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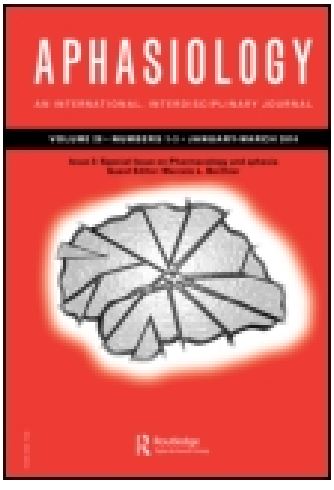

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Aphasiology
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/paph20

Use of the Progressive Aphasia Severity Scale (PASS) in monitoring speech and language status in PPA

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Published online: 24 Jul 2014.

To cite this article: Daisy Sapolsky, Kimiko Domoto-Reilly & Bradford C. Dickerson (2014) Use of the Progressive Aphasia Severity Scale (PASS) in monitoring speech and language status in PPA, Aphasiology, 28:8-9, 993-1003, DOI: 10.1080/02687038.2014.931563

To link to this article: http://dx.doi.org/10.1080/02687038.2014.931563

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Aphasiology, 2014
Vol. 28, Nos. 8–9, 993–1003, http://dx.doi.org/10.1080/02687038.2014.931563

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Use of the Progressive Aphasia Severity Scale (PASS) in monitoring speech and language status in PPA

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Background: Primary progressive aphasia (PPA) is a devastating neurodegenerative syndrome involving the gradual development of aphasia, slowly impairing the patient's ability to communicate. Pharmaceutical treatments do not currently exist and intervention often focuses on speech and language behavioural therapies, although further investigation is warranted to determine how best to harness functional benefits. Efforts to develop pharmaceutical and behavioural treatments have been hindered by a lack of standardised methods to monitor disease progression and treatment efficacy.
Aims: Here, we describe our current approach to monitoring progression of PPA, including the development and applications of a novel clinical instrument for this purpose, the Progressive Aphasia Severity Scale (PASS). We also outline some of the issues related to initial evaluation and longitudinal monitoring of PPA.
Methods & Procedures: In our clinical and research practice, we perform initial and follow-up assessments of PPA patients using a multifaceted approach. In addition to standardised assessment measures, we use the PASS to rate presence and severity of symptoms across distinct domains of speech, language, and functional and pragmatic aspects of communication. Ratings are made using the clinician's best judgement, integrating information from patient test performance in the office as well as a companion's description of routine daily functioning.
Outcomes & Results: Monitoring symptom characteristics and severity with the PASS can assist in developing behavioural therapies, planning treatment goals, and counselling

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We appreciate the invaluable contributions of our patients and families, without which this work would not have been possible. This work was supported by NINDS [grant number R21-NS077051].

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patients and families on clinical status and prognosis. The PASS also has potential to advance the implementation of PPA clinical trials.
Conclusions: PPA patients display heterogeneous language profiles that change over time given the progressive nature of the disease. The monitoring of symptom progression is therefore crucial to ensure that proposed treatments are appropriate at any given stage, including speech and language therapy and potentially pharmaceutical treatments once these become available. Because of the discrepancy that can exist between a patient's daily functioning and standardised test performance, we believe a comprehensive assessment and monitoring battery must include performance-based instruments, interviews with the patient and partner, questionnaires about functioning in daily life, and measures of clinician judgement. We hope that our clinician judgement-based rating scale described here will be a valuable addition to the PPA assessment and monitoring battery.

Keywords: PPA; Aphasia; Monitoring.

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Primary progressive aphasia (PPA) is a neurodegenerative syndrome that involves the relentless worsening of aphasia with relative sparing of other cognitive functions, such as memory, executive functioning, and visuo-spatial processing, at least early in its course (Mesulam, 1982). In recent years, three major subtypes of PPA have been recognised and widely described—nonfluent/agrammatic, semantic, and logopenic. The clinical phenotype of each subtype is associated with distinct areas of regional atrophy within the language network (Gorno-Tempini et al., 2004, 2011; Grossman, 2010; Mesulam et al., 2009). While each subtype is associated with a primary deficit (e.g., abnormality in syntax, single-word comprehension, or word retrieval), there is considerable variation across patients in terms of presence and severity of impairment in any particular language domain at a specific time in the disease course. That is, symptoms evolve in their characteristics and severity, and new symptoms emerge, while other domains of language remain at the same level of impairment or even relatively intact.

Characterisation of patients with PPA has been challenging in part due to the lack of a "big picture" clinical instrument to grade the impairment in specific language domains. The Clinical Dementia Rating (CDR) scale (Morris, 1993) is widely used in Alzheimer's disease clinical assessment and research trials to grade cognitive impairment and level of daily functioning. Research in Alzheimer's disease has shown that the sole use of performance-based measures, such as those typically used in stroke aphasiology (e.g., Boston Diagnostic Aphasia Examination (BDAE)) (Goodglass, Kaplan, & Barresi, 2000), fails to adequately capture information about symptom severity in daily life, while ratings of symptom severity based on the clinician's judgement may provide complementary information and help in the scoring of disease severity (Dickerson, Sperling, Hyman, Albert, & Blacker, 2007). In PPA clinical care and research programs as well, the use of a structured, semiquantitative instrument that allows the clinician to rate the relative severity of impairment in each language domain based on language assessment and patient and partner interview may provide a more complete clinical picture, rather than solely using information from test performance.

In the research realm, the development of new treatments for PPA has suffered from the lack of a symptom rating instrument that separates symptoms by language domain and allows for scoring of severity in each domain. The CDR scale has a supplemental language box (Knopman, Weintraub, & Pankratz, 2011), a single

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global rating that captures overall level of language impairment in patients with cognitive impairment. Scoring is based on the level of difficulty in areas including word finding, word choice, phrase length, auditory and written comprehension, and grammar. However, these domains are not rated separately; instead, one global rating is given. Elaborating on the supplemental language box of the CDR scale, we developed a clinical instrument to rate the presence and severity of symptoms in 13 domains of speech and language. The instrument is designed to allow the clinician to integrate complementary data from formal test performance with the daily experience of the patient and family. For reasons including patient motivation, fatigue, and testing anxiety, there are often discrepancies between ability to communicate in daily life and performance on testing. It is therefore important to consider both test performance and daily communication functioning when determining the level of impairment. For example, we have observed a patient struggling through a picture description task only to speak with greater fluency when describing a highlight of her daughter's graduation ceremony. In contrast, another patient is able to respond well in writing during a confrontation naming task, but his partner, unaware of his ability with writing, reports that his word retrieval is severely impaired given that his speech output is minimal.

Below, we describe our development of the Progressive Aphasia Severity Scale (PASS) instrument to date and some applications of this tool. First, we make a number of comments on the importance of these applications, which include aiding in diagnosis of the PPA subtype, establishing baseline communication strengths and weaknesses and monitoring change over time, planning speech and language treatment goals and monitoring progress towards these goals, and providing patient and caregiver education and counselling.

AIDING DIAGNOSIS AND CHARACTERISING BASELINE STRENGTHS AND WEAKNESSES

A comprehensive baseline assessment is the first step in the journey with the patient and family and serves several purposes. The clinician can better determine PPA subtype through a full characterisation of the language profile. Early and accurate subtyping is important for helping the patient and family understand the condition, for planning speech and language therapy, and potentially for identifying individuals for inclusion in clinical trials targeting specific symptoms or underlying pathologies, once these become available. Also, given that symptoms are expected to progress, establishing the baseline level of impairment is all the more important to determine the impact of potential interventions.

The types of language impairments in PPA vary substantially. For example, semantic variant PPA is characterised by impairment in single-word comprehension and confrontation naming with preserved articulation, syntax, and fluency. Patients with the nonfluent/agrammatic variant typically have difficulty with the production and/or comprehension of syntax/grammar with preserved single-word comprehension. Speech is often effortful, hesitant, and dysfluent, and a motor speech disorder may be present. The speech of patients with logopenic variant PPA contains word-finding pauses and phonemic paraphasias. Speech is typically more fluent in conversation than in tasks that require the use of precise words (e.g., picture description). Repetition and spelling are usually impaired. Some patients have mixed forms of aphasia that do not fit cleanly into these categories.

A variety of methods can be used to identify the specific language domains that are impaired in a patient with PPA, as described in the following.

MONITORING CHANGE OVER TIME

Next is the question of how to monitor patients for worsening of symptoms, emergence of new symptoms, and efficacy of treatments (pharmaceutical and/or behavioural). Once a baseline profile is established, it is useful to perform follow-up assessments at periodic intervals of 6–12 months and after completion of a treatment program. Establishing a profile of progressive language decline is necessary to confirm the diagnosis of PPA. Information from these follow-up assessments may show emerging areas of difficulty, worsening of impaired skills, stable domains, and hopefully any positive effects of treatment. It is also important to recognise unexpected symptoms or increased rate of change that could herald an unrelated disease process.

Through monitoring, we aim to learn about the evolution of language symptoms in each PPA subtype. Patients and their families often ask questions about prognosis, level of severity, and whether the patient will eventually lose abilities not yet affected. Profiles of symptom progression by subtype have potential to show us where the patient falls along the spectrum of severity, which in turn may contribute to the planning of speech therapy including when to implement use of communication devices and alternative communication strategies. Domains of relative strength can be capitalised on when proposing compensatory communication strategies.

THE PROGRESSIVE APHASIA SEVERITY SCALE: DEVELOPMENT TO DATE

Description of the scale

The PASS is a clinical instrument used to rate presence and severity of impairment in specific domains of speech and language, as opposed to making a single global language rating. The clinician uses his/her best clinical judgement to make ratings on a 5-point scale from "normal" (0) to "questionable/very mild" (0.5), "mild" (1.0), "moderate" (2.0), or "severe" (3.0) impairment. The scale is modelled after the CDR scale (Morris, 1993) and expands upon the supplemental language box (Knopman et al., 2011).

Scores are meant to reflect a snapshot of the patient's current functioning as compared to the premorbid baseline, thereby capturing any decline in abilities attributable to the disease as opposed to any possible developmental or educational weaknesses in language abilities (which may influence test performance). The scale includes 10 discrete domains of speech and language abilities and three supplemental domains related to the social pragmatics of communication (additional domains of verbal and nonverbal pragmatics would likely be valuable to include in future versions, particularly given the personality and behavioural changes that may eventually develop in people with PPA). Table 1 provides a list of the PASS domains (please note that additional detail is provided in each rating box that describes the patient's functioning at that level of impairment). Please refer to Table 2 for detail on three domains as provided on the PASS worksheet. For details of how to work with us to use the PASS and to download the current version of the scale, please visit http://www.nmr.mgh.harvard.edu/~bradd/PASS.html

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TABLE 1
Description of the domains of the Progressive Aphasia Severity Scale (PASS)

	Description
PASS primary domains	
Articulation	Ability to say sounds and syllables accurately and effortlessly
Fluency	Degree to which speech flows easily or is interrupted by hesitations, fillers, pauses; reduced fluency is associated with decreased phrase length and words per minute
Syntax and grammar	Use of word forms (run, ran), functor words (the, an), and word order when forming phrases and sentences in primary modality (speech or writing)
Word retrieval and expression	Ability to express the intended word through primary modality (speech or writing)
Repetition	Ability to repeat words, phrases, sentences; difficulty should not be attributable to working memory problem; do not penalise for sound distortions resulting from apraxia of speech or dysarthria
Auditory comprehension	Ability to understand spoken phrases and sentences (e.g., conversation, commands)
Single-word comprehension	Ability to understand spoken or written single words
Reading	Ability to decode and understand written material; difficulty should not be attributable to an elementary visual problem
Writing	Ability to write and spell; difficulty should not be attributable to an elementary motor problem
Functional communication	Ability to communicate despite the speech and language impairment; ability to compensate for the impairment
PASS supplemental domains	
Initiation of communication	Tendency to take an active or passive role in communication exchanges
Turn–taking	Ability to take turns during conversation versus speaking/writing over another person
Generation of language	Ability to use novel language to express oneself versus using stereotyped or scripted language

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The PASS profile shows the rate of change of individual language skills relative to each other, which may be useful information for planning and modifying treatment approaches. In one example, a skill (e.g., word retrieval) that is declining more rapidly than others may require use of additional compensatory strategies to prepare for future decline as well as counselling and preparation for continued loss of that skill. In another example, voice banking, or making recordings of an individual's speech, might be appropriate for a patient whose spoken output is quickly declining.

Informant questionnaire

We developed a structured questionnaire organised by PASS domains (excluding repetition, which is not typically an observed skill in daily life) for a companion of the person with PPA to complete. Each section starts with a general question about whether the patient is experiencing difficulty in that domain; if not then the section can be skipped. If difficulty is endorsed, questions then probe for additional information. The format is multiple choice with room for elaboration and examples.

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TABLE 2
Three representative domains of the Progressive Aphasia Severity Scale (PASS)

PASS domain	*0 = normal*	*0.5 questionable/very mild impairment*	*1 = mild impairment*	*2 = moderate impairment*	*3 = severe impairment*
Fluency: Degree to which speech flows easily or is interrupted by hesitations, fillers, pauses; reduced fluency is associated with decreased phrase length and words per minute (WPM)	Normal flow of speech	Speech contains occasional blank pauses or use of fillers (umm); reduced WPM and/or phrase length.	Speech is in short phrases, interrupted with pauses or groping for words but there are occasional runs of fluent speech	Dysfluencies in most utterances; phrase length rarely exceeds three words	Severely dysfluent speech; phrase length rarely exceeds one word. May not speak
Syntax and grammar: Use of word forms (run, ran), functor words (the, an), and word order when forming phrases and sentences in most used modality (speech or writing)	No difficulty in the use of grammar and syntax	Occasional agrammatism or paragrammatism (i.e., odd sentence structure such as, "I my car drive in your house."); may complain it is effortful to combine words into phrases or sentences	Frequent agrammatism; sentence structures are simple; frequent misuse/omission of grammatical words or morphology	Utterances contain mostly content words with rare use of syntactic word groupings, functor words, or morphological markers	Single-word utterances or no speech/writing.
Single-word comprehension: Ability to understand spoken or written single words	No difficulty understanding single words in conversation or testing	Occasional difficulty understanding low frequency words (e.g., cork); may question the meaning of words (e.g., "What is a__?").	Displays lack of word comprehension several times in a brief conversation but able to carry on reasonably meaningful conversation	Understands some high frequency and/or familiar words. Questions the meaning of many words in conversation	Minimal comprehension of single words

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Interviews

The completed questionnaire then serves as a guide for the clinician to use in the interview, which is an opportunity to discuss areas of change in the patient's functioning. When the questionnaire has been completed by the partner, we suggest conducting an interview with both the patient and partner, ideally independently, so that both interviewees feel free to be open and honest. The patient, particularly in the early stages of the disease, often has a high level of insight into his/her strengths and limitations and can provide valuable information to the clinician; therefore, it is crucial to conduct a thorough interview with the patient.

The PASS interview provides a formalised structure with which to discuss the specific domains of language functioning with the patient and family member, to learn about their perception of the primary problems in daily life. The clinician can then take this information into account in planning areas of assessment and treatment goals. For example, a patient's primary area of frustration may be difficulty with writing emails. For this patient, the assessment may focus on written language and ability to use compensatory strategies such as dictation software or prewritten scripts.

Baseline assessment and monitoring

In addition to the interview, a comprehensive language assessment at baseline and monitoring sessions should be performed to gather quantitative information. The assessment can be performed using items from the clinician's existing arsenal of tests. Tasks in our battery include the Boston Naming Test (Kaplan, Goodglass, & Weintraub, 1983), the commands, repetition, and picture description tasks from the Western Aphasia Battery (WAB)-Revised (Kertesz, 2006), the word–picture matching task from the Cambridge Semantic Battery (CSB) (Adlam, Patterson, Bozeat, & Hodges, 2010) to assess single-word comprehension, and the Northwestern Anagram Test (Mesulam et al., 2009) to assess syntactic processing. The latter was specifically developed for the PPA population. A motor speech exam is also typically performed to determine the presence of apraxia of speech, which can be the presenting symptom in the nonfluent/agrammatic subtype, or may indicate a distinct clinical subtype (Josephs et al., 2006).

We encourage patients to use their most functional modality to respond to questions in an assessment, which is often writing, and we award credit for correct responses regardless of the modality in which they were given. In fact, observation of the patient's use of alternative modalities can inform the clinician's rating of the PASS functional communication domain, which considers successful use of adaptive strategies. When patients have difficulty responding in writing as well as in speech, they may be better able to select a response from presented choices. Therefore, it is likely valuable to consider the development of measures with multiple-choice response format.

It is likely also beneficial to include a general cognitive measure, in part to assist in interdisciplinary communication between clinicians. The Mini Mental State Exam (Folstein, Folstein, & McHugh, 1975) is widely used in behavioural neurology practice, but due to its heavy linguistic load, we administer an adapted version that uses multimodality (written and spoken) administration and multiple-choice response options in an effort to avoid underestimating cognitive abilities due to interference

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from the aphasia. Given the possible involvement of motor and behavioural/affective functioning as the disease progresses, an initial assessment and monitoring battery should also include sensitive and specific measures of these areas. In our assessment approach, the PASS is never used in isolation; a person's overall level of functioning in typical hobbies and professional and family responsibilities relies on several factors including social support, mood, and general cognitive functioning. Therefore, we always discuss and use scales related to mood and behavioural symptoms and the ability to perform activities of daily living.

Considerations for longitudinal assessment

The unfortunate nature of PPA is that a decline in language abilities is expected. This has particular considerations for longitudinal assessment and monitoring. For example, the same test should be used at each evaluation over time to determine if there has been a change in abilities (Nickels, Taylor, & Croot, 2011). However, this may pose a challenge when assessing patients with PPA, as the patient may no longer be able to perform tasks they were able to do earlier in the disease course. Conversely, it may have been necessary to implement more demanding tasks at disease onset to detect subtle symptoms. In these cases, easier items can be used (e.g., naming tasks that previously included low-frequency items may now need to include primarily high-frequency items; comprehension tasks of complex syntax may now need to include simpler and shorter items). In addition, patients in later stages of PPA may develop impairments in areas of attention, executive functioning, and/or memory that may hinder ability to follow task instructions and comply with assessments. The PASS offers a benefit in this area as it is a tool that can be used consistently throughout the course of the disease. The PASS is also potentially useful to display the areas that remain stable; as decline is an inherent part of PPA, stable or slowly declining ratings may suggest a positive outcome.

Completing the PASS worksheet

The clinician considers all sources of information—the informant's questionnaire and interview and the patient's interview and test performance—when making a clinical judgement about the presence and severity of impairment in each PASS domain. The PASS worksheet has boxes for each rating (0, 0.5, 1, 2, 3) within each domain, and each box briefly describes a level of ability/functioning to help the clinician determine which one best matches the patient's situation (see Table 2). In the event that it is difficult to decide between two ratings, we suggest going back to the patient or partner to gather more information. If this is not possible, we recommend giving the patient "the benefit of the doubt" and assigning the more mild rating.

CLINICAL/BEHAVIOURAL PROPERTIES OF THE PASS

We have used the PASS approach with 42 PPA patients to date, representing the three primary subtypes as well as some phenotypes that do not fit neatly into a subtype (e.g., one patient displayed progressive alexia and agraphia without other typical PPA symptoms). Ratings have been made approximately every 6 months at clinical or research visits with some patients being monitored for up to 4 years.

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We examined the clinical/behavioural properties of the PASS, using the three canonical language domains of PPA clinical characterisation—fluency, syntax, and single-word comprehension (Sapolsky et al., 2010). In this study, a behavioural neurologist (B.C.D.) and a speech and language pathologist (D.S.) evaluated PPA patients (n = 23) who were recruited from a longitudinal study that was ongoing in the Massachusetts General Hospital Frontotemporal Dementia Unit. Each clinician then made PASS ratings independently. For complete demographic information on the participants, as well as detailed description of the assessment process, please refer to Sapolsky et al. (2010). Findings from this study demonstrate that PASS ratings in these three domains were related to specific performance deficits, supporting the validity of the scale.

Results from this original cohort of patients demonstrated high interrater reliability (between speech pathologist and neurologist) of PASS ratings with an intraclass correlation coefficient (ICC) >0.9 for fluency (0.99), grammar/syntax (0.99), word comprehension (0.91), and global CDR language (1.0). For subsequent validity analyses, a consensus PASS score of the two raters was used. The level of impairment that the PASS scores reflected was strongly correlated with deficits on specific speech and language tests, supporting the validity of the scale. Correlations were present between PASS fluency and WAB fluency (r = −0.92) and BDAE grammar (r = −0.94), PASS syntax/grammar and WAB fluency (r = −0.81) and BDAE grammar (r = −0.82), and PASS word comprehension and CSB word–picture matching (r = −0.87). The CDR scale supplemental language box rating correlated with WAB fluency (r = −0.59) and BDAE grammar (r = −0.66) but not CSB word–picture matching. In contrast, correlations were weaker between certain PASS domains and language test measures that are not meant to assess that domain; for example, PASS single-word comprehension did not show a correlation with performance on WAB repetition (r = −0.01). Investigation into the validity and reliability of the additional domains in the PASS rating scale is in progress.

HOW THE PASS FITS IN TO OUR CLINICAL APPROACH

In our clinical work, we have found that the process of making PASS ratings itself provides a structured opportunity to reflect on the patient's language functioning and to identify areas that should be prioritised in speech and language therapy (Sapolsky et al., 2011). We have also had many conversations with patients and families about our findings from the systematic monitoring of specific aspects of speech and language functioning over time. These conversations may be reassuring when there is a slow rate of progression with several domains intact, while in other cases may be confirmatory of a family's observation of rapid decline. From a research standpoint, we continue to use PASS ratings in our efforts in subtyping, prognostication, and investigation of the relationships between clinical impairment, as indicated by the PASS ratings, and location and extent of anatomic abnormalities in the language network.

The PASS translates easily into clinical use, given its relevance to all subtypes of PPA as well as to other conditions that affect speech and language abilities, the speed with which ratings can be made, the weight it places on clinical judgement, and its applications for the diagnostic, monitoring, and treatment aspects of clinical care. It attempts to fill the gap between a global aphasia measure (e.g., CDR scale supplemental language box, WAB Aphasia Quotient), which does not detail symptoms, and

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a psycholinguistic performance-based battery (e.g., the Psycholinguistic Assessments of Language Processing in Aphasia, Kay, Lesser, & Coltheart, 1992), which assesses each level of linguistic processing but does not incorporate clinician judgement or partner input. By specifying the deficits and strengths by domain, the PASS profile may also guide the clinician through assessing the areas relevant to the subtype as well as those that are preserved to monitor for changes.

Clinician judgement is important in making the PASS ratings, and as such, it is useful for the clinician to have some experience with working with patients with PPA. However, as the PASS provides an organised framework for assessing abilities across language domains over time, it can be a helpful guide for clinicians who have little prior experience in this area. In addition, training materials on how to use the PASS are in development, which we hope will be useful for clinicians in their assessments of people with PPA.

In a busy speech and language pathology or neurology department, it is important for a clinical tool to require as little time as possible to administer while still supplementing and enhancing the patient's profile. Completion of the PASS ratings takes about 10 minutes and does not require gathering more information beyond what is typically obtained in a comprehensive evaluation and interview. It is in the clinician's synthesis and application of the information where the PASS adds its value. The clinician may use his/her preferred evaluation materials; the PASS does not require specific measures as long as the domain is assessed and discussed in the interview. PASS profiles may also have value in providing feedback to the person with PPA and partner as well as to other members of the care team such as social workers, primary care physicians, and neurologists, who may have limited familiarity with detailed language assessments.

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CONCLUSIONS

The PPA population presents with heterogeneous language impairments. Quantification of symptom presence and severity at the initial encounter and at follow-up sessions is crucial for planning speech and language therapy goals and evaluating the efficacy of potential pharmaceutical or behavioural treatments. We employ the PASS, a scoring system that involves quantification of symptom severity using information from language test performance measures as well as from the judgement of trained clinicians, providing a comprehensive assessment of 13 domains of speech, language, and functional and pragmatic communication areas. Additional work must be dedicated to the continued development of tools to evaluate and monitor PPA patients, including performance-based instruments, questionnaires for the patient and partner, and measures of clinician judgement. We believe a comprehensive battery that integrates these various sources of information will benefit clinical research with the ultimate goal of use in treatment trials. We hope the PASS instrument described here is one step towards these goals.

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