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Assessing functional impairment in individuals with mild cognitive impairment

Abstract

To date, there is no consensus on how to assess functional impairment in individuals with mild cognitive impairment (MCI), and this lack of consensus is reflected in the clinical practice. Since the criterion used in the literature is very vague, clinicians are still left without much guidance in this area. Thus, the main goal of this study was to examine how functional impairment in individuals with MCI has been assessed in the literature.

An electronic database search strategy was developed in consultation with an experienced librarian. Four databases (CINAHL, PsycINFO, PubMed, and MEDLINE) were searched from 2000 to May 2014 to provide a comprehensive coverage of the literature.

The literature search yielded 14 tools that assessed functional impairment in MCI. Among those, nine tools were performance-based measures in which participants were observed while executing a task in a simulated environment using real life material. In terms of questionnaires (either informant- or self-reports), five tools were found. Different functional domains have been assessed in each tool. According to this review, the characteristics of the instruments used in the literature to assess functional impairment in individuals with MCI vary greatly. Nonetheless, results of this study allow clinicians to make better-informed decisions when choosing a functional assessment for this population.

Keywords

IADL, mild cognitive impairment, functional performance, assessments

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Mild cognitive impairment (MCI) is one of the most recognized risk factors for dementia. However, only a small proportion of individuals diagnosed with MCI will actually convert to dementia (Palmer, Bäckman, Winblad, & Fratiglioni, 2008). MCI is typically classified into four broad subgroups depending on the cognitive areas affected: (a) amnestic MCI (aMCI) single domain, in which only memory is affected; (b) amnestic MCI multiple domain, in which memory is affected among other cognitive abilities; (c) non-amnestic MCI (naMCI) single domain, in which there is decline in only one cognitive domain excluding memory; and (d) non-amnestic MCI multiple domain, in which there is a decline in multiple cognitive functions excluding memory. To date, there is no cure for dementia. In the hopes of finding strategies to delay its progression, researchers are targeting MCI in intervention studies. Thus, considerable attention has been given to refining the MCI diagnostic criteria so that individuals can be identified early and interventions can be proposed.

Literature Review

Peterson first identified the concept of MCI in 1999. Its current diagnostic criteria includes subjective cognitive complaints, objective cognitive impairment assessed with neuropsychological tests, very mild problems in Instrumental Activities of Daily Living (IADLs), and no dementia diagnosis (Petersen et al., 2014). Specific to IADL problems, individuals with MCI are still independent in performing everyday tasks (Albert et al., 2011; Petersen et al., 2014), however, they make more errors, are less efficient, and take more time when performing these tasks in comparison to healthy controls (Albert et al., 2011). However, considering that (a) functional decline is also a part of the normal aging process, (b) that functional decline in MCI is very subtle, and (c) that no clear operationalization of it exists, clinicians are faced with the challenge of accurately determining when normal decline becomes pathological.

A recent study has investigated current clinical practices in this area and found a lack of consensus among occupational therapists in relation to the best functional assessment tool to use with individuals with MCI (Belchior, Korner-Bitensky, Holmes, & Robert, 2015). In the study, clinicians were prompted by two vignettes representing two different MCI cases (i.e., aMCI and naMCI). They were asked to (a) identify potential problems and (b) indicate which assessments, if any, they would use with each client. Even though the majority of the clinicians were able to recognize some cognitive decline signs reflective of possible MCI, only a minority reported using standardized functional assessments (46.2% for the aMCI case and 35.5% for the naMCI case). Among the assessments identified, 14 were performance-based, one was a semi-structured interview, and three were questionnaires. Moreover, only two of the assessments reported have been validated with MCI (Belchior, Holmes et al., 2015). The lack of consensus seems to be a reflection of the lack of operational criteria and evidence in the literature about how to assess functional performance in this target population.

In fact, the literature shows that several tools have been used to assess functional decline in MCI

and that each tool measures different sets of activities (Bangen et al., 2010; Griffith et al., 2003; Pereira, Yassuda, Oliveira, & Forlenza, 2008; Schmitter-Edgecombe, McAlister, & Weakley, 2012). Specifically, while some of these tools focus on finance management, others address shopping skills, meal preparation, and other broad areas of IADLs, demonstrating the lack of criterion to assess functional performance. Along with these challenges, the instruments usually use a rather global scoring system in which only the ability to complete a task is assessed. Thus, the subtleties of performances are not captured.

Another important point to be considered is the MCI subtypes recruited for each study. In fact, preliminary evidence shows a link between the type of IADL restriction and the MCI subtype. This was to be expected given that different types of MCI impact different skills required to perform IADLs. For instance, Bangen and colleagues (2010) found that participants with aMCI demonstrated significant impairment in specific financial management tasks (e.g., counting money, taking precautions with finances), whereas those with naMCI demonstrated poor performance on abilities related to health and safety (e.g., awareness of personal health status, dealing with medical emergencies) when compared to healthy older adults. Another study found that participants with naMCI primarily demonstrated impairment in executive function, which is an important factor in predicting fall risks (Delbaere et al., 2012). Kim and colleagues (2009) examined different profiles of impairment in IADL tasks among individuals with four different MCI subtypes (e.g., amnestic single and multiple domain and non-amnestic single and multiple domain). Individuals with single domain naMCI reported problems using the telephone and using household appliances, while individuals with multiple domain aMCI reported more difficulties using the telephone, using transportation, and managing finances.

In conclusion, there is no consensus in the literature on how to assess functional impairment in individuals with MCI, and this lack of consensus is reflected in clinical practice (Belchior, Korner-Bitensky et al., 2015). Since the criterion used in the literature is vague, clinicians are still left without much guidance in this area. Thus, the goal of this study was to conduct a literature review of how functional impairment has been assessed in individuals with MCI and provide preliminary guidance to clinicians. Only tools that have been studied with the MCI population were included. The main goal was to examine the specific functional domains assessed in each tool. The secondary goal was to (a) report on the specific types of MCI population recruited in each study and (b) report on the scoring system of each tool.

Methods

An electronic database search strategy was developed in consultation with an experienced health sciences librarian. Four databases—CINAHL, PsycINFO, PubMed, and MEDLINE—were searched from 2000 to May 2014 to provide a comprehensive coverage of the literature. In order to define the key words, a preliminary search was conducted to identify the words used in the literature to describe the subject of the study. Key words in each database included “mild cognitive

impairment" or "MCI" combined with any of the following terms: "functional impairment," "functional limitation," "functional performance," or "activities of daily living." This approach yielded 1,238 articles (184 from CINAHL, 173 from PsycINFO, 507 from PubMed, and 374 from MEDLINE). Of these, 653 articles were duplicates and were removed. The final pool of records without duplicates consisted of 585 articles.

As the goal of the study was to investigate functional tools that have been studied with the MCI population, the following eligibility criteria was applied: (a) tools used with the MCI population; (b) tools standardized and available in English; and (c) tools validated with the MCI population (based on preliminary reviews of validation studies) and have discriminative abilities to distinguish MCI from other diagnostic groups (i.e., healthy controls and dementia) (Belchior, Holmes et al., 2015; Kaur, Belchior, Gélinas, & Bier, in press).

We excluded 525 articles because they did not include any functional tools. The remaining 60 articles were further analyzed. Forty-six studies were additionally excluded because (a) the tools were not available in English, (b) there was insufficient information about them, (c) the tools had not been validated with the MCI population, or (d) the study had not been peer reviewed. Fourteen studies met the inclusion criteria and were retained for complete analysis.

Classification of the Assessments

The assessments were classified according to the type of tool, the functional domains assessed, the MCI subtypes recruited, and the scoring system. In order to accomplish this classification, four steps were taken. First, the assessments were classified into either performance-based tools, in which individuals are assessed during the performance of a task in a simulated environment using real life materials, or questionnaires (self-reports or informants reports). Second, the functional domains from each tool were classified using the International Classification of Functioning Disability and Independence (ICF) (World Health Organization [WHO], 2001). In this review, we mainly focused on the activities and participation domain, which refers to the execution of tasks and the involvement in life situations. Third, the number of items assessed in each domain was counted. Fourth, the different MCI subtypes enrolled in the studies and the scoring system used in each tool was reported. The classification was determined after a consensus meeting between the authors, which included an occupational therapist with clinical experience with older adults diagnosed with MCI, a researcher with expertise in functional assessment with MCI, and four masters of occupational therapy students.

Results

The literature search yielded 14 tools that commonly assess functional impairment.

Functional domains assessed. Among the 14 tools, nine were performance-based measures in which participants were observed while executing a task in a simulated environment using real life material (see Table 1). The performance-based tools included: (a) Day-Out Task (DOT) (Schmitter-Edgecombe et al., 2012); (b) Direct Assessment of Functional Status-Revised (DAFS-R) (Pereira et al.,

2008); (c) Financial Capacity Instrument (FCI) (Griffith et al., 2003); (d) Functional Cognitive Assessment (FUCAS) (Kounti, Tsolaki, & Kiosseoglou, 2006); (e) Independent Living Scales (ILS) (Bangen et al., 2010); (f) Naturalistic Action Test (NAT) (Giovannetti et al., 2008); (g) Texas Functional Living Scale (TFLS) (Binegar, Hynan, Lacritz, Weiner, & Cullum, 2009); (h) The University of California, San Diego (UCSD) Performance-Based Skills Assessment (UPSA) (Gomar, Harvey, Bobes-Bascaran, Davies, & Goldberg, 2011); and (i) Timed Instrumental Activities of Daily Living (TIADL) (Wadley, Okonkwo, Crowe, & Ross-Meadows, 2008).

Among the performance-based tools, 12 domains were assessed (see Table 1). The domains of economic transaction were the most assessed. While the complex economic transaction (d865) component had 18 items, the basic economic transaction (d860) component had 39 items, adding up to 57 items. Looking after one's health was the second most assessed domain and included 26 items, followed closely by using communication devices and techniques, which included 20 items. The domains with fewer items were washing oneself (d510), dressing (d540), and doing housework (d640), all counting one item each.

Table 1

Number of Domains and Items Applied in Performance-Based Tools used to Assess Functional Impairment in MCI

	Using communication devices and Techniques d360	Using transportation d470	Washing oneself d510	Dressing d540	Looking after one's health d570	Acquisition of goods and services d620	Preparing meals d630	Doing housework d640	Household tasks, other specified and unspecified d649	Basic economic transactions d860	Complex economic transactions d865	**Total Domains**
Day-Out Task (DOT) (Schmitter Edgecombe et al., 2012)		X (1)			X (1)		X (2)	X (1)	X (1)	X (1)	X (1)	**7**
Direct Assessment of Functional Status-Revised (DAFS-R) (Pereira et al., 2008)	X (2)				X (3)	X (3)				X (2)	X (1)	**5**
Financial Capacity Instrument (FCI) (Griffith et al., 2003)										X (10)	X (11)	**2**
Functional Cognitive Assessment (FUCAS) (Kounti et al., 2006)	X (1)		X (1)	X (1)	X (1)	X[a] (1)				X[a] (1)		**7**
Independent Living Scales (ILS) (Bangen et al., 2010)	X (1)				X (19)					X (12)	X (5)	**4**
Naturalistic Action Test (NAT) (Giovannetti et al., 2008)							X (3)		X (2)			**2**
Texas Functional Living Scale (TFLS) (Binegar et al., 2009)	X (6)						X (2)			X (7)		**3**
The University of California, San Diego (UCSD) Performance-Based Skills Assessment (UPSA) (Gomar et al., 2011)	X (9)	X (6)					X (1)			X (5)		**5**
Timed Instrumental Activities of Daily Living (TIADL) (Wadley et al., 2008)	X (1)				X (2)	X (1)	X (3)			X (1)		**5**
Total of items in each domain	**20**	**7**	**1**	**1**	**26**	**5**	**11**	**1**	**3**	**39**	**18**	

Note. X[a] both domains were assessed in the same item. The number in parenthesis refers to the number of items in each domain.

In terms of questionnaires (either informant or self-reports), five tools were found (see Table 2): (a) Advanced Activities of Daily Living (De Vriendt et al., 2013); (b) Bayer Activities of Daily Living (Kochan et al., 2011); (c) Disability Assessment for Dementia (DAD)-6 (Rotrou et al., 2012); (d) Pfeffer Functional Activities Questionnaire; and (e) The Alzheimer's Disease Cooperative Study/Activities of Daily Living Scale for MCI (Galasko et al., 1997).

Table 2

Questionnaires used to Assess Functional Impairment in MCI

	Carrying out daily routine d230	Conversation d350	Using Communication Devices and	Walking d450	Using transportation d470	Driving d475	Caring for body parts d520	Dressing d540	Looking after one's health d570	Acquisition of goods and services	Preparing meals d630	Doing housework d640	Household tasks, other specified and	Assisting Others d660	Non-remunerative employment d855	Basic economic transactions d860	Complex economic transactions	Community Life d910	Recreation and Leisure d920	**Total Domains**
Advanced Activities of Daily Living (De Vriendt et al., 2013)			X (2)			X (1)					X (5)	X (15)	X (1)	X (4)	X (1)		X (2)	X (3)	X (12)	**10**
Bayer Activities of Daily Living (Kochan et al., 2011)	X (1)	X (1)	X (2)	X (1)	X (1)		X (1)		X (3)	X (1)	X (1)	X (1)				X (1)	X (1)		X (1)	**14**
Disability Assessment for Dementia (DAD)-6 (Rotrou et al., 2012)			X (3)						X (3)		X (3)						X (3)		X (3)	**5**
Pfeffer Functional Activities Questionnaire (Pfeffer et al., 1982)					X[a] (1)	X[a] (1)				X (1)	X (1)	X (1)				X[b] (1)	X[b] (1)		X (1)	**8**
The Alzheimer's Disease Cooperative Study/Activities of Daily Living Scale for MCI (Galasko et al., 1997)	X (1)		X (2)		X (1)	X (1)		X (2)	X (1)	X (1)	X (1)	X (3)					X (1)		X (2)	**12**
Total of items in each domain	**2**	**1**	**9**	**1**	**3**	**3**	**1**	**2**	**7**	**3**	**11**	**20**	**1**	**4**	**1**	**2**	**8**	**3**	**19**	

Note. X[a-b] both domains were assessed in the same item. The number in parenthesis refers to the number of items in each domain.

Among the questionnaires, 20 functional domains were assessed (see Table 2). Most of the tools assessed one item in each domain. Doing housework (d640) was the most assessed domain, with 20 items, followed by recreation and leisure (d920) and preparing meals (d360), having 19 and

11 items respectively. The domains with fewer items included conversation (d350), walking (d450), caring for body parts (d520), household tasks (d649), informal education (d810), and non-remunerative employment (d855), counting one item each.

Study population. Participants with different MCI subtypes were included in these validation studies. In terms of the performance-based assessments, of the nine studies, one did not specify the MCI subtype (Functional Cognitive Assessment Scale [FUCAS]), four recruited individuals with amnestic and non-amnestic single and multiple domain MCI (NAT, ILS, DOT, and DAFS-R), two included participants with amnestic single and multiple domain MCI (UPSA, TFLS), and the final two investigated only participants with the amnestic MCI subtype (FCI, TIADL).

In terms of the questionnaires, of the five studies, one study recruited amnestic MCI (Alzheimer's Disease Cooperative Study/Activities of Daily Living (ADCS/MCI/ADL-24), two studies did not specify MCI type (Advanced activities of daily living (a-ADL), Bayer's ADL), and two studies recruited single and multiple domains MCI (i.e., the DAD-6 and the FAQ).

Scoring. Most of the performance-based assessments use an accuracy score, which evaluates individuals on their ability to complete the items correctly. One exception concerns the NAT, in which individuals are scored on the accomplishment of each subtask (e.g., bread toasted, sandwich made) and error score (i.e., toasts more than one slice of bread). Each item has a particular preset number of steps to be performed. Thus, the accomplishment score is the percentage of the completed required steps (with or without error).

Different scoring systems have been used for the questionnaires. One tool uses a dichotomous scale (yes/no, able or unable to do the task) and further refined the scoring according to the level of independence and physical assistance required (i.e., ADCS/MCI/ADL-24). Two tools use a point scale (i.e., the a-ADL and the FAQ) based on the level of difficulty or assistant required to perform the activity. One tool (i.e., the FAQ) uses a 10-point scale (from "never" to "always"), and, finally, one tool (i.e., the DAD-6) includes three questions pertaining to executive functioning (i.e., initiation, planning-organization, and effective performance) and the scores vary from 0 to 3. The informant can answer "yes" or "no" to indicate whether the patient can perform an IADL or not. The response "no" is grouped in three categories based on the cause of difficulty (e.g., sensorimotor).

Discussion

According to this review, the characteristics of the instruments used in the literature to assess functional impairment in individuals with MCI vary greatly. Specifically, different functional domains have been assessed, different scoring systems have been used, and different MCI subtypes have been recruited in each study. Each of these points has clear implications in clinical practice.

First, while the vast majority of tools assess complex IADLs (e.g., finance management or meal preparation), there are many that still assess more basic functions (e.g., washing oneself, dressing). Considering that the current criteria for the

diagnosis of MCI states that MCI individuals may preserve independence in functional activities but exhibit very subtle difficulties in function (Albert et al., 2011), we question the appropriateness of using basic IADL domains when assessing functional impairment in this population, as the basic skills are expected to still be intact in this clientele. Clearly, there is no consensus regarding assessment of functional domains. Nonetheless, some studies have identified certain activities that might be more restricted in MCI, such as financial management, shopping, medication management, walking, traveling, and managing everyday technology (Dodge, Mattek, Austin, Hayes, & Kaye, 2012; Hughes, Chang, Vander Bilt, Snitz, & Ganguli, 2012; Nygård, Pantzar, Uppgard, & Kottorp, 2012). However, considering individuals' different lifestyles and activity performance, should the focus be on a specific activity or on the level of difficulty across many activities? To date, no criterion has been proposed in the literature in order to assess functional impairment in this population, and this review did little to shed light in this area, as different groups are using different instruments and assessing different functional domains.

Second, different MCI subtypes have been recruited in each study, without prior evidence to support a link between the type of IADL restriction and the MCI subtype. Thus, it is not possible to generalize the findings of the studies. In essence, without more standard criteria for diagnosis and better characterization of subtypes, a consensus on functional criteria cannot be reached.

Third, different scoring systems have been used. Most of the assessments use a global scoring system. However, global scores might not capture the very subtle changes in functional performance that affect individuals with MCI as they are still independent in performing everyday activities but make more errors through their performance (Albert et al., 2011). Thus, applying error analysis to a performance-based tool might be more sensitive to capture the subtle changes in MCI (Giovannetti et al., 2008). Quantifying errors in different tasks could enable clinicians to identify the specific functional impairments. The NAT was the only tool found in our review that uses error analysis. However, the unfamiliar and simulated environments in the studies of this review pose challenges to assess individuals with MCI as it is now recognized that performance observed in the person's home and familiar community environment better reflects real-life abilities (Provencher, Demers, Gagnon, & Gélinas, 2012).

Fourth, clinicians should be cautious when using a questionnaire with this population. While Farias, Mungas, and Jagust (2005) state that people with MCI may be fairly accurate in their ability to report their functional status, other investigations have revealed a difference between self- or informant-reported functional status and actual functional status. For instance, Tabert et al. (2002) state that MCI patients may tend to overestimate their functional status. Moreover, collateral sources may be biased and underestimate the functional performance due to emotional factors or their relationship with the patient (Lowenstein & Mogosky, 1999). Therefore, both self- and informant-report questionnaires have limitations, as they may not offer an accurate indication of

functional abilities.

Limitations

Every effort was made to ensure that the search encompassed all of the tools that have been used to assess functional performance in MCI. Nonetheless, it is possible that some instruments have been missed. In addition, we only included tools that are available in English and were peer-reviewed. Thus, the conclusion drawn is limited to the tools included in this study.

Conclusion

There is no consensus in the literature in terms of how to assess functional impairment in MCI. In fact, different groups are using different tools and covering different functional domains, and different MCI subtypes have been recruited for these studies. It is also not clear from the literature if it is important to focus on specific functional domains or more general errors during task performance. Based on the results of this study, no specific tool can be recommended to clinicians to assess functional performance in individuals with MCI. Nonetheless, along with other studies that have looked at the validations of the tools proposed here (Belchior, Holmes et al., 2015; Kaur, et al., 2015), this study allows clinicians to make better-informed decisions when choosing a functional assessment for this population. Specifically, this study provides information about the tools that have been validated with the MCI population, the specific functional domains covered in each tool along with the scoring system, and the MCI subtypes recruited in each study. Also, considering that observing a person in a natural environment better reflects real-life abilities, clinicians should consider using performance-based tools to assess the subtle functional difficulties experienced by individuals with MCI. Future research should establish operationalization criteria for functional impairment in MCI as well as rates of functional decline in MCI, norms of instruments, and cutoff points.

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