Test item priorities for a screening tool to identify cognitive-communication disorder after right hemisphere stroke

Background: Early recognition of stroke signs and symptoms is critical to ensure people receive the right treatment at the right time. Communication impairment associated with left hemisphere stroke is easily identifiable due to the recognisable signs of aphasia, whereas signs of cognitive-communication disorder (CCD) after right hemisphere (RH) stroke are often subtler. In contrast to aphasia, no sensitive screening tools exist to allow for early identification of CCD after RH stroke.

Aims: To prioritise test items required for a screening tool to identify CCD after RH stroke from the perspective of expert speech-language pathologists.

Methods & Procedures: The nominal group technique (NGT) was used with expert speech-language pathologists to determine the most important test items required for a screening tool to identify RH CCD. Results were analysed using a quantitative measure of item ranking and inductive content analysis.

Outcomes & Results: Five expert speech pathologists located across Australia and the USA, representing a mix of clinicians and researchers participated in the nominal group. The highest ranked test items across the four cognitive-communication domains (lexical semantics, discourse, pragmatics and prosody) were interpretation of sarcasm or humour, rating conversational discourse, a conversational skills checklist and expressive prosody. Content analysis revealed three themes: Assessment Domains, Considerations in Item Design and Knowledge Gap.

Conclusions: The NGT revealed that multiple considerations exist in developing a screening tool for CCD after RH stroke.

Keywords: right hemisphere stroke, cognitive-communication disorder, screening, nominal group technique

Introduction

Early recognition of stroke is critical to ensure that individuals receive the right treatment at the right time. For those individuals who experience a stroke in the right cerebral hemisphere this early recognition may be more difficult than expected. This difficulty may be related to reduced awareness and recognition of right hemisphere (RH) stroke symptoms, including potential changes in communication (Fink, 2005). The communication impairment that presents after RH stroke is a cognitive-communication

disorder (CCD). Areas of communication affected include pragmatics, discourse, prosody and lexical semantics which differs significantly from the presentation of aphasia associated with left hemisphere damage (Ferré & Joanette, 2016). Like aphasia, severe CCD is easily identifiable as the disruption to 'normal' communication interaction is obvious. However, while signs of mild aphasia (e.g., word retrieval difficulties) may be detected more easily through casual conversation, mild RH cognitive-communication dysfunction is more difficult to detect. As CCD may impact return to employment, interpersonal relationships and independent living skills (Hewetson et al., 2018), it is essential to identify even subtle communication changes after RH stroke.

Accurate identification of RH CCD may be further compromised by the limited availability of evidence-based screening and assessment tools. Current speech-language pathology practice for this population often relies on clinician observation, informal conversation and/or the use of informal communication screening tools. Observation was considered the most important diagnostic tool for identifying impaired pragmatics and prosody in a recent survey of American speech-language pathologists (Ramsey & Blake, 2020). Screening for receptive aprosodia, a sensitive indicator of RH stroke in the acute setting (Dara et al., 2014), may be challenging for speech-language pathologists to conduct using observation alone. Cognitive function was more commonly screened than some areas of communication with abstract language comprehension and pragmatics the least screened by speech-language pathologists (Ramsey & Blake, 2020). Ineffective or incomplete screening processes may lead to an under-diagnosis of RH CCD, premature discharge from hospital and reduced access to communication-based rehabilitation (Hewetson et al., 2018).

Early identification of RH CCD has important implications for best practice stroke care. Global stroke scales, such as the National Institutes of Health Stroke Scale (NIHSS) (Goldstein et al., 1989), the European Stroke Scale (ESS) (Hantson et al., 1994), the Scandinavian Stroke Scale (Scandinavian Stroke Study Group, 1985) and the Canadian Neurological Scale (CNS) (Côté et al., 1986) include items related to the presence of aphasia but omit items that would be required to identify RH CCD, and thus may result in low referral rates for further speech-language pathology assessment (Blake, 2016).

Existing language screening tools such as the Frenchay Aphasia Screening Test (Enderby et al., 1987), the Language Screening Test (Flamand-Roze et al., 2011), the Mississippi Aphasia Screening Test (Nakase-Thompson et al., 2005) and the Brisbane

Evidence-Based Language Test (Rohde et al., 2020) have been designed and validated to identify language impairment associated with LH stroke. However, these tools assess only a restricted range of traditional language skills associated with aphasia including automatic speech, repetition, object naming, auditory and written comprehension and writing, and do not consider the unique communication changes associated with CCD such as discourse and prosody. As such, these screening tools are not suitable for the identification of communication impairment in RH stroke patients and if used with this population, may further contribute to the under-diagnosis of CCD.

Although individuals with impaired cognition may also present with a communication impairment following a RH stroke, no formal relationship has been established as yet (Ferré & Joanette, 2016). Despite this, speech-language pathologists commonly assess aspects of cognition after RH stroke (Ramsey & Blake, 2020). General cognition measures such as the Mini Mental State Examination (MMSE) (Folstein et al., 1975), the Montreal Cognitive Assessment (MoCA) (Nasreddine et al., 2005) and The Addenbrooke's Cognitive Examination Revised (ACE-R) (Mioshi et al., 2006) have been used in the past to identify cognitive dysfunction post-stroke. Recently, however, two cognitive screening tools have been developed specifically for the acute stroke population: the Oxford Cognitive Screen (OCS) (Demeyere et al., 2015) and the Cognitive Screening Method for Stroke Patients (CoMet) (Saar et al., 2019). These tools screen for impairments in perception, language, praxis, attention, memory, number processing and executive function following stroke. The OCS, in particular, has high sensitivity in detecting cognitive impairment post-stroke and may identify neglect, apraxia and reading and writing difficulties that would otherwise be missed by tools like the MoCA (Demeyere et al., 2015). Nevertheless, the OCS could not replace a screening tool to detect CCD as it would not identify impairments in prosody, pragmatics or discourse.

Two screening tools have been designed for the RH stroke population: the Burns Brief Inventory of Communication and Cognition (Burns, 1997) and the Mini-Inventory of Right Brain Injury - 2 (MIRBI-2) (Pimental & Knight, 2000). The Burns Brief Inventory of Communication and Cognition (Burns, 1997) consists of a Right Hemisphere Inventory with subtests related to scanning and tracking, visuospatial skills, prosody and abstract language. The MIRBI-2 includes test items related to visuospatial and attentional processing, lexical knowledge processing, affective processing and

general behaviour processing (Pimental & Knight, 2000). While these tools assess some aspects of RH CCD (e.g., abstract language and prosody), they have omitted some key features of CCD such as discourse production and pragmatics. Although these two screening tools are criterion-referenced, both tools have limitations in their validity and reliability data (Tompkins et al., 2016).

A number of theoretical frameworks have been proposed to account for the varied communication impairments seen after RH stroke (e.g., Jung-Beeman, 2005; Tompkins, 2008; Tompkins et al., 2015; Weed et al., 2010). Each framework considers a potential underlying cause of the communication impairment seen after RH stroke (Tompkins, 2012). The frameworks remain theoretical and have not been systematically applied in research resulting in limited evidence-based recommendations for speech-language pathologists to guide assessment for RH CCD (Ramsey & Blake, 2020). As such, consultation with speech-language pathologists with an understanding of the theoretical underpinnings of RH CCD and expertise in clinical management of this population was sought. This study is part of a larger research program, which aims to develop a reliable and valid screening tool to identify RH CCD during the acute phase of stroke management. This study is positioned within the first stage of the test construction process as described by Shum and colleagues (2017): test item writing. Therefore, this study aimed to prioritise test items to be included in a screening tool to identify CCD after RH stroke from the perspective of expert speech pathologists using the nominal group technique (NGT) (Delbecq et al., 1975).

Materials and methods

This study used a multiple methods research design, consisting of nominal group rankings and inductive content analysis (Graneheim & Lundman, 2004). Ethical approval was obtained from Griffith University Human Research Ethics committee (GU Ref No. 2019/063).

Participants

Expert speech-language pathologists in the field of RH stroke were the target of this study. It was expected that consultation with speech-language pathologists with research or clinical experience in this area would more likely result in clear test item priorities. Potential participants identified through local networks and international special interest

groups were recruited via email invitation. Participants were considered eligible for inclusion in the study if they were a qualified speech-language pathologist, had more than 10 years' experience with the RH stroke population in a teaching, research or clinical capacity, and were able to provide informed consent. To ascertain level of experience, participants were asked to describe their experience with the RH stroke population using a demographic questionnaire. All participants reported current and extensive involvement with the RH stroke population in their research, academic or clinical roles.

A total of five expert speech-language pathologists participated in this study across Australia and the United States of America (USA). Although a mix of geographic locations was sought where possible, potential participants' availability for online discussion in terms of time zones was also considered. No participants declined involvement due to a time zone conflict. All participants provided informed consent prior to inclusion in the study.

Measure and procedure

This study used the NGT, a structured consensus building process (Delbecq et al., 1975). The technique requires participants to respond individually to a question, which is followed by recording and discussion of ideas, and finally an individual voting process. The NGT was chosen for this study as it has previously been used to establish priorities in a number of healthcare areas, including priorities for outcomes in living kidney donors (Hanson et al., 2018), paediatric chronic pain rehabilitation (Hurtubise et al., 2019), haemodialysis (Urquhart-Secord et al., 2016) and aphasia treatment (Wallace et al., 2017). This approach also minimises the risk of participant dominance or facilitator influence that may be present in more traditional focus groups (Delbecq & Van de Ven, 1971; Jones, 2004). Group size was capped at six participants to ensure group judgment reliability, and to minimise group prioritisation issues (Aspinal et al., 2006; Vella et al., 2000).

The nominal group was run in April 2019 through the communications platform, Zoom™ using an online, virtual meeting. The primary investigator (AL) conducted the nominal group with an additional investigator present (RH) who was responsible for taking field notes. Using the share screen function, a Microsoft Office PowerPoint presentation was visible to all participants. The PowerPoint presentation was also used as

a virtual ‘whiteboard’ to record participant responses. The nominal group was audio recorded and transcribed verbatim by the primary investigator.

The two-hour nominal group comprised four nominal questions each consisting of three phases (see Figure 1). The four nominal questions were developed based on emerging research suggesting four distinct clinical profiles of CCD exist after RH stroke (Côté et al., 2017) and results from a previous modified Delphi study. This unpublished modified Delphi study was conducted by the current research team as part of the larger research program with the purpose of developing initial recommendations for test items to include in a screening tool to identify RH CCD through consensus from speech-language pathologists, ranging in levels of experience. This study identified four broad areas to focus the test development (lexical semantics, discourse, pragmatics and prosody) but failed to identify clear recommendations with over 60 potential test items reaching consensus to be included in the screening tool. As a result, the nominal group study was conducted to refine the outcomes from this study. The nominal group questions were based on the four broad areas identified through the modified Delphi study and were presented to the participants as follows:

(1) Which test items relating to *lexical semantics* do you believe are important to be included in a screening tool to identify RH CCD?
(2) Which test items relating to *discourse* do you believe are important to be included in a screening tool to identify RH CCD?
(3) Which test items relating to *pragmatics* do you believe are important to be included in a screening tool to identify RH CCD?
(4) Which test items relating to *prosody* do you believe are important to be included in a screening tool to identify RH CCD?

In the first phase, participants were asked to ‘silently’ generate responses to the nominal question and email their responses to the primary investigator. All 60 potential test items generated from the previous modified Delphi study were displayed on the PowerPoint presentation during this phase. Following this, each participant was invited to share their most important response with the group. New responses were shared in rounds until no new responses were elicited (i.e., saturation of ideas occurred). Group discussion was encouraged during this phase. Participants were then asked to rank the responses generated in order of importance and email their votes to the primary investigator.

Informal discussion was held at the end of the four questions around the importance of including cognition and reading / writing tasks.

Figure 1 about here

Data management and analysis

Nominal group rankings:

The highest ranked (i.e., most important) test item was given a value of 1 by each participant, the next most important given a value of 2 and so on. Participants were instructed to rank all test items generated within the four categories. However, ~~as~~ not all participants ranked each test item generated, and so calculating the mean ranking for test items within each category was not considered appropriate. The overall ranking of each test item was used to prioritise the test items for each category and was based on the original rankings assigned by participants. To calculate this measure, the Bradley-Terry model was used (Bradley & Terry, 1952). The Bradley-Terry model determines probabilities for an item in a set being preferred over others through a series of pairwise comparisons (Bradley, 1984). A strength parameter is assigned to each item in a group based on the number of pairwise comparisons, which then allows each item to be given an overall ranking (Bradley, 1984). Statistical analysis was completed directly in R (Firth, 2005).

Content analysis:

The discussion elicited during the nominal group was analysed using inductive content analysis (Graneheim & Lundman, 2004) to gain a deeper understanding of the reasoning behind participant's priorities. Meaning units were identified and organised into content codes, sub-categories, categories and themes. A full content analysis, as described by Graneheim and Lundman (2004), was completed by the primary investigator, an experienced speech-language pathologist. The preliminary findings were then discussed with two members of the research team experienced in qualitative research to examine and refine the codes, sub-categories, categories and themes generated, and to ensure the interpretation of participants' reasoning was accurate. An audit trail (Koch, 1994) was kept to record the methodological and analytical decisions, and included raw data (i.e., de-identified email responses from the silent generation and voting phases of the nominal

group), identifying and condensing meaning units, and analysing and refining content codes, sub-categories, categories and themes. Discussions held between the research team around the development of the final themes were documented to enhance reflexivity.

Results

Of the six participants who were invited to attend the nominal group, five expert speech-language pathologists participated in the nominal group. The sixth participant was unable to attend the nominal group due to conflicting appointments. Three participants were recruited from Australia, and two from the USA. All participants were female. All participants had more than 10 years' experience in speech-language pathology. Three participants (60%) held a doctoral degree while two participants (40%) possessed a bachelor's degree. Three participants (60%) were employed as university academic staff and two participants (40%) were employed as senior speech-language pathologists in either acute stroke or rehabilitation settings.

Nominal group rankings

Participants identified a total of 36 potential test items to include in a screening tool to detect RH CCD. Eight potential test items were identified for the cognitive-communication domains of lexical semantics, pragmatics and prosody. Twelve potential test items were identified for discourse. The overall rankings across the four cognitive-communication domains are shown in Figure 2. The highest ranked test items for lexical semantics were inferential language (comprehension of sarcasm and humour), explanation of inconsistencies and metaphor interpretation. Verbal fluency tasks were the lowest ranked test items for lexical semantics. A conversational skills checklist and use of facial expression were highly ranked test items for pragmatics while social inferences and use of linguistic context (e.g., topic maintenance, presupposition of listener knowledge) ranked lowest for pragmatics. For prosody, the highest ranked test items were use of prosody in conversation and expressive prosody, with linguistic prosody production and receptive prosody the lowest ranked test items. The highest ranked test items for discourse were rating conversational discourse, followed by communication partner rating of conversational discourse and procedural discourse. Lowest ranked items for discourse were group conversation, social network analysis and challenging listening environments.

Figure 2 about here

Inductive content analysis

Analysis of the data identified three main themes. The first theme was *Assessment Domains* that should be considered for the screening tool and the relative importance of individual test items. The second theme centred around *Considerations in Item Design*. The final theme explored the *Knowledge Gap* that participants reported currently exists around the understanding of RH CCD. Each theme contained a number of categories and sub-categories, which are discussed in more detail below. All participants have been allocated a pseudonym to maintain anonymity.

Theme 1: Assessment Domains

The first theme, A*ssessment Domains*, consisted of two categories: impairment level assessment (sub-categories: all four communication domains and cognition) and activity level assessment (sub-categories: need to capture functional impairment and communication partner input). For impairment level assessment, discussion centred around the four communication domains (lexical semantics, discourse, pragmatics and prosody) and the relative importance of individual test items. Participants prioritised specific test items across each of the communication domains of lexical semantics (e.g., *"inferential language is useful, [the] interpretation of sarcasm and humour"*, Lauren), discourse (e.g., *"my number one was to rate conversational discourse because it is the most common thing we do with our language"*, Julie), pragmatics (e.g., *"the ability to understand social inferences because that can really impact on communication breakdown"*, Brooke) and prosody (e.g., *"the four aspects, expression and comprehension of both affective and linguistic prosody would be good in my opinion"*, Julie). Discussion was also generated around less important test items within these four communication domains. The use of metaphors in screening tools was considered overdone (e.g., *"too much focus on metaphoric explanations"*, Paula), time-consuming and not applicable universally due to linguistic and cultural nuances. Explanation of inconsistencies and prosody were also considered less important for a screening tool by one participant (Megan). Additionally, one participant felt that no new information could

be gathered from a written discourse task in comparison to a verbal discourse task (e.g., *"how much more will you get out of a written discourse than you would from a verbal discourse"*, Lauren). As well as these four communication domains, participants also expressed the importance of including test items relating to cognition such as attention and neglect. They identified the importance of considering the person's level of insight into their difficulties (e.g., *"what is their recognition of their performance, how do they continue to try and cue themselves, or do they just not respond?"*, Lauren).

The need to capture the functional impact of this disorder and include test items relating to everyday activities was also highlighted by participants (e.g., *"I would think of it functionally and come at it from a functional perspective"*, Megan). In particular, the functional impact of impaired verbal fluency was identified as an area to explore (e.g., *"what is the functional impact [of verbal fluency]?"*, Lauren), as well as the functional impact of impaired comprehension (e.g., *"the functional implication of someone having trouble understanding something complex"*, Paula). The functional impact of this disorder on communicating with family members and friends was also recognised as important (e.g., *"what can we use out of this screening assessment that's going to be useful in communicating with family members"*, Brooke). Participants highlighted that establishing social networks during this screening process may also be beneficial (e.g., *"there might be an opportunity to look at specific questions around establishing people's social networks"*, Brooke). The importance of input from communication partners for these activity-level tasks was identified by the participants (e.g., *"communication partner input would be helpful but not just the pre-stroke conversation style but what they see now, if they see something different now…a lot of information could come from them"*, Julie) as well as their role in rating communication change (e.g., *"the MEC [Montreal Protocol for the Evaluation of Communication] conversation rater thing is fantastic…I like the idea of what it does when it also asks family members the same things"*, Paula).

Theme 2: Considerations in Item Design

Two main categories for this theme emerged: standardised and ecologically valid items (sub-categories: a need to standardise, mode of delivery and contextual considerations) and test item selection. The need to standardise the screening process for this population was expressed frequently by the group (e.g., *"a kind of screening tool where all this comes together for clinicians so that there's a standardised way [that] we're doing it"*,

Paula). In particular, the need to standardise screening for impairments within discourse and pragmatics was highlighted (e.g., *"there needs to be something that is definitely concrete and more standardised"*, Megan) as observing and rating tangentiality and appropriateness of discourse production can be subjective. Rating procedural discourse was identified as a task that could be easily standardised (e.g., *"procedural discourse [has] a more standardised approach"*, Paula). Participants also felt that screening for pragmatics should be standardised (e.g., *"[we] should be able to look at a variety of pragmatic components and if there's a standardised way that we're doing it"*, Paula).

Ecological validity of items was also considered important when developing a screening tool to identify RH CCD. Participants expressed a need to consider the way a stimulus is delivered to this population using technology (e.g., *"the opportunity to be looking at videos"*, Brooke) and the potential to investigate multiple communication areas in one task (e.g., *"there might be a way to join the comprehension discourse with the production discourse in a task…you'll get pragmatics from there as well"*, Brooke). Participants expressed the need to consider the context and the purpose of the screening tool (e.g., *"thinking about that environment of that acute hospital situation where we need to try and gather as much information as possible to go what do we need to know in terms of ongoing referral or…about [whether] this person would benefit from ongoing rehab"*, Brooke). The applicability of test items such as prosodic variation in an acute setting was also questioned (e.g., *"how much prosodic variation might we see in conversation when someone is in hospital and maybe not feeling well and has been through a lot and is tired"*, Julie).

In terms of test item selection, participants expressed that some test items, particularly those related to lexical semantics, would need to be sensitive (e.g., *"how do we choose the right metaphors to have it be sensitive enough?"*, Lauren). Participants also identified a need to include tasks that could be scaffolded (e.g., *"if a person can't produce these different prosodic variations, can they do it in repetition just to see if they can do it at all…could be [a] nice add on if you get nothing"*, Julie).

The challenges of selecting test items for screening in this population were also explored. It was acknowledged that it may be difficult for a speech-language pathologist to generate quality conversation with the person with RH stroke to be able to effectively rate conversational discourse production. It was also recognised that some aspects of communication may overlap, for example, observing conversational skills such as turn-

taking, topic maintenance and topic initiation may overlap with discourse production (e.g., *"it feels like it overlaps a lot with the discourse"*, Julie). Inclusion of an item to screen for a difficulty in executive functioning was also expressed as potentially challenging (e.g., *"I'm not sure whether we're going to have a chance to see it [executive functioning] in a screening tool with [the] depth that might be required"*, Brooke).

Theme 3: Knowledge Gap

An interesting theme emerged during the group discussion of a *Knowledge Gap*. This theme was divided into two categories: limited research and understanding the cause of impairment (sub-categories: theoretical model of cause and interplay between communication and cognition). The paucity of research in this population was frequently expressed by participants (e.g., *"it's very challenging because we don't know enough about these disorders"*, Megan). It was acknowledged that there is limited research on specific areas of impairment in RH stroke patients (e.g., *"I don't' know that we know much about this* [discourse comprehension] *really for people with right hemisphere brain damage"*, Julie). The potential to draw upon previous research within the traumatic brain injury population was also suggested (e.g., *"some of the TBI stuff is showing written discourse issues that are more apparent in the simpler tasks than a verbal task"*, Paula).

Understanding the cause of the impairment and applying the known theoretical models was expressed by the participants (e.g., "*the cognition load hypothesis would mean some of these tasks are difficult for them because of the nature of the cognitive load not necessarily the linguistic component"*, Paula; and *"it depends on the theoretical understanding of what you think some of this is doing and what it's showing"*, Paula). The need to understand the cognitive deficits impacting communication was also recognised as important (e.g., *"my feeling is attention [is the most common cognitive deficit that impacts on communication]"*, Paula). Participants also expressed a difficulty in distinguishing between a cognitive impairment in comparison to a communication impairment (e.g., *"we may have trouble teasing apart what is actually going on"*, Paula). Cognition as an underlying cause of the communication impairment was identified by the participants (e.g., *"some of this non-verbal stuff also then starts to play into some of the cognitive, in terms of attention and responsiveness to the interaction"*, Lauren).

Based on results obtained from the nominal group rankings and the qualitative content analysis, 13 test items will be included in the first trial version of the screening

tool. For lexical semantics these test items will include interpretation of sarcasm, metaphor interpretation and explanation of inconsistencies. The discourse test items will include a conversational discourse rating and family/friend checklist, procedural discourse rating and discourse comprehension task. The pragmatic test items will include conversational skills checklist and social inferences. Prosody test items will include expressive and receptive prosody (emotional and linguistic) tasks.

Discussion

This study aimed to prioritise test items for inclusion in a screening tool to identify CCD after RH stroke from the perspective of expert speech-language pathologists. This study is the first step in a larger research program that aims to develop a reliable and valid screening tool to identify CCD after RH stroke. The outcomes from the nominal group rankings is a starting point for screening tool development with some test item priorities identified across the four broad communication domains.

For lexical semantics, the three highest ranked test items were: inferential language (comprehension of sarcasm and humour), explanation of inconsistencies and metaphor interpretation. Interestingly, metaphor interpretation was highly ranked despite being discussed as overdone, time-consuming and irrelevant during the nominal group. Similarly, explanation of inconsistencies was described by participants in the nominal group to be a non-essential test item yet was ranked highly. These contradictory results may be a result of the profusion of research focussed on lexical semantic abilities after RH stroke in comparison to other cognitive-communication domains. Alternatively, it may suggest that the importance or relevance of these test items are not as well understood by speech-language pathologists. Careful consideration will be required when selecting metaphors for this screening tool. Conventional or familiar metaphors may not be sensitive in identifying an impairment when compared with novel or unfamiliar metaphors (Diaz & Eppes, 2018). Inclusion of these test items is supported, however, by theories behind RH CCD: the coarse coding hypothesis (Jung-Beeman, 2005; Tompkins et al., 2008), which attempts to explain the difficulties in non-literal language interpretation often present following RH stroke (e.g., metaphor interpretation) and the suppression deficit hypothesis (Tompkins et al., 2001), which proposes that discourse comprehension requires contextually inappropriate or irrelevant information to be suppressed in order to arrive at the correct interpretation (e.g., comprehension of sarcasm

and humour). Verbal fluency, both semantic and phonemic, were the lowest ranked items for this domain. This may reflect the perception that verbal fluency measures executive function rather than lexical semantic abilities (Whiteside et al., 2016).

There were also clear priorities for discourse-related test items. Rating conversational discourse was the top ranked test item, which was reflected in the group discussion. Communication partner rating of conversational discourse was also considered a high priority test item by the experts, highlighting that the screening tool should focus on activity/participation levels as well as the impairment level. Rating procedural discourse and discourse comprehension (implied meaning) were also ranked highly. Evidence for deficits in procedural discourse in individuals with RH stroke is limited (Minga, 2016), however, this task is commonly included in informal screening processes, and therefore may have been considered a familiar or routine task by the expert speech-language pathologists rather than a task that should be included based on available evidence. The suppression deficit hypothesis would support the inclusion of a test item related to discourse comprehension as individuals with RH stroke may present as lacking capacity for effective meaning selection and integration in discourse tasks (Tompkins et al., 2001). In contrast, screening for difficulties in participating in group conversation or challenging listening environments, and social network analysis were the lowest ranked test items for discourse. These test items may have been ranker lower than others due to the acknowledgement of time constraints associated with screening (e.g., generally less than 30 minutes) (Rohde et al., 2018), and the need to select the most sensitive test items to identify RH CCD.

For the area of pragmatics, the highest ranked test items were a conversational skills checklist and the use of facial expression. As impaired pragmatics is often considered a key marker of RH CCD (Ramsey & Blake, 2020), it is not surprising that inclusion of a conversational checklist was identified as important for a screening tool. This was evidenced in the nominal group discussion where participants felt speech-language pathologists should consider a variety of pragmatic components when screening. Further, the prioritisation of an item related to an individual's use of facial expression may be related to perception that hypoaffective behaviours are more common in individuals following RH stroke. In fact, hypoaffective behaviours have been reported to occur at a similar frequency to hyperaffective behaviours in individuals with RH stroke (Blake et al., 2002). Use of linguistic context was the lowest ranked test item. It is possible

that the experts presumed that screening for use of linguistic context (e.g., topic maintenance, presupposition of listener knowledge) could be incorporated into a conversational skills checklist, which was the highest ranked item. Although not highly ranked, the expert speech-language pathologists highlighted the functional importance of social inferential reasoning in the nominal group discussion, which is in line with current evidence. Recent research has found that the RH plays an essential role in processing social and contextual information, supporting the social cognition deficit hypothesis that attributes these impairments to an inability to infer the mental states of others (Balaban et al., 2016; Champagne-Lavau & Joanette, 2009; Tompkins et al., 2001; Weed et al., 2010). Other test items were ranked more highly than social inferential reasoning in this domain and may be a result of the unclear pattern of pragmatic impairment in this population (Blake, 2018).

Expressive prosody and imitation of prosody were considered essential test items for this screening tool by the experts. While expressive aprosodia may be identified by clinicians easily through informal conversation and/or observation, it is subjective with identification relying on the listener's level of knowledge and experience of aprosodia as well as knowledge of the individual's pre-morbid communication style. The opportunity to observe prosodic variation in conversation while an individual is in hospital and feeling unwell and tired was also questioned in the nominal group discussion. There is mixed evidence around the contribution of the RH to the production of linguistic prosody (Walker et al., 2004), which was reflected in the nominal group rankings with linguistic prosody production ranked second to last. Comprehension of prosody was the lowest ranked test item despite being acknowledged in the nominal group discussion as an aspect of cognitive communication which is supported by the evidence as a sensitive indicator of RH stroke (Dara et al., 2014). Therefore, inclusion of a test item related to receptive prosody seems to have a strong evidence base. The variation between the rankings and the content analysis may be a result of a reduced understanding of what would be most sensitive for this screening tool in the area of prosody.

The results of this study add support for the need to develop a new screening tool in light of advances in our understanding of RH CCD. The existing screening tools for this population: the MIRBI-2 and the Burns Brief Inventory of Communication and Cognition (Right Hemisphere Inventory) contain test items related to lexical semantics, including interpretation of humour, explanation of inconsistencies and metaphor

interpretation, and expressive prosody. However, neither tool contains test items related to emotional prosody comprehension, which has been reported to be a good indicator of RH stroke in the acute phase of care (Dara et al., 2014). Discourse production and comprehension test items are also not included in these tools. Further, their ecologically validity and applicability across cultures are unknown.

Appropriate and psychometrically sound tests are essential to assist clinical decision making and provision of best practice health care (Shum et al., 2017). This requirement was reinforced during the nominal group discussion with the concept of a standardised and ecologically valid screening tool frequently expressed by the expert speech-language pathologists. Tablet technology (e.g., iPad) has the potential to address the ecological validity of this screening tool through video and audio functions. Tablet-based screening tools have been used successfully to identify aphasia (Choi et al., 2015; Guo et al., 2017) and cognitive impairment (Tung et al., 2016; Wall et al., 2018; Willer et al., 2016) in the stroke population.

A knowledge gap in the area of RH CCD was an interesting theme generated from the nominal group discussion. Although the last 60 years has seen a change in our understanding of the role of the RH in communication function, there is still much research required to fully understand the patterns and profiles of RH CCD as well as the impact of cognition on this disorder (Ferré et al., 2012). Further, there are limited evidence-based assessment options for RH CCD, requiring speech-language pathologists to draw upon their own knowledge and experience to identify an impairment (Ramsey & Blake, 2020). The varied results from the nominal group rankings and the content analysis revealed that there is a dissonance among the expert speech-language pathologists as to which features of RH CCD would be most sensitive in a screening tool, and even which test items would be best suited to a screening tool when compared with an assessment tool. Developing a valid and reliable screening tool that includes test items related to the key aspects of RH CCD will address a gap in current clinical practice for this population.

We recruited expert speech-language pathologists who had more than 10 years' experience with RH stroke in a teaching, research or clinical capacity. The mixed-methods design generated comprehensive data about test item priorities to include in this screening tool and perspectives regarding the test item design, the mode of delivery and the current knowledge gap. However, there are limitations to our study. While our sample size was small and limited to participants from two countries, it should be acknowledged

that this field of research is developing and experts in this field are limited. We included participants from Australia and USA but could have considered experts from other countries such as Canada. Although this screening tool is designed for use within an English-speaking population, the inclusion of participants from more culturally diverse populations may have resulted in different priorities. Cultural and linguistic elements will be considered in the test item development phase, particularly with regards to discourse and pragmatics, which are influenced by culture. Although not all test items were considered for ranking by all participants, there were clear test item priorities generated in all four cognitive-communication domains, which will form the basis of the test item development.

Test items for this screening tool were identified from both the nominal group rankings and the associated discussion. The need to include test items based on theoretical knowledge and existing evidence in addition to expert opinion was highlighted. Following a testing phase, it will be interesting to establish which test items are indeed sensitive in identifying RH CCD. The results of this study reveal multiple considerations exist in developing this screening tool. Considerations include test item design, mode of delivery, integrating impairment- and activity-level assessments and ensuring the tool is standardised and ecologically valid. This study represents the first stage of a larger project to develop a valid and reliable screening tool to detect RH CCD. The development of an accurate and sensitive screening tool that identifies RH CCD may improve the under-identification of this disorder and assist speech-language pathologists to recognise the need for comprehensive assessment and ensure early access to rehabilitation and appropriate intervention. Further studies will be conducted examining the validity, reliability and useability of this screening tool.

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Declaration of interest statement

The authors have no declaration of interest to report.

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Figure 1. Nominal group procedure