday contexts (Ferrucci et al., 2004). They are easy and efficient to administer and can also capture facilitators and barriers to participation in daily activities as well as the client's performance satisfaction (Egan & Dubouloz, 2013). One disadvantage is that self-reports can overestimate or underestimate actual functioning due to biases or limited self-awareness. Studies have suggested that both self-report and performance-based methods provide different estimates of an individual's ability to perform everyday activities and that both are needed to provide a comprehensive picture of a person's level of functioning (Goverover et al., 2005; Schmitter-Edgecombe et al., 2011).

A combination of functional assessment methods are recommended to identify early changes in cognitive function, track functional changes, and measure the effectiveness of treatment (e.g., Ferrucci et al., 2004). Since self-report measures gather data on broad aspects of functioning quickly, they may be particularly helpful in guiding the therapist in selecting the type of activities that may need to be further assessed or observed.

Several self-report functional questionnaires have been previously described. However, such questionnaires focus either on everyday function or on cognitive symptoms and do not integrate both dimensions (e.g., the Functional Activities Questionnaire [FAQ]; Pfeffer, Kurosaki, Harrah Jr., Chance, & Filos, 1982 or; the Dysexecutive Questionnaire; Bennett, Ong & Ponsford, 2005). The Daily Living Questionnaire (DLQ), developed for use in clinical settings, assesses everyday difficulties that persons with higher-level cognitive disabilities may experience, such as organizing closets, shelves, or drawers; planning and preparing meals; or finding their way in unfamiliar environments.

The DLQ was designed based on a broad conceptualization of function as described by the ICF (WHO, 2001) and following the type of difficulties typically observed and reported by individuals with neurological difficulties. The DLQ is divided into two parts that reflect the key dimensions of the ICF: activities and participation and impairments. Part 1 of the DLQ includes instrumental activities of daily living (IADL), such as financial management and household activities, as well as participation in social, community, and work activities. Part 2 focuses on the key dimensions of EF described in the literature as related to or predicted by daily function (Vaughan & Giovanello, 2010), defined as body functions in the ICF terminology. EF includes the areas of working memory and attention, flexibility (switching), initiation and inhibition of irrelevant information, planning, organizing, problem solving, and self-monitoring. In addition, items that tap processing speed were included, as reduced processing speed and working memory deficits have been linked among patients with cognitive decline, such as in

Multiple Sclerosis (MS) patients (Reicker, Tombaugh, Walker, & Freedman, 2007). Furthermore, prospective memory or future intentions items were included, as they have been linked to EF (Chiaravalloti & DeLuca, 2008). A unique aspect of the DLQ is that unlike other self-report scales, it specifically asks the person to rate the degree of mental or cognitive difficulty they are experiencing in IADL and EF skills. The goals of the questionnaire are:

1. To identify and rate areas of functioning that have been changed as a result of cognitive decline or changed from the person's perspective.
2. To assist therapists in identifying cognitive symptoms that may need to be better managed in daily activities as well as to determine functional intervention goals.

The aim of this study was to present the DLQ's development and expert validity establishment and to report the results obtained by exploratory factor analysis following internal consistency reliability by factors. In addition, construct validity among healthy adults in two gender and age groups and healthy individuals and those with MS are reported. The rationale for group selection for the construct validity establishment is described.

While no EF or cognitive ability differences were expected across gender (Jurado & Rosselli, 2007), differences were expected across age groups. Previous literature has described deterioration in cognitive abilities and EF control with age among people aged 20 to 80 years. This deterioration was reflected in actual performance, such as the dual-task physical test (Coppin et al., 2006), handwriting (Rosenblum & Werner, 2006), and driving (Anstey & Wood, 2011). Though the question of when this cognitive decline begins is still under discussion, there is a consensus about the need for intervention in cases of cognitive decline over age 60 (Salthouse, 2009). Cognitive decline may also be linked with various neurocognitive disorders, such as MS (Chiaravalloti & DeLuca, 2008). Cognitive deficits may occur at a very early stage among individuals with MS (Nourbakhsh et al., 2016) and deficits in complex attention, efficiency of information processing, executive functioning, processing speed, and long-term memory have been reported (Chiaravalloti & DeLuca, 2008). Such deficits may affect many daily life activities, such as running a household, participating fully in society, and maintaining employment, and thus may affect the overall quality of life for MS patients (Chiaravalloti & DeLuca, 2008).

Method

Phase 1: Construction of the Questionnaire and Content Validity Establishment

Items from the DLQ were originally selected based on interviews and informal group discussions with clients who experienced higher-level cognitive deficits resulting from a mild stroke, brain tumor, traumatic brain injury, MS, or lupus. Clients were asked to describe some of the cognitive difficulties or concerns they experienced in their daily lives. The responses were recorded and the common areas identified across the participants were integrated into the DLQ.

In 2006, an interdisciplinary panel of 10 clinicians (neuropsychologists [n = 2], physicians [n = 2], and occupational therapists [n = 6]) with special expertise in Lupus (n = 3) and MS (n = 7) formally examined the DLQ and rated the

relevance, clarity, and usefulness of each of the 71 DLQ items for people with Systemic Lupus Erythematosus (SLE) or MS using a written questionnaire. The DLQ items were grouped into broad categories of activity limitations, participation restrictions, and cognitive impairments. The rating scales consisted of a 4-point ordinal rating scale where options for rating were: 1 = *not relevant*, 2 = *slightly relevant*, 3 = *relevant*, 4 = *extremely relevant*. A 4-point response scale is supported in the literature (Chang, 1994; Lozano, García-Cueto, & Muñiz, 2008) and has the advantage of increasing reliability and decreasing the need for finer discrimination and decisions that can be difficult for those with cognitive limitations.

In addition, the respondents were asked to provide any recommendations or comments on the individual items, as well as on the content and scope of the questionnaire. More than 75% of the questions in the DLQ were strongly supported by the clinician experts. However, items that were not rated highly by clinical experts were rated highly by more than 75% of the client experts and vice versa. For example, the question about "getting ready in the morning" was rated as "extremely relevant" by 90% of the clinicians and by only 28% of client experts.

The final version of the questionnaire used in the current study includes 71 daily activities. The respondents were requested to rate the level of mental or cognitive difficulty when carrying out the activities on a scale of 1-4: 1 = *no mental or cognitive difficulty*, 2 = *some mental difficulty*, 3 = *much mental difficulty*, and 4 = *unable to complete*.

Phase 2: Examination of the Questionnaire's Factor Analysis

Participants. In order to evaluate the DLQ's reliability and validity among the participants from two different cultures, we recruited a convenience sample of 194 healthy adults, aged 18 to 85 years. Ninety-three (47.4%) resided in northern Israel and 101 (52.6%) resided in the United States (i.e., the greater New York City area). The participants were recruited by advertisements at the universities and hospitals that described the inclusion criteria for study participation. The participants completed the DLQ in their language (English in the USA and Hebrew in Israel, following a valid back and forth translation process) while sitting in a room with a clinician who was available to reply to any questions.

The participants had no documented neurological or physical impairments. The participants over the age of 60 were included if they scored above the cutoff point on a mental status screening test (i.e., a score of > 24 on the Mini Mental State Examination test [MMSE]) (Folstein, Folstein, & McHugh, 1975) or a score of > 4 on the 6-item Cognitive Impairment Test (6CIT) (Katzman et al., 1983). Sensitivity and specificity of the 6CIT in identifying dementia has been found to be similar to the MMSE (Brooke & Bullock, 1999). Furthermore, 34 patients with MS without dementia who were living independently in the community were recruited in the USA and Israel. While no significant gender differences were found between the groups from Israel and the USA, significant age differences were found between the groups: Israel, M = 38.72 ± 7.91; USA, M = 44.35 ± 22.45 t (190) = -2.21 *p*

= (.028). The participants' demographic details are presented in Tables 1 and 2.

Table 1

The Entire Sample's Healthy Participants' Characteristics

	N = 194 M (*SD*)
Age (years) range: 18-85	42.31 (17.72)
Gender	
Men	89 (46%)
Women	105 (54%)
Education (years) range: 0-25	
Elementary and high school (0-12 years)	41 (21.1%)
College and graduate school (13 + years)	139 (71.6%)
Missing	14 (7.2%)
Employment	
Full time	124 (63.3%)
Part time	31 (15.7%)
Unemployed or disabled	-
Retired	37 (19%)
Missing	2 (1%)
Living	
With others	191 (97.4%)
Alone	3 (2.6%)

Table 2

MS Group and Control Group (Smaller Sample) Characteristics: frequency and percent

	MS *n* = 35 M (*SD*)	**Controls *n* = 37 M (*SD*)**
Country		
USA	13 (37%)	23 (62%)
Israel	22 (63%)	14 (38%)
Age (years) range: 18-85	46.09 (11.10)	42.41 (18.40)
Gender		
Men	5 (14.3%)	5 (13.5%)
Women	30 (85.7%)	32 (86.5%)
Education (years) range: 0-25		
Elementary and high school (0-12 years)	10 (28.6%)	9 (24.3%)
College and graduate school (13 + years)	25 (71.4%)	23 (62.2%)
Missing		5 (13.5%)
Employment		
Full time	12 (34.3%)	23 (62.2%)
Part time	6 (17%)	8 (21.6%)
Unemployed or disabled	13 (37%)	-
Retired	4 (8.6%)	6 (16.2%)
Living		
With others	27 (77.1%)	36 (97.3%)
Alone	8 (29.9%)	1 (2.7%)
MMSE score		
28	1(2.9%)	
29	2 (5.9%)	
30	31 (91.2%)	
No. of years since MS diagnosis (1-45 years)	9.2 (9.8)	
EDSS score: Range 0-7.5	3.68 (1.82)	

Note: MMSE = Mini-Mental State Examination. EDSS = Expanded Disability Status Scale.

Procedure. The study was approved by the University and hospital Helsinki Committees in Israel and the USA. After the participants signed an informed consent in Israel and oral consent in the USA, they were asked to complete the DLQ with respect to their everyday function and a demographic questionnaire.

Data Analysis. The data was analyzed using SPSS software version 17. In order to verify the DLQ's construction and dimensions based on the theoretical and clinical experience of the DLQ's developer, exploratory factor analysis (EFA) was conducted, using principle components, for finding the factors of each of the two parts (activities and participation and impairments). The number of extracted factors in each part was chosen on the basis of both a screen plot of the eigenvalues (Cattell, 2007) and factor interpretability. The resulting factor solution was subsequently rotated by means of an oblique (Oblimin) rotation procedure. Item factor loading with values of at least .35 was deemed salient. All items that did not meet this criterion were dropped, as were all items that loaded highly on multiple factors. Internal consistency reliability was evaluated using Cronbach's alpha coefficient.

Following establishment of the DLQ's

final format, gender differences were analyzed for the entire sample while age differences and differences between MS patients and controls were analyzed among smaller samples. In order to examine age differences, 91 of the participants, who were divided into two age groups that were matched for gender, were sampled from the entire sample. The young group included 47 participants, aged 18 to 30 years (19 men, 28 women, mean age 23.96 ± 3.47), and the elderly group included 44 participants aged 60 to 85 years (17 men, 27 women, mean age 71.43 ± 5.49).

The final format of the DLQ was further administered to 34 people diagnosed with MS. Their DLQ scores were compared to a randomized sample taken from the entire sample described above (N = 194). Following reduction of the healthy sample group, the demographic characteristics (age, gender, education type, and country of origin) and the DLQ scores of the smaller sample (n = 37) and of those who were excluded (n = 157) were compared and no significant group differences were found between the smaller sample and the entire sample.

Due to abnormal distribution, Mann-Whitney analyses were then used to test for group differences (MS vs. controls), and gender and age as independent variables across the DLQ parts and factors as dependent variables, for further construct validity, i.e., discriminate validity establishment. After Bonferroni correction, statistical significance was set at .013. Effect size was also computed (r = Z/square root N) while r = 0.1 is a small effect size, 0.3 is medium, and 0.5 is a large effect size.

Results

Phase 2: Examination of the Questionnaire's Validity and Reliability

Construct validity A. An exploratory principal factor extraction with Oblimin rotation was conducted separately for Parts A and B of the DLQ to determine the factors that the questionnaire items of each part fall into. A factor loading above .35 was considered acceptable. The two parts included 71 items altogether, 40 items in Part A and 31 items in Part B.

Part A of the DLQ (items 1-40): Activities and participation (WHO, 2001). The analysis revealed four distinct factors with eigenvalues > 1, comprised of 28 items (see Table 3). The four factors yielded a cumulative percentage of variance of 56.77% with an internal consistency of α = .94. The four factors, as well as the internal consistency reliability, measured by the coefficient alpha of each factor, were as follows:

1. The first factor, household tasks, included 8 items and accounted for 7% of the variance with α = .82.
2. The second factor, activities involving language/comprehension/expression, included 7 items and accounted for 5.6% of the variance with α = .86.
3. The third factor, community/participation, included 7 items and accounted for 37.7% of the variance with α = .83.
4. The fourth factor, complex tasks (organization, less predictable), included 7 items and accounted for 6.5% of the variance with α = .84.

Following the FA results, the number of items in Part A was reduced to 28 out of 40 items.

Part B of the DLQ (items 41-71):

Cognitive symptoms or impairments (body functions) (WHO, 2001). The analysis revealed three distinct factors with eigenvalues > 1, comprised by 24 items (see Table 4). The cumulative percentage of variance comprised of the three factors was 57.47% with an internal consistency of α = .97. The three factors were as follows:

1. The first factor, EFs (working memory, multi-tasking, organization), included 11 items and accounted for 45.59% of the variance with α = .92.
2. The second factor, memory, included four items and accounted for 6.02% of the variance with α = .74.
3. The third factor, EF's monitoring, included nine items and accounted for 5.86% of the variance with α = .88.

Following the FA results, the number of items in Part B was reduced to 24 out of 30 items. In summary, 18 items were deleted following the factor analysis, thus the final version of the DLQ included 52 items.

Table 3

DLQ - Factor Loading of Questionnaire Items Part A (*n* = 194)

Item	Item name	1 Household tasks	2 Activities involving language/ comprehension	3 Community/ participation	4 Complex tasks
1	Getting ready in the morning	.520			
2	Finding items on a crowded shelf or closet	.473			
3	Organizing closets/shelves/drawers	.447			
4	Planning and preparing meals	.390			
6	Household tasks (organizing laundry)	.538			
7	Shopping (buying what you need, making decisions, finding items)	.504			
8	Organizing and scheduling own daily activities and errands	.461			
10	Planning/choosing what to wear	.726			
15	Reading newspapers/magazines		.685		
16	Reading books		.736		
17	Searching for information (on internet, library, etc.)		.519		
22	Planning social arrangements with family friends			.516	
23	Participating in social activities with others			.771	
24	Participating in recreational activities, leisure, hobbies			.847	
25	Fixing / repairing things				.434
27	Finding way in unfamiliar environments				.658
28	Crossing a busy street			.760	
29	Driving a car			.485	
30	Math / calculations				.835
31	Organizing and managing finances				.684
32	Paying bills				.808
33	Operating a bank machine			.468	
34	Expressing your thoughts		.642		

Item	Item name	1 Household tasks	2 Activities involving language/ comprehension	3 Community/ participation	4 Complex tasks
35	Following a conversation		.730		
36	Participating in group discussions		.722		
38	Following written directions				.688
39	Composing a letter or report		.413		
40	Completing applications and forms			.455	
	Eigenvalue	1.96	1.56	10.54	1.83
	% of variance	7%	5.6%	37.7%	6.5%
	Internal consistency (α)	.82	.86	.83	.84

Table 4

DLQ - Factor Loading of Questionnaire Items Part B (*n* = 194)

Item	Item name	1 EF	2 Memory	3 EF's monitoring
41	Understanding new information	.824		
44	Remembering things you need to do during the day		.624	
45	Attending to all aspects of a task or situation without missing information	.706		
46	Handling complex tasks that include keeping track of a lot of information at once	.765		
47	Screening out irrelevant background noises or thoughts while engaging in a task			.395
48	Resuming an activity without difficulty after being interrupted			.535
49	Keeping track of appointments		.657	
50	Keeping track of where things are		.803	
51	Keeping track of time		.611	
53	Approaching tasks in an organized and efficient way	.480		
54	Planning and thinking ahead	.474		
56	Prioritizing tasks			.489
57	Maintaining focus on a task			.614
58	Switching easily from one task to another			.748
59	Seeking out and investigating information when needed	.522		
60	Solving problems without difficulty	.556		
61	Managing multiple step tasks	.704		
62	Adjusting easily to unexpected changes	.604		
64	Accomplishing tasks within a reasonable time frame			.700
65	Responding quickly to situations when necessary			.561
66	Stopping and starting activities without difficulty			.708
67	Performing daily activities at a normal speed			.856
69	Taking initiative to start a new activity or project	.713		
71	Learning new factual information	.835		
	Eigenvalue	10.94	1.44	1.40
	% of variance	45.59%	6.02%	5.86%
	Internal consistency (α)	.92	.74	.88

Note. EF = Executive Functions.

Internal consistency reliability.

Cronbach's alpha coefficient was calculated for all 52 items and for each of the two parts separately, with .70 previously defined as an acceptable level. Based on the results obtained from the initial 52 questions, an alpha coefficient of .97 was found, indicating excellent internal consistency. The Cronbach's alpha reliability for

Part 1 (28 items) was .93 and for Part 2 (24 items) .95, indicating excellent internal consistency for each of the two parts. The Cronbach's alpha reliability values of each of the DLQ's factors are presented in Table 2. Based on the factor analysis results, a mean score for each of the two DLQ components (A and B) and for each of the seven factors was computed for further validity establishment.

Construct validity B. At this phase, construct validity of the 52-item questionnaire (Part A and B) was examined by analyzing gender and age differences as well as differences between healthy people and those with MS.

The hypotheses related to Part A, activities and participation, and Part B, cognitive symptoms and impairments, of the DLQ were as follows:

1. No significant gender differences will be found for both DLQ parts.
2. Significant age differences will be found among healthy people for both DLQ parts.
3. Significant differences will be found between healthy people and those with MS in both DLQ parts.

Gender Differences

The participants were divided into two groups, 90 men and 105 women. In order to prevent the impact of confounding variables, an initial analysis was conducted to test for differences between the two gender groups on age and level of education. No significant differences were found for either variables (age: men mean age = 41.65(*SD* = 16.74), women mean age = 42.96 (*SD* = 18.55), $t(191) = -.51$, $p > .05$ / education level: men mean = 1.65 (*SD* = .52), women mean = 1.73 (*SD* = .44), $t(191) = .15$, $p > .05$.

The Mann-Whitney analysis revealed that the distributions in the two groups were not significantly different for any of the factors in Part A, activities and participation, nor for those of Part B, cognitive symptoms or impairments.

Age Differences

As mentioned above, 91 participants from the entire sample were divided into two age groups: the young group included 47 participants, aged 18 to 30 years (19 men, 28 women, mean age 23.96 ± 3.47), and the elderly group included 44 participants aged 60 to 85 years (17 men, 27 women, age, mean age 71.43 ± 5.49), and their DLQ scores were compared.

Part A: activities and participation. As presented in Table 5, the Mann-Whitney test indicated that the distributions in the two groups differed significantly for the first factor: household tasks of Part A ($U = 669$, $N_1 = 47$, $N_2 = 44$, $Z = -3.06$ $p = .002$ Effect size = -.32)

Part B: cognitive symptoms or impairments. The Mann-Whitney test also revealed that the distributions in the two groups differed significantly for the second factor, memory, of Part B ($U = 756$, $N_1 = 47$, $N_2 = 44$, $Z = -2.48$ $p = .013$)

Table 5

Median Means and Standard Deviation of the Two Parts of the DLQ Across Each Part's Factors. A Comparison Between Age Groups

DLQ factors	Young *n* = 47		Elderly *n* = 44			
	Median	M ± SD	Median	M ± SD	Z	P
Part A: Activities and participation						
1. Household task	1.30	1.34 ± .40	1	1.11 ± .17	-3.06	.002
2. Activities involving language/comprehension	1.14	1.31 ± .41	1	1.13 ± .19	-1.8	>.05
3. Community/participation	1	1.23 ± .35	1	1.10 ± .20	-1.76	>.05
4. Complex task	1	1.48 ± .51	1.15	1.28 ± .28	-1.46	>.05
Part B: Symptoms that might be interfering						
1. EF	1.27	1.40 ± .43	1.27	1.30 ± .28	-.51	>.05
2. Memory	1.25	1.29 ± .37	1	1.15 ± .31	-2.48	.013
3. EF monitoring	1.22	1.32 ± .39	1.06	1.14 ± .18	-2.05	>.05

Differences Between Participants with Multiple Sclerosis and Controls

Part A: activities and participation. The distributions between the two groups differed significantly for the third factor, community/participation, as indicated by the Mann-Whitney test (U = 432, N_1 = 47, N_2 = 44, Z = - 2.52, p = .012, effect size: -.26). The results are presented in Table 6.

Part B: cognitive symptoms or impairments. As presented in Table 6, the Mann-Whitney analysis showed that the distributions in the two groups were not significantly different for any of the factors in part B.

Table 6

Median, Means, and Standard Deviations of the DLQ Parts Across Each Part's Factors. A Comparison Between MS Patients and Controls

DLQ factors	MS *n* = 35		Controls *n* = 37			
	Median	M ± *SD*	Median	M ± *SD*	Z	p
Part A: Activities and participation						
1. Household tasks	1.38	1.58 ± .63	1.13	1.32 ±.40	-1.55	>.05
2. Activities involving language/comprehension	1.29	1.48 ± .52	1	1.33 ±.45	-1.41	>.05
3. Community/ participation	1.4	1.48 ±.47	1	1.23 ±.32	-2.52	.012
4. Complex task	1.5	1.52 ±.48	1.5	1.59 ±.52	-.65	>.05
Part B: Symptoms that might be interfering						
1. EF	1.45	1.62 ± .56	1.36	1.48 ± .43	-.79	> .05
2. Memory	1.25	1.53 ± .66	1.25	1.30 ± .34	-.89	> .05
3. EF monitoring	1.38	1.55 ± .53	1.22	1.33 ± .38	-1.98	> .05

Discussion

The aim of this study was to develop a self-report questionnaire that could identify difficulties in performing everyday activities and participation tied with higher-level cognitive disabilities and establish its psychometric properties. The identification of difficulties in daily activities combined with cognitive disabilities can help clinicians learn about clients' barriers and their participation level. In accordance with the ICF concepts (WHO, 2001), the factor analysis confirmed that the DLQ simultaneously covers the two parts of activities and participation and body functions, where cognitive abilities are one of the components (WHO, 2001). Four factors of activities/participation were established (Part A). The factors were household tasks, those involving language/comprehension, activities occurring outside the home in the community or participation, and complex tasks. The principle that distinguishes between these four factors is the change in the type and level of the stimulus as well as the cognitive resources required to perform the activities in each factor.

Activities in the household tasks factor include getting ready in the morning or household tasks (e.g., home organizing, laundry) that are usually carried out by the person taking care of him or herself or of the house. Such activities are done routinely and involve use of familiar objects, such as the person's clothes or shelves in a familiar kitchen or bathroom cabinet. Even in shopping, objects are placed in front of the person who needs to choose them based on memory or a pre-prepared shopping list (Dawson et al., 2009). The role of cognitive abilities in performing activities of daily living and IADLs as these has been well established in the literature (Green, Kern, & Heaton, 2009).

In contrast, tasks such as reading the newspaper or a book and searching for information or following a conversation are a second factor comprised of higher cognitive demands that require attention, working memory process, decoding, and language comprehension (Reid, 2016). Higher-cognitive abilities are needed for successful communication, and in this modern era many forms of communication are conducted via computer or multi-media platforms. One such daily activity in modern society is searching the web for information, which requires hypertext reading, which is the collection of documents containing links that allow readers to move from one chunk of text to another (DeStefano & LeFevre, 2007). Previous performance of such an activity together with current avoidance of performance may indicate cognitive deterioration.

While most activities included in the previous two factors can be explained by Bandura's social cognitive theory (Bandura, 2012) as personal agency activities, activities included in the third factor, community/participation, belong to proxy agency activities that rely on others to act on one's behalf to secure desired outcomes (Bandura, 2012).

The last factor in the activities/participation part includes activities that constitute complex tasks, such as fixing things, finding your way in unfamiliar environments, organizing, math calculations, and managing finances. Such activities require visual spatial abilities and problem solving skills. Unlike the

activities in the second factor that lean on the linguistic modality, it seems that in this factor, abilities related to visual-spatial and numerical representations are required. Furthermore, as in the previous factor, such activities pose a challenge to the individual as an ongoing process of planning; shifting and adaptation are required throughout performance.

The distribution of the tasks to those leaning on verbal and those leaning on visuo-spatial abilities is in line with the two domain-specific working memory storage presented by Baddeley (2012), a phonological loop specialized for maintaining verbal-linguistic information, and a visuospatial sketchpad specialized for maintaining visual and spatial information. These skills provide a foundation for problem-solving abilities, as solving a problem requires the ability to simultaneously keep in mind and manipulate all of the relevant variables.

The four factors described above cover a wide range of functioning areas from basic (i.e., those performed at home) to complex activities. This range highlights how higher-level cognitive abilities affect participation in a variety of life roles and how potentially debilitating impairments in this area can be. The division of factors can enable clinicians to pinpoint where clients may be struggling most.

In the factors depicting function as related to cognitive impairments (Part B), the majority of the items (11) fell into the EF factor and are conceptually related to this area (e.g., understanding new information, planning and thinking ahead, solving problems without difficulty). Four items (remembering things you need to do during the day, keeping track of appointments/where things are/of time) fell into the memory factor, and nine items included in the EF's monitoring factor (e.g., prioritizing tasks, maintaining focus on a task or stopping and starting activities without difficulty).

The distinction between EF and EF's monitoring indeed reflects the differences in the level of cognitive demands required in daily function for the activities in each factor. Understanding new information or planning and thinking ahead (EF factor) requires certain cognitive skills, while prioritizing tasks, or maintaining focus on a task (EF's monitoring), requires a high level of analysis and synthesis ability combined with varied cognitive skills, such as working memory, shifting, and image preservation. In the EF's monitoring factor, activities such as maintaining focus on a task, switching easily from one task to another, or performing daily activities at a normal pace are included. Such activities depend on the ability to focus, sustain, and shift attention in a dynamic process of doing sequential activities. Performance time is a good indicator of such EF's monitoring, indicating whether it is performed sufficiently and whether the person starts and stops sequential activities without difficulty and responds quickly to situations when needed.

As mentioned above, four items fell into the memory factor. Memory is required for daily function and memory deficits indeed cause a failure to perform daily tasks and to participate sufficiently (Green et al., 2004). Difficulties in keeping track of where things are or remembering daily tasks may be markers for cognitive deterioration as reflected in daily function.

Identification of factors in the

activity/participation and cognitive symptoms or impairment part, which seem to be sensitive to changes in daily function allowed for analysis of gender and age differences related to these factors. The fact that there were no significant gender differences in all of the DLQ factors is in accordance with the results of other studies. For example, Barnes et al. (2003) suggested the presence of gender differences in cognitive function constitute a risk for Alzheimer's disease (AS) in older persons. However, longitudinal studies comparing change in cognitive function and risk of AD in men and women have had mixed results. This fact strengthens the uniqueness of the DLQ and its efficiency, as its score is not gender-dependent.

Conversely, as expected in light of the literature on cognitive decline with age and its influence on daily function (Anstey & Wood, 2011; Coppin et al., 2006; Rosenblum & Werner, 2006), when looking at the mean scores + *SD* of the two age groups, the younger group reported lower performance abilities related to all the factors in comparison to the older group. Significant age group differences were found for both the household tasks (Part A, Factor 1) and the memory factor (Part B, Factor 2) in the DLQ. This result refutes our hypothesis and raises questions.

It may be that the youngest age group (average age 24), who may have just transitioned to working and living on their own, are more likely to acknowledge difficulties than older, experienced adults. An older age group with an average age of 80 or 85, rather than 71, may yield different results. It is, therefore, recommended to continue to study the DLQ in different age groups in larger and more representative samples.

It is important to state that despite the significant age group differences, the participants in both groups still performed at the levels of between Score 1 = *no mental or cognitive difficulty* and Score 2 = *some mental or cognitive difficulty*, on the DLQ scoring scale. Thus, the clinical meaning of such significant differences requires further exploration.

When looking at the differences between controls and MS clients in the first part of the DLQ questionnaire, activities and participation, significant group differences were found only in the community/participation factor (Part A, Factor 3) with a small effect size. Here again, the scores are in the normal range, between 1 to 2. In the community/participation factor, higher cognitive abilities, such as problem-solving and remembering details, as well as communicating with others in order to accomplish the activities are needed. No significant differences were found for any of the factors of Part B, cognitive impairments. Those results need to be considered in light of the features of the MS group participants. All of them were living independently in the community, while 91% of them had MMSE score of 30, which is considered normal cognitive function. It may be that the significant difference in their community/participation is the first functional sign for their cognitive decline. However, this finding needs to be further studied in a larger sample among people with various levels of cognitive decline.

The question of finding the appropriate tool with sufficient sensitivity to capture higher-level cognitive decline through daily function

among MS patients has been discussed in the literature. Goverover et al. (2005) studied the relationships between subjective and objective ADL assessment in people with MS. They used the EFPT (Baum et al., 2008) as their performance-based (objective) measure and found very little to no relation between the EFPT and the subjective self-report assessment tools used in their study. They suggested that the objective and subjective self-report measures each provide unique contributions to the evaluation of functional performance in persons with MS. Self or proxy report can provide information about patient or caregiver perceptions regarding the level of participation in activities that cannot be measured using an objective performance-based assessment tool.

The question of appropriate tools for measuring the cognitive abilities as related to actual daily function has been continuously debated in the literature (Schwartz, Averbuch, Katz, & Sagiv, 2016). Measuring participation in activities related to daily function is a complex task and may be the reason why few instruments have focused on this construct. Since participation is complex and affected by many factors, both internal and external, it is easier to assess specific neuropsychological components, such as attention and working memory. Nonetheless, the DLQ makes possible the connection between measurement of activity and participation and impaired cognitive functions. The DLQ is unique in that it asks respondents to rate the level of a task's cognitive difficulty. In this manner, both functioning in activities and participation are captured, since it is likely that reduced participation will be evident either in that particular activity (due to the difficulty to perform) or in other similar activities that require much mental effort.

Study Limitations and Future Research

Although the DLQ is designed to measure the daily function of populations with subtle cognitive difficulties or possible cognitive decline, in this primary study, only aging and MS populations were included. The psychometric characteristics of the DLQ, including reliability and validity, should be further studied and include other populations with mild cognitive difficulties or deterioration, such as mild stroke, TBI, or older adults with mild cognitive impairment. In addition, the DLQ uses a 4-point response scale that is supported in the literature (Chang, 1994; Lozano et al., 2008); however, an expanded response format could be compared to a 4-point scale in future studies to determine whether there are differences in sensitivity and reliability. Furthermore, since the DLQ is based on the individual's perception of changes in his or her daily function, its use among people with moderate or severe cognitive deterioration whose self-awareness may be impaired is limited and would require research involving comparison of the perception of others.

Conclusion

This study's findings indicate that the DLQ has promising psychometric properties and addresses the need for capturing higher-level cognitive deficiency through real-life daily activities. Such a scale, built based on the ICF concepts, is a dynamic interactional model of cognition that may be used for both research and clinical purposes among populations such as the elderly and those with cognitive decline as a result

of various diseases. The DLQ may serve as a tool in future research among persons with varied pathologies, including expected cognitive decline; it can focus on the actual deficits and even evaluate dependency and required assistance among these populations (Caro et al., 2002). Further studies analyzing the DLQ's sensitivity and specificity among varied populations are required.

***Sara Rosenblum, PhD, OT**, Department of Occupational Therapy, Faculty of Social Welfare & Health Sciences, University of Haifa*

***Naomi Josman, PhD, OT**, Department of Occupational therapy, Faculty of Social Welfare & health Sciences, University of Haifa*

***Joan Toglia, PhD, OTR/L, FAOTA**, School of Health & Natural Sciences, Mercy College, Dobbs Ferry, NY*

References

Anstey, K. J., & Wood, J. (2011). Chronological age and age-related cognitive deficits are associated with an increase in multiple types of driving errors in late life. *Neuropsychology*, *25*(5), 613-621. https://doi.org/10.1037/a0023835

Baddeley, A. (2012). Working memory: theories, models, and controversies. *Annual Review of Psychology*, *63*, 1-29. https://doi.org/10.1146/annurev-psych-120710-100422

Bandura, A. (2012). On the functional properties of perceived self-efficacy revisited. *Journal of Management*, *38*(1), 9-44. https://doi.org/10.1177/0149206311410606h

Barkley, R. A., & Murphy, K. R. (2011). The nature of executive function (EF) deficits in daily life activities in adults with ADHD and their relationship to performance on EF tests. *Journal of Psychopathology and Behavioral Assessment*, *33*(2), 137-158. https://doi.org/10.1007/s10862-011-9217-x

Barnes, L. L., Wilson, R. S., Schneider, J. A., Bienias, J. L., Evans, D. A., & Bennett, D. A. (2003). Gender, cognitive decline, and risk of AD in older persons. *Neurology*, *60*(11), 1777-1781. https://doi.org/10.1212/01.WNL.0000065892.67099.2A

Baum, C. M., Connor, L. T., Morrison, T., Hahn, M., Dromerick, A. W., & Edwards, D. F. (2008). Reliability, validity, and clinical utility of the Executive Function Performance Test: A measure of executive function in a sample of people with stroke. *American Journal of Occupational Therapy*, *62*, 446-455. https://doi.org/10.5014/ajot.62.4.446

Bennett, P. C., Ong, B., & Ponsford, J. (2005). Measuring executive dysfunction in an acute rehabilitation setting: Using the dysexecutive questionnaire (DEX). *Journal of the International Neuropsychological Society*, *11*(4), 376-385. http://dx.doi.org/10.1017/S1355617705050423

Brooke, P., & Bullock, R. (1999). Validation of a 6 item cognitive impairment test. *International Journal of Geriatric Psychiatry*, *14*(11), 936-940. https://doi.org/10.1002/(SICI)1099-1166(199911)14:11<936::AID-GPS39>3.0.CO;2-1h

Burgess, P. W., Alderman, N., Forbes, C., Costello, A., M.-A. Coates, L., … Channon, S. (2006). The case for the development and use of "ecologically valid" measures of executive function in experimental and clinical neuropsychology. *Journal of the International Neuropsychological Society*, *12*(2), 194-209. https://doi.org/10.1017/s1355617706060310

Caro, J., Ward, A., Ishak, K., Migliaccio-Walle, K., Getsios, D., Papadopoulos, G., & Torfs, K. (2002). To what degree does cognitive impairment in Alzheimer's disease predict dependence of patients on caregivers? *BMC Neurology*, *2*(6). https://doi.org/10.1186/1471-2377-2-6h

Cattel, R. B. (2007). *The scientific analysis of personality*. Baltimore, MD: Penguin Books.

Chang, L. (1994). A psychometric evaluation of 4-point and 6-point Likert-type scales in relation to reliability and validity. *Applied Psychological Measurement*, *18*(3), 205-215. https://doi.org/10.1177/014662169401800302

Chiaravalloti, N. D., & DeLuca, J. (2008). Cognitive impairment in multiple sclerosis. *The Lancet Neurology*, *7*(12), 1139-1151. https://doi.org/10.1016/S1474-4422(08)70259-X

Cicerone, K. D., Langenbahn, D. M., Braden, C., Malec, J. F., Kalmar, K., Fraas, M., … Ashman, T. (2011). Evidence-based cognitive rehabilitation: Updated review of the literature from 2003 through 2008. *Archives of Physical Medicine and Rehabilitation*, *92*(4), 519-530. https://doi.org/10.1016/j.apmr.2010.11.015

Coppin, A. K., Shumway-Cook, A., Saczynski, J. S., Patel, K. V., Ble, A., Ferrucci, L., & Guralnik, J. M. (2006). Association of executive function and performance of dual-task physical tests among older adults: Analyses from the InChianti study. *Age and Ageing*, *35*(6), 619-624. https://doi.org/10.1093/ageing/afl107

Dawson, D. R., Anderson, N. D., Burgess, P., Cooper, E., Krpan, K. M., & Stuss, D. T. (2009). Further

development of the Multiple Errands Test: Standardized scoring, reliability, and ecological validity for the Baycrest version. *Archives of Physical Medicine and Rehabilitation*, *90*(11), S41-S51. https://doi.org/10.1016/j.apmr.2009.07.012

DeStefano, D., & LeFevre, J. (2007). Cognitive load in hypertext reading: A review. *Computers in Human Behavior*, *23*(3), 1616-1641. https://doi.org/10.1016/j.chb.2005.08.012

De Vriendt, P., Gorus, E., Cornelis, E., Velghe, A., Petrovic, M., & Mets, T. (2012). The process of decline in advanced activities of daily living: A qualitative explorative study in mild cognitive impairment. *International Psychogeriatrics*, *24*(6), 974-986. http://dx.doi.org/10.1017/S1041610211002766

Dixon, D., Johnston, M., McQueen, M., & Court-Brown, C. (2008). The Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH) can measure the impairment, activity limitations and participation restriction constructs from the International Classification of Functioning, Disability and Health (ICF). *BMC Musculoskeletal Disorders*, *9*(114). https://doi.org/10.1186/1471-2474-9-114

Egan, M., & Dubouloz, C. J. (2013). Practical foundations for practice: planning, guiding, documenting, and reflecting. In M. V. Radomski & C. A. Trombly (Eds.). *Occupational Therapy for Physical Dysfunction* (7th ed., pp. 24-29). New York, NY: Lippincott Williams & Wilkins.

Eriksson, G., Tham, K., & Kottorp, A. (2013). A cross-diagnostic validation of an instrument measuring participation in everyday occupations: The Occupational Gaps Questionnaire (OGQ). *Scandinavian Journal of Occupational Therapy*, *20*(2), 152-160. https://doi.org/10.3109/11038128.2012.749944

Ferrucci, L., Guralnik, J. M., Studenski, S., Fried, L. P., Cutler, G. B., & Walston, J. D. (2004). Designing randomized, controlled trials aimed at preventing or delaying functional decline and disability in frail, older persons: A consensus report. *Journal of the American Geriatrics Society*, *52*(4), 625-634. https://doi.org/10.1111/j.1532-5415.2004.52174.x

Folstei, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state": A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, *12*(3), 189-198. https://doi.org/10.1016/0022-3956(75)90026-6

Goverover, Y., Kalmar, J., Gaudino-Goering, E., Shawaryn, M., Moore, N. B., Halper, J., & DeLuca, J. (2005). The relation between subjective and objective measures of everyday life activities in persons with multiple sclerosis. *Archives of Physical Medicine and Rehabilitation*, *86*(12), 2303-2308. https://doi.org/10.1016/j.apmr.2005.05.016

Green, M. F., Kern, R. S., & Heaton, R. K. (2004). Longitudinal studies of cognition and functional outcome in schizophrenia: Implications for MATRICS. *Schizophrenia Research*, *72*(1), 41-51. https://doi.org/10.1016/j.schres.2004.09.009

Green, R. C., Schneider, L. S., Amato, D. A., Beelen, A. P., Wilcock, G., Swabb, E. A., & Zavitz, K. H. (2009). Effect of Tarenflurbil on cognitive decline and activities of daily living in patients with mild Alzheimer disease: A randomized controlled trial. *Jama*, *302*(23), 2557-2564. https://doi.org/10.1001/jama.2009.1866

Jurado, M. B., & Rosselli, M. (2007). The elusive nature of executive functions: A review of our current understanding. *Neuropsychology Review*, *17*(3), 213-233. https://doi.org/10.1007/s11065-007-9040-z

Katzman, R., Brown, T., Fuld, P., Peck, A., Schechter, R., & Schimmel, H. (1983). Validation of a short Orientation-Memory-Concentration Test of cognitive impairment. *American Journal of Psychiatry*, *140*(6), 734-739. https://doi.org/10.1176/ajp.140.6.734

Kizony, R., Demayo-Dayan, T., Sinoff, G., & Josman, N. (2011). Validation of the Executive Function Route-Finding Task (EFRT) in people with mild cognitive impairment. *OTJR: Occupation, Participation and Health*, *31*(1), S47-S52. https://doi.org/10.3928/15394492-20101108-08

Lozano, L. M., García-Cueto, E., & Muñiz, J. (2008). Effect of the number of response categories on the Reliability and Validity Rating Scores. *Methodology*, *4*(2), 73-79. https://doi.org/10.1027/1614-2241.4.2.73

Nourbakhsh, B., Nunan-Saah, J., Maghzi, A., Julian, L. J., Spain, R., Jin, C., … Waubant, E. (2016). Longitudinal associations between MRI and cognitive changes in very early MS. *Multiple Sclerosis and Related Disorders*, *5*, 47-52. https://doi.org/10.1016/j.msard.2015.10.010

Pfeffer, R. I., Kurosaki, T. T., Harrah, C. H., Jr., Chance, J. M., & Filos, S. (1982). Measurement of functional activities in older adults in the community. *Journal of Gerontology*, *37*(3), 323-329. https://doi.org/10.1093/geronj/37.3.323

Reicker, L. I., Tombaugh, T. N., Walker, L., & Freedman, M. S. (2007). Reaction time: An alternative method for assessing the effects of multiple sclerosis on information processing speed. *Archives of Clinical Neuropsychology*, *22*(5), 655-664. https://doi.org/10.1016/j.acn.2007.04.008

Reid, G. (2016). *Dyslexia: A practitioner's handbook*. (5th ed.). West Sussex, UK: Wiley-Blackwell.

Rosenblum, S., & Werner, P. (2006). Assessing the handwriting process in healthy elderly persons using a computerized system. *Aging Clinical and Experimental Research*, *18*(5), 433-439. https://doi.org/10.1007/BF03324840

Schmitter-Edgecombe, M., Parsey, C., & Cook, D. J. (2011). Cognitive correlates of functional performance in older adults: Comparison of self-report, direct observation, and performance-based measures. *Journal of the International Neuropsychological Society*, *17*(5), 863-864. https://doi.org/10.1017/S1355617711000865

Salthouse, T. A. (2009). When does age-related cognitive decline begin? *Neurobiology of Aging*, *30*(4), 507-514. https://doi.org/10.1016/j.neurobiolaging.2008.09.023

Schwartz, Y., Averbuch, S., Katz, N., & Sagiv, A. (2016). Validity of the Functional Loewenstein Occupational Therapy Cognitive Assessment (FLOTCA). *American Journal of Occupational Therapy*, *70*, 7001290010. https://doi.org/10.5014/ajot.2016.016451

Toglia, J. P., Rodger, S. A., & Polatajko, H. J. (2012). Anatomy of cognitive strategies: A therapist's primer for enabling occupational performance. *Canadian Journal of Occupational Therapy*, *79*(4), 225-236. https://doi.org/10.2182/cjot.2012.79.4.4

Vaughan, L., & Giovanello, K. (2010). Executive function in daily life: Age-related influences of executive processes on instrumental activities of daily living. *Psychology and Aging*, *25*(2), 343-355. http://dx.doi.org/10.1037/a0017729

World Health Organization (2001). *International classification of functioning, disability and health (ICF).* Geneva: World Health Organization.