

Variables Associated with Self-reported Language Impairment in Multiple Sclerosis

A Regression Analysis

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CME/CNE Information

Activity Available Online: To access the article, post-test, and evaluation online, go to <https://www.highmarksce.com/mscare>.

Target Audience: The target audience for this activity is physicians, physician assistants, nursing professionals, speech pathologists, and other health care providers involved in the management of patients with multiple sclerosis (MS).

Learning Objectives:

- 1) Identify several variables that may place a person with MS at risk of language symptoms.
- 2) Describe the role of frontline health care providers in management of language and communication symptoms in patients with MS.

Accreditation Statement:



In support of improving patient care, this activity has been planned and implemented by the Consortium of Multiple Sclerosis Centers (CMSC) and Delaware Media Group. The CMSC is jointly accredited by the Accreditation Council for Continuing Medical Education (ACCME), the Accreditation Council for Pharmacy Education (ACPE), and the American Nurses Credentialing Center (ANCC), to provide continuing education for the healthcare team.

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Disclosures: Francois Bethoux, MD, Editor in Chief of the *International Journal of MS Care (IJMSC)*, has served as Physician Planner for this activity. He has disclosed relationships with Springer Publishing (royalty), Qr8 (receipt of intellectual property rights/patent holder), Biogen (receipt of intellectual property rights/patent holder, speakers' bureau), GW Biosciences (consulting fee), MedRhythms (consulting fee, contracted research), Genentech (consulting fee), Helius Medical Technologies (consulting fee), Osmotica (consulting fee), and Adamas Pharmaceuticals (contracted research). Laurie Scudder, DNP, NP, has served as Reviewer for this activity. She has disclosed no relevant financial

Note: Supplementary material for this article is available at ijmsc.org.

DOI: 10.7224/1537-2073.2020-096

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relationships. Sarah El-Wahsh, BAppSc (Sp Path) (Hons 1), has disclosed no relevant financial relationships. Rob Heard, PhD, has disclosed no relevant financial relationships. Hans Bogaardt, PhD, has disclosed no relevant financial relationships. Fiona Kumfor, PhD, has disclosed no relevant financial relationships. Kirrie J. Ballard, PhD, has disclosed founding a start-up unrelated to the topic of this article; to date, the start-up designs apps for delivering speech therapy to children with developmental speech disorders. The peer reviewers for *IJMSC* have disclosed no relevant financial relationships. The staff at *IJMSC*, *CMSC*, and Delaware Media Group who are in a position to influence content have disclosed no relevant financial relationships. Note: Financial relationships may have changed in the interval between listing these disclosures and publication of the article.

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Release Date: April 1, 2021

Valid for Credit Through: April 1, 2022

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Background: Persons with multiple sclerosis (MS) can experience language-related symptoms such as difficulty with word finding, understanding verbal information, and structuring discourse. These symptoms have negative psychological and interpersonal consequences. Studies exploring characteristics of language impairment in MS are limited. The aim of this study was to investigate what symptom-related (eg, fatigue), demographic (eg, age), clinical (eg, MS type), social network, and quality of life (QOL) variables are associated with language impairment in MS.

Methods: Participants were recruited internationally to complete an online questionnaire. A forward stepwise regression analysis was run with the dependent variable being a language impairment index from the Communication and Language Assessment questionnaire for persons with Multiple Sclerosis (CLAMS). Nineteen independent variables were entered into the regression.

Results: Two hundred and two participants completed the questionnaire. The CLAMS language impairment score was significantly associated with self-reported cognitive impairment, speech and voice impairment, yes/no response to a binary question on presence of language impairment, group membership and participation, and QOL. The adjusted R^2 value was 0.717 ($P < .001$).

Conclusions: Self-reported language impairment in MS is significantly associated with several symptom-related, social network, and QOL variables. These results provide an early model of language impairment in MS to guide future studies of treatment approaches and causative relationships between variables. *Int J MS Care.* 2021;23:85-92.

Persons with multiple sclerosis (MS) can experience language-related symptoms. Research studies involving standardized assessments and self-report measures have found that persons with MS can experience difficulty with word finding,¹⁻³ comprehending spoken language,³ discourse structure,⁴ and comprehending nonliteral language.^{5,6}

Effective communication is critical for performing daily activities, pursuing goals and hobbies, making and maintaining relationships, participating in health care decisions, having independence, and being involved in the community. Language-related symptoms in MS can have negative psychosocial ramifications, such as frustration, embarrassment, loneliness, and limitations in social and familial relationships.^{7,8} In a study on quality of life (QOL), 43% of persons with MS (N = 30) experienced language difficulties that affected their QOL (eg, “It is extremely frustrating. I can’t say what I want to say,” “You feel incompetent”).⁸ There is growing evidence that language can be affected in MS; however, studies that examine what variables are associated with these symptoms are lacking. This information would inform

patient care and future studies investigating the management of language-related symptoms in MS.

Patient-reported outcome measures (PROMs) are tools that gather information about the effects of a condition from the perspective of the individual with the disease without input from an external party.⁹ These tools are especially useful when exploring variables that are difficult to observe firsthand (eg, fatigue, pain, emotional well-being),¹⁰ which are variables of interest in this study. A previous study used PROMs to explore the association between self-reported language impairment in MS and health-related QOL (HRQOL), demographic, and clinical variables.³ This research quantitatively found that self-reported language impairment was associated with lower mental and physical HRQOL. An acknowledged limitation was that self-reported language function was assessed using four questionnaire items. This may be considered a cursory measure of language function. Moreover, the study involved only bivariate analysis to explore potential relationships. Given the potential impact of language-related symptoms on HRQOL, this preliminary study highlights the need to further investigate variables associated with language function in MS using a more comprehensive PROM and more advanced methods of statistical analysis.

The aim of this study was to investigate what self-reported symptom-related, demographic, clinical, social network, and QOL variables are significantly associated

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with self-reported language impairment in a sample of persons with MS. A data-driven approach was used.

Methods

This research was approved by The University of Sydney Human Research Ethics Committee.

Participant Sample and Recruitment

To be eligible, participants were required to be 18 years of age or older, report a diagnosis of MS, speak English as their main language (ie, the language spoken most fluently and most often), and report no other history of neurologic deficits. Participants were not required to have a language impairment.

Participants were recruited internationally in response to advertisements placed with MS organizations, neurology and general practitioner clinics, and speech pathology forums, as well as social media platforms. These relevant groups were identified through a Google search. The advertisement informed participants about the study purpose and procedures, and it contained the questionnaire link.

Procedure

Participants completed a package of self-reported questionnaires covering numerous topics: language-related symptoms, speech and voice symptoms, cognitive functions, fatigue, pain, mobility, hearing, vision, social networks, emotional well-being, and general HRQOL. These topics were selected based on findings from previous research indicating that these variables are pertinent to MS. Participants completed the questionnaire package online using REDCap (Research Electronic Data Capture) software. Submission of a completed questionnaire constituted informed consent. Participants were able to complete the questionnaire in one or multiple sessions to reduce respondent burden. Participants were asked if they used the "save and return later" function to complete the full questionnaire within 1 week.

Questionnaire Battery

Demographic and Clinical Questions

Participants reported their sex, age, country of residence, highest level of education, employment status, and number of languages spoken. Participants also completed clinical questions pertaining to MS type, disease duration, age at diagnosis, history of childhood communication difficulties, and involvement with speech pathology services.

Language Functioning

Language skills were measured using the Communication and Language Assessment questionnaire for persons with Multiple Sclerosis (CLAMS).¹¹ The CLAMS is an 11-item PROM that assesses self-reported language function in MS. Items address a variety of language skills (eg, word finding, clarity, cohesion, specificity, and logicalness of verbal expression). The CLAMS has been validated for persons with MS, and statistical analyses have demonstrated satisfactory internal consistency, test-retest reliability, criterion validity, and no floor or ceiling effects.

Speech and Voice Functioning

Speech and voice skills were measured using the Speech pathology-specific questionnaire for persons with Multiple Sclerosis (SMS).¹² The SMS has been validated for persons

with MS and has been shown to be psychometrically sound. The five items of the speech and voice component of the SMS were used in this study.

Speech Usage

Speech usage was measured using the Levels of Speech Usage scale.¹³ This is a single-item scale that asks participants to select a category that best reflects their speech demands in everyday living. The five categories are undemanding, intermittent, routine, extensive, and extraordinary use.

Cognitive Functioning

Cognitive ability was measured using the five-item version of the Perceived Deficits Questionnaire (PDQ).¹⁴ Although performance-based neuropsychological assessment is a well-established measure of cognitive ability, it can be time-consuming and expensive and was impractical for this study given its international online design. The PDQ was designed specifically for persons with MS to evaluate self-reported cognitive skills and is one of the symptom-specific measures in the Multiple Sclerosis Quality of Life Inventory (MSQLI).¹⁵

Symptoms of MS

Symptoms of MS, including those concerning pain, fatigue, emotional well-being, and mobility, were measured using the 36-item Short Form Health Survey (SF-36).¹⁶ The SF-36 is one of the most widely used patient-reported HRQOL measures and is frequently used in MS research.¹⁷ It is also included in the MSQLI.¹⁵

Quality of Life

General QOL was measured using a single-item scale that asks participants to rate their overall QOL on a 10-point visual analogue scale, with anchors of 0 (worst possible QOL) and 10 (best possible QOL). A definition of QOL was provided to participants. This single-item scale is similarly used in the MSQLI.¹⁸

Social Networks

Social networks were primarily measured using the Stroke Social Network Scale.¹⁹ This tool measures social networks across five key domains: children, close relatives, close friends, groups, and satisfaction. Questions pertain to size of networks, frequency of contact, proximity, and satisfaction with frequency of contact. Although this tool is validated for the stroke population, this 22-item questionnaire was used given its underlying conceptual model, ensuring brevity but also ability to capture information across separate social constructs. The SF-36 also yields a social functioning scale and was used as a collateral measure of social networks.

Data Analysis

Raw data from REDCap were transferred into SPSS Statistics for Windows, version 26.0 (IBM Corp) for analyses. This study involved a quantitative experimental design using survey methods and a forward stepwise linear regression analysis. The dependent variable was the CLAMS score. Before performing the regression analysis, categorical data were dichotomized. Type of MS was collapsed into two categories: relapsing-remitting MS and chronic progressive MS (secondary progressive MS, primary progressive MS, progressive relapsing MS). Education data were collapsed into two categories: university degree (undergraduate qualification, postgraduate qualifica-

tion) and no university degree (secondary education, certificate/diploma). Correlations between the CLAMS score and potential independent variables were evaluated using Pearson or Spearman correlation coefficients between continuous variables and point biserial or nonparametric point biserial correlations between continuous and dichotomous variables. These correlational data were used to evaluate statistical significance and to inspect for the possibility of multicollinearity. If two independent variables correlated greater than 0.7 with each other, one of the two independent variables was removed from the regression analysis to avoid multicollinearity.²⁰ Independent variables that did not have a statistically significant correlation ($P > .10$) were not entered into the regression analysis.²¹ All the statistical tests were two-tailed. A z test using skewness and kurtosis (the statistic divided by its standard error) was used to examine the normality of residuals. An absolute $z < 2.575$ was considered to indicate a normal distribution.²⁰

Results

Participants

Two hundred and two participants responded to the questionnaire package. Characteristics of all but one participant are shown in Table 1.

Variables Associated with Language Impairment

Descriptive statistics of the CLAMS and independent variables entered into the regression analysis can be found in Table S1 (published in the online version of this article at ijmsc.org). Bivariate correlations between language impairment scores and all the potential independent variables considered for inclusion in the regression analysis can also be found in Table S2.

No pairs of independent variables correlated greater than 0.7. Twelve variables were not statistically significantly correlated with the dependent variable. The following 19 variables were entered into the regression analysis: age, MS type, vision impairment, language impairment–binary, speech and voice impairment, levels of speech use, QOL, language impairment and QOL, cognitive impairment, fatigue, pain, role limitations due to physical health, role limitations due to emotional health, emotional well-being, general health, close friends, group membership and participation, social functioning, and satisfaction with social networks. Participants were provided with a definition of language and examples of language difficulties to ensure a common understanding of terminology.

A box and whisker plot showed a data point beyond the upper fence, indicating that one participant seemed to be an extreme outlier. The regression analysis was run without this extreme case. Using SPSS, we built a model in five steps. In the final model, the following variables combined were identified as significant predictors of the CLAMS score and were added by SPSS in the following

Table 1. Characteristics of 201 study participants

Characteristic	Value
Sex	
Female	183 (91.0)
Male	18 (9.0)
Age, median [IQR], y	48.0 [37.0-57.0]
Country of residency	
Australia	128 (63.7)
United Kingdom	25 (12.4)
United States	28 (13.9)
New Zealand	14 (7.0)
Other	6 (3.0)
Multiple sclerosis type	
Relapsing-remitting	157 (78.1)
Secondary progressive	22 (10.9)
Primary progressive	20 (10.0)
Progressive relapsing	2 (1.0)
Disease duration, median [IQR], y	8.0 [3.0-14.0]
Age at diagnosis, median [IQR], y	38 [28.0-45.5]
Education	
Secondary education	33 (16.4)
Certificate/diploma	74 (36.8)
Undergraduate qualification	61 (30.3)
Postgraduate qualification	33 (16.4)
Currently employed	
Yes	106 (52.7)
No	95 (47.3)
Employment status	
Full-time	56 (27.9)
Part-time	39 (19.4)
Self-employed	6 (3.0)
Retired due to disability	45 (22.4)
Retired due to age	14 (7.0)
Student	6 (3.0)
Volunteer	8 (4.0)
Stay-at-home parent	13 (6.5)
Other	14 (7.0)
Receiving speech pathology services	
Yes	19 (9.5)
No	182 (90.5)
No. of languages spoken	
1	174 (86.6)
>1	27 (13.4)
History of childhood communication difficulties (stuttering, speech, language, voice, hearing)	
Yes	16 (8.0)
No	185 (92.0)

Note: Values are given as number (percentage) unless otherwise indicated. Data from one of the 202 participants were removed in the regression analysis stage and are not reported in this table. Abbreviation: IQR, interquartile range.

order: cognitive impairment, speech and voice impairment, language impairment–binary, group membership and participation, and language impairment and QOL (Table 2). The percentage of variance explained by the

Table 2. Regression coefficients and statistical significance for final regression model

Variable	Unstandardized coefficients	Standardized coefficients	t value	P value
Constant	8.081		7.863	<.001
Cognitive impairment	0.805	0.527	11.123	<.001
Speech and voice impairment	0.605	0.285	6.361	<.001
Language impairment–binary	2.016	0.125	2.949	.004
Group membership and participation	–0.025	–0.122	–3.163	.002
Language impairment and quality of life	1.305	0.083	1.989	.048

Note: The single outlier case was removed.

model was 71.7% (adjusted $R^2 = 0.717$, $P < .001$). The z values of kurtosis and skewness of the residuals fell within the acceptable range for being normally distributed (z values: kurtosis = 0.6, skewness = 1.9).²⁰

Discussion

There is growing evidence that language can be affected in MS; however, quantitative studies investigating variables associated with these symptoms are lacking. This study aimed to investigate what self-reported symptom-related, demographic, clinical, social network, and QOL variables are associated with language impairment in MS using a comprehensive PROM and multivariate analysis. The results of this study suggest that self-reported cognitive impairment, speech and voice impairment, yes/no response to a binary question on presence of language impairment, and QOL can predict scores on the CLAMS.

Symptom-Related Variables and Language Impairment

In this study, persons with MS who self-reported greater cognitive impairment tended to score higher on the CLAMS, which indicates greater language impairment. Cognitive impairment is a common feature of MS, affecting approximately 43% to 70% of persons with MS.²² There is increasing interest in and discussion about the interrelationship between cognitive functions (eg, memory, perception, thinking), executive functions (eg, attention, inhibition, flexibility), and the production and comprehension of language.²³ Persons with MS present with difficulty with high-level language tasks (eg, making inferences, interpreting metaphors).^{5,6} Lethlean and Murdoch⁵ describe high-level language skills as the ability to execute both complex linguistic skills and cognitive processes simultaneously to participate in a communicative act. One of the most commonly reported language-related symptoms in MS is word-finding difficulty.¹⁻³ Lethlean and Murdoch²⁴ suggest that naming errors in MS are due to a lexical semantic accessing deficit. Others have argued that naming deficits in MS extend beyond the language system to other cogni-

tive functions, such as attention and memory.²⁵ The interaction between language and cognition remains an unresolved scientific question. It is currently unclear whether language difficulties in MS are due to damage to language-specific brain networks or to domain-general cognitive skills, such as attention or working memory capacity. From a clinical perspective, the present results suggest that persons with MS who have an identified cognitive impairment should be asked about potential language-related symptoms and given the option for referral to speech pathology for further evaluation.

Greater self-perceived speech and voice impairment on the SMS was associated with higher CLAMS scores, indicating greater language impairment. The reported prevalence of motor speech impairment (ie, dysarthria) in MS varies from 40% to 55%.²⁶ Ataxic, spastic, and mixed ataxic-spastic dysarthria are the most frequent dysarthria types in MS.²⁷ Common deviant motor speech and voice changes reported in MS include imprecise articulation, slow speech rate, impaired loudness and pitch control, asthenia, strain, and breathiness.²⁷ The results of this study support previous clinical studies that language changes in MS can co-occur with dysarthria.²⁸ It is important that speech pathologists working with persons with MS with motor speech and voice changes are vigilant about subtle language-related symptoms and screen, assess, and manage these symptoms appropriately.

A notable finding of this study was that a binary yes/no question (ie, “Since your MS diagnosis, have you experienced any language difficulties?”) was significantly associated with scores on the CLAMS. This single question accounted for 23% of variance in the CLAMS score ($r = 0.480$). Therefore, although it is not sufficient to replace the CLAMS, it may be useful as an initial screening question. Conversely, an answer of “no” is not sufficient to rule out potential language impairment and should be considered alongside other risk factors identified herein, such as self-reported cognitive, motor speech, and voice impairment.

QOL and Language Impairment

Persons with MS who self-reported that a language impairment negatively affected their QOL tended to score more highly on the CLAMS, indicative of more severe language-related symptoms. There is a growing body of evidence suggesting that language impairment in MS can negatively affect QOL.^{7,8} Furthermore, it has been found that concerns of doctors may not correlate with those of persons with MS, whereby doctors focus more on physical manifestations and patients are more concerned by less tangible difficulties, such as the mental, emotional, and psychological ramifications of the condition.²⁹

Group Membership and Participation and Language Impairment

The final significant variable in the model was group membership and participation. Individuals who reported lower levels of group membership and participation tended to score higher on the CLAMS. The directionality of this association cannot be determined from the data. There are no studies that comprehensively investigate the experiences of persons with MS with language impairment and group involvement. In the absence of research investigating group involvement and language impairment in MS, we can turn to the more well-established body of research on poststroke aphasia to elucidate this finding. Barriers to participation in community groups reported by people with poststroke aphasia include limited awareness from others about communication difficulties, unwillingness of group members to converse with less fluent communicators, feeling different, misconceptions about intelligence, and concerns of not being understood.³⁰ Moreover, people with poststroke aphasia report environmental factors in group settings (eg, background noise, crowded spaces, poor lighting) as being less conducive to effective communication and, hence, creating a sense of disablement.³⁰ Perhaps these barriers to group participation experienced by people with poststroke aphasia are also shared with persons with MS. It is also possible that group involvement is associated with variables not tested in this study, such as social anxiety and access challenges (eg, travel). Participation in nonobligatory groups can foster a sense of relatedness, support, companionship, and feelings of happiness.³¹ Furthermore, perhaps increasing social participation can provide opportunities for practicing, maintaining, and/or extending communication skills. Further research is needed to identify whether increased group membership improves language or whether

improving language results in more group membership in persons with MS.

Demographic and Clinical Variables and Language Impairment

Most of the demographic and clinical variables assessed in this study were not statistically significantly associated with language impairment in the bivariate analyses and, hence, were not entered into the regression. Exceptions were age and MS type, which were statistically significantly associated with the CLAMS score and, hence, were entered into the regression. However, they were not identified as statistically significant variables in the final model. This is consistent with previous research that demographic and clinical characteristics may not be useful in indicating persons with MS who have or may be at risk for language impairment.^{3,10}

Limitations and Future Research

There are several limitations in the present study. The study used an online questionnaire. This meant that the research team was unable to verify whether participants had a formal MS diagnosis and had to rely on participants reporting inclusion criteria accurately. Despite this limitation, the online method allowed for rapid dissemination and international participation.³² Moreover, it ensured that all participants received the questionnaire in exactly the same way, reduced participant burden because participants could save and return to the questionnaire, and used minimal costs and resources.³² The findings from this study provide preliminary results to guide future, more comprehensive clinical research.

In addition, one of the measures used to evaluate social networks, the Stroke Social Network Scale, was validated in the stroke population. It is acknowledged that PROMs should be validated in the population of interest to ensure a valid and reliable tool that measures the intended construct.³³ This tool was chosen given its structure, which provides a breakdown of different social circles (children, close relatives, close friends, groups) across different components (circle size, frequency of contact, satisfaction). The authors carefully reviewed the questionnaire, and the items were considered highly relevant to the MS population. Moreover, a collateral measure of social networks was used (SF-36 social functioning items). Also note that the PDQ has been shown to correlate more with measures of depression than with standardized cognitive assessments³⁴; however, it was used in this study because it is a measure from the MSQLI, a battery of PROMs that address the concerns most pertinent to the MS population.¹⁵

Another limitation is that this study investigated a large number of potential independent variables in a relatively small sample size. Furthermore, the findings are limited to variables entered in the regression model. Future research may consider confirming this regression model in a larger sample, as well as the addition of other variables.

Although PROMs provide a useful means for evaluating variables more difficult to observe firsthand (eg, fatigue), there is limited research on the correlation between PROMs and standardized language assessments. Nevertheless, the online method had several advantages, as mentioned previously herein. Future work should consider how self-reported language measures correlate with standardized assessments.

Future research should also seek to elucidate the nature and underlying neuropathology of language impairment in MS. Little work has been performed to methodically or thoroughly explore the interrelationship between language and cognition in MS. Accordingly, future research might consider using a combination of standardized language and cognitive assessments, neuroimaging, and PROMs. New insights into potential correlations between language and cognition in MS may help provide the necessary groundwork to develop evidence-based interventions to target these symptoms.

Clinical Implications

The findings reported herein and elsewhere³ indicate that language impairment is reported by at least one in four persons with MS. It would be expected that speech pathology services are frequently used by persons with MS given the reported frequency of symptoms and their effect on QOL. However, this is not the case. In this study, only 19 participants (9.5%) reported engagement with speech pathology services. The scarcity of speech pathology services to persons with MS who report language-related symptoms is a trend observed in other studies.^{2,3,8,12} Speech pathologists need to raise awareness and promote their role as extending beyond dysarthria and dysphagia management in MS to include assessment and management of language-related symptoms.

A speech pathologist can be a valuable member of a team caring for individuals with neurologic disorders such as MS.³⁵ Speech pathologists can play a role in conducting comprehensive language assessment, providing education to patients and carers about language-related symptoms in MS, teaching compensatory strategies, collaborating with multidisciplinary professionals (eg, occupational therapists, neuropsychologists) to manage other cognitive functions that may influence language

(eg, attention), advocating for services, and attending to the holistic psychosocial well-being of the individual. The overall aim of these supports is to optimize the individual's educational, vocational, and psychosocial outcomes.³⁵

Frontline health care providers on the MS health care team should ask their patients about potential language-related symptoms and whether these difficulties affect their QOL. Although all patients should be asked about these potential symptoms, based on the results of this study, extra attention should be given to individuals with cognitive, motor speech, and voice impairment. Subsequently, the health care provider can administer a PROM to further screen for language impairment and discuss the option for referral to speech pathology for further evaluation.

Early referrals from frontline health care providers are key to early identification of and intervention for language impairment. As such, frontline health care providers are encouraged to refer patients to speech pathology liberally rather than undertaking "presorting triage" (eg, "symptoms are too mild").³⁶ Speech pathologists can work with individuals to determine whether they would benefit from speech pathology services. Miller et al³⁷ highlight the importance of early evaluation and intervention of communication changes in neurodegenerative conditions in their remark, "There exists an argument for early referral for evaluation of communi-

PRACTICE POINTS

- Self-reported language impairment in MS can be predicted by self-reported cognitive impairment, speech and voice impairment, yes/no response to a binary question on presence of language impairment, group membership and participation, and negative effect on quality of life (QOL).
- Frontline health care providers (eg, neurologists, general practitioners) should be alert to these variables because they may place persons with MS at risk of language impairment and lowered QOL.
- Frontline health care providers on the MS health care team should ask their patients about potential language-related symptoms and whether these affect their QOL, with the option for referral to speech pathology for further evaluation and management.

cation changes extending to psychosocial impact If one waits until these become obvious, the person may well have developed such feelings of loss of control and confidence that these become significant added barriers to improvement”

Conclusions

This study shows that self-reported language impairment in MS is significantly associated with several symptom-related, social network, and QOL variables. Frontline health care providers should be alert to this constellation of variables because they may place persons with MS at risk for language impairment and lowered QOL. Persons with MS who report language-related symptoms across the spectrum of severity, including mild symptoms, should be offered referral to speech pathology. The results of this study provide an early model of language impairment in MS that can guide future studies of intervention approaches and exploration of causative relationships between variables. □

Acknowledgments: The authors acknowledge with gratitude the persons with MS who participated in this study. Without them, this study would not be possible.

Financial Disclosures: Dr Ballard has disclosed founding a start-up unrelated to the topic of this article; to date, the start-up designs apps for delivering speech therapy to children with developmental speech disorders. The other authors declare no conflicts of interest.

Funding/Support: Dr Kumfor is supported by a National Health and Medical Research Council (NHMRC) Career Development Fellowship (GNT1158762).

References

- Renauld S, Mohamed-Saïd L, Macoir J. Language disorders in multiple sclerosis: a systematic review. *Mult Scler Relat Disord*. 2016;10:103-111.
- Johansson K, Schalling E, Hartelius L. Self-reported changes in cognition, communication and swallowing in multiple sclerosis: data from the Swedish Multiple Sclerosis Registry and from a national survey. *Folia Phoniatri Logop*. 2021;73:50-62.
- El-Wahsh S, Ballard K, Kumfor F, Bogaardt H. Prevalence of self-reported language impairment in multiple sclerosis and the association with health-related quality of life: an international survey study. *Mult Scler Relat Disord*. 2020;39:101896.
- Arrondo G, Sepulcre J, Duque B, Toledo J, Villoslada P. Narrative speech is impaired in multiple sclerosis. *Eur Neurol J*. 2010;2:1.
- Lethlean JB, Murdoch BE. Performance of subjects with multiple sclerosis on tests of high-level language. *Aphasiology*. 1997;11:39-57.
- Carotenuto A, Arcara G, Orefice G, et al. Communication in multiple sclerosis: pragmatic deficit and its relation with cognition and social cognition. *Arch Clin Neuropsychol*. 2018;33:194-205.
- Yorkston KM, Baylor CR, Klasner ER, et al. Satisfaction with communicative participation as defined by adults with multiple sclerosis: a qualitative study. *J Commun Disord*. 2007;40:433-451.
- Klugman TM, Ross E. Perceptions of the impact of speech, language, swallowing, and hearing difficulties on quality of life of a group of South African persons with multiple sclerosis. *Folia Phoniatri Logop*. 2002;54:201-221.
- Patient-reported outcome measures—use in medical product development to support labeling claims. US Food and Drug Administration. December 2009. Accessed May 2, 2020. <https://www.fda.gov/regulatory-information/search-fda-guidance-documents/patient-reported-outcome-measures-use-medical-product-development-support-labeling-claims>

- Yorkston KM, Baylor C, Amtmann D. Communicative participation restrictions in multiple sclerosis: associated variables and correlation with social functioning. *J Commun Disord*. 2014;52:196-206.
- El-Wahsh S, Bogaardt H, Kumfor F, Ballard K. Development and validation of the Communication and Language Assessment questionnaire for persons with Multiple Sclerosis (CLAMS). *Mult Scler Relat Disord*. 2020:102206.
- El-Wahsh S, Heard R, Bogaardt H. Development and validation of a speech pathology-specific questionnaire for persons with multiple sclerosis (SMS). *Int J Speech Lang Pathol*. 2019;21:553-563.
- Baylor C, Yorkston K, Eadie T, Miller R, Amtmann D. Levels of Speech Usage: a self-report scale for describing how people use speech. *J Med Speech Lang Pathol*. 2008;16:191-198.
- Sullivan MJ, Edgley K, Dehoux E. A survey of multiple sclerosis, I: perceived cognitive problems and compensatory strategy use. *Can J Rehabil*. 1990;4:99-105.
- Rivo PG, Fischer JS, Miller DM, et al. *Multiple Sclerosis Quality of Life Inventory: A User's Manual*. National Multiple Sclerosis Society; 1997.
- Stewart AL, Hays RD, Ware JE. The MOS short-form general health survey: reliability and validity in a patient population. *Med Care*. 1988;26:724-735.
- Hobart J, Freeman J, Lamping D, et al. The SF-36 in multiple sclerosis: why basic assumptions must be tested. *J Neural Neurosurg Psychiatry*. 2001;71:363-370.
- Vickrey B, Hays RD, Harooni R, Myers LW, Ellison GW. A health-related quality of life measure for multiple sclerosis. *Qual Life Res*. 1995;4:187-206.
- Northcott S, Hilari K. Stroke Social Network Scale: development and psychometric evaluation of a new patient-reported measure. *Clin Rehabil*. 2013;27:823-833.
- Tabachnick BG, Fidell LS. Screening data prior to analysis. In: Mosher J, ed. *Using Multivariate Statistics*. 6th ed. Pearson; 2013:73-74,84.
- Hosmer DW Jr, Lemeshow S, Sturdivant RX. *Applied Logistic Regression*. Vol 398. John Wiley & Sons; 2013.
- Grzegorski T, Losy J. Cognitive impairment in multiple sclerosis—a review of current knowledge and recent research. *Rev Neurosci*. 2017;28:845-860.
- Perlovsky L. Language and cognition—joint acquisition, dual hierarchy, and emotional prosody. *Front Behav Neurosci*. 2013;7:123.
- Lethlean JB, Murdoch BE. Naming errors in multiple sclerosis: support for a combined semantic/perceptual deficit. *J Neurolinguistics*. 1994;8:207-223.
- de Dios Pérez B. *Anomia in People With Relapsing-Remitting Multiple Sclerosis*. Master's thesis. The University of Manchester; 2017.
- Hartelius L, Runmarker B, Andersen O. Prevalence and characteristics of dysarthria in a multiple-sclerosis incidence cohort: relation to neurological data. *Folia Phoniatri Logop*. 2000;52:160-177.
- Duffy JR. Mixed dysarthria. In: *Motor Speech Disorders: Substrates, Differential Diagnosis, and Management*. Elsevier; 2019:227-256.
- Mackenzie C, Green J. Cognitive-linguistic deficit and speech intelligibility in chronic progressive multiple sclerosis. *Int J Lang Commun Disord*. 2009;44:401-420.
- Rothwell P, McDowell Z, Wong C, Dorman P. Doctors and patients don't agree: cross sectional study of patients' and doctors' perceptions and assessments of disability in multiple sclerosis. *BMJ*. 1997;314:1580.
- Lanyon L, Worrall L, Rose M. Exploring participant perspectives of community aphasia group participation: from "I know where I belong now" to "Some people didn't really fit in." *Aphasiology*. 2018;32:139-163.
- Meshram K, O'Cass A. Exploring civic engagement through seniors' good citizenship behavior within clubs. *J Nonprofit Public Sector Marketing*. 2013;25:256-283.
- Ball HL. Conducting online surveys. *J Hum Lact*. 2019;35:413-417.
- Kingsley C, Patel S. Patient-reported outcome measures and patient-reported experience measures. *BJA Educ*. 2017;17:137-144.
- Strober LB, Binder A, Nikelshpur OM, Chiaravalloti N, DeLuca J. The Perceived Deficits Questionnaire: perception, deficit, or distress? *Int J MS Care*. 2016;18:183-190.
- National Clinical Guideline Centre (UK). *Multiple Sclerosis: Management of Multiple Sclerosis in Primary and Secondary Care*. National Institute for Health and Care Excellence; 2014.
- LaPointe LL. What the speech pathologist expects from the neurologist. In: *Clinical Aphasiology: Proceedings of the Conference 1977*. BRK Publishers; 1977.
- Miller N, Noble E, Jones D, Allcock L, Burn DJ. How do I sound to me? perceived changes in communication in Parkinson's disease. *Clin Rehabil*. 2008;22:14-22.