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Treating reading comprehension deficits in sub-acute brain injury rehabilitation:

identifying clinical practice and management

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Highlights

- SLPs provided multiple-component reading interventions in sub-acute rehabilitation
- Reading rehabilitation involved impairment, activity and strategy-based interventions
- Reading strategies were heavily used by SLPs for ABI reading rehabilitation
- Broad similarities were found between clinical practice and the literature

Abstract: There is limited evidence for cognitive-communication reading comprehension (CCRC) interventions for adults following acquired brain injury (ABI), particularly during sub-acute rehabilitation. The purpose of this study was to investigate the clinical practice of speech-language pathologists (SLPs) with CCRC deficits during sub-acute ABI rehabilitation and compare it to the best available evidence. An electronic survey was used to gather information from clinicians across Australia regarding clinical practice in the areas of assessment, intervention, treatment hierarchies and service delivery; survey questions were developed from an extensive review of the literature and expert clinician opinion. Survey findings were then compared with the literature in the form of a systematic review. Surveyed clinicians provided multiple interventions for CCRC rehabilitation, including impairment based (94.7%), activity based (94.7%) and reading strategy interventions (100.0%). Five strategies were used by >94% of SLPs (highlighting, identifying main points / wh-questioning, re-reading, summarising, reducing visual load). When compared with the literature, strong similarities were found for strategy-based interventions and individual service delivery, with broad similarities for functional and impairment-based interventions, and impairment based treatment hierarchies. Strong differences in assessment were identified. Strategy use reported in clinical practice (100.0% SLPs) was higher than in the literature. Further investigation into the effectiveness of specific reading strategies for people with ABI is warranted.

1. INTRODUCTION

Adults with literacy difficulties face a range of challenges that can impact their education, future employment, self-image [1] and their ability to access the health system [2]. Consequently, these adults often develop a range of strategies and social support networks to help with reading based tasks [2,3]. For adults who experience changes to their reading skills suddenly, for example, following an acquired brain injury (ABI) or traumatic brain injury (TBI), a range of similar challenges may arise and rehabilitation may be required. Due to the sudden nature of their injury, these adults may not have immediate access to support networks or be able to develop compensatory strategies in early recovery to assist with complex reading. Therefore, remediation of reading comprehension may be required, to support and equip people with ABI (pwABI) with strategies to increase their independence with reading for both rehabilitation and discharge home. As the median age of adults experiencing TBI is increasing [4], reading deficits may impact not only younger adults attempting to resume study or work, but also older adults attempting to return to work.

Reading comprehension is the act of interpreting written information from a text; this involves using prior knowledge to interpret information, making a representation in the mind about the text and its content, and then applying this information to new situations [5]. For adults with intact reading comprehension skills, the process of reading and understanding is often quick and simple. However, reading is a complex process which uses a wide range of physical, cognitive and linguistic skills and systems. Perceptual and visual skills (e.g., vision, visual processing, saccadic eye movements, scanning) [6-8], cognitive skills (e.g., memory, attention, executive functioning) [9-11] and linguistic skills (e.g., decoding, word comprehension, sentence processing, comprehending syntax and grammar) [12,13] are needed to enable discourse level reading comprehension. Following ABI, difficulties in reading can

arise following changes to any of these skills. Difficulties arising from changes to cognitive or cognitive-linguistic skills result in cognitive-communication reading comprehension (CCRC) deficits.

Typically, pwABI experience discourse or text level reading comprehension deficits (i.e., occurring at a paragraph level or above) in the context of a cognitive-communication disorder (CCD) [14,15], however these deficits may also occur following aphasia [16]. A recent systematic review investigated discourse level reading comprehension difficulties following ABI [17]. It identified these deficits arose following TBI, stroke, and other ABI (including inflammatory and infectious processes, post-aneurysm clipping, sub-arachnoid haemorrhage, post-tumour removal) [17].

While the incidence of CCRC deficits in pwABI is unknown, the features of these reading changes have been documented across the rehabilitation continuum. Early in recovery, people with traumatic brain injury (pwTBI) have demonstrated deficits in reading vocabulary, literal and inferential reading comprehension [18], and short discourse reading of up to four paragraphs [19]. Chronic, longer term reading changes for pwABI include deficits in text level reading comprehension [9,20], comprehension of text coherence [9] and inferential reading comprehension [11].

Reading comprehension deficits can impact the activity, participation and independence of pwABI across many settings, including during rehabilitation [21], returning home, and in attempting to engage in future work or study [22]. People living in the community with severe TBI reported reduced independence in daily functional reading tasks, including reading

newspapers (51.8% independent), magazines (50.4% independent) and books (45.4% independent) [23]. They often relied upon family to assist them to perform reading tasks.

1.1 The importance of reading in brain injury rehabilitation

While reading comprehension deficits occur as part of a broader CCD following ABI, their importance and impact on rehabilitation and recovery for pwABI may be under-recognized. The recovery of reading skills has been linked with cognitive recovery following ABI [18,21], and reading ability may reflect the level of academic ability for pwABI [21]. In a small study of pwTBI (n=10), the recovery of reading skills was reported as similar to the recovery of intelligence scores on cognitive assessment during the first six months of rehabilitation [18].

Reading was identified as one of three predictors of patient outcome for pwABI in outpatient rehabilitation, alongside time post onset and level of severity [21]. Reading comprehension was also a predictor of positive outcomes in vocational ABI rehabilitation, and the highest predictor from a range of neuro-psychological assessments of whether participants received a vocational evaluation [24]. As reading comprehension may predict success in ABI rehabilitation [21,24], rehabilitation programs that use literacy-based interventions may impact the participation of pwABI with reading deficits [21] and possibly influence their rehabilitation outcomes.

1.2 Rehabilitation of ABI reading deficits and best practice

Speech-Language Pathologists (SLPs) typically provide rehabilitation for CCRC deficits following ABI as part of clinical practice [17,25-28]. Outcome measures have been used by SLPs to demonstrate improvements in CCRC following right hemisphere brain damage [27] and TBI

5

[28], yet types of interventions have not been reported. While current clinical and professional guidelines do not provide specific recommendations for discourse level CCRC interventions following ABI, their recommendations for service delivery can be utilised. These include delivering interventions that: are person centred, use individualised treatment items, and recognises patients' previous literacy skills [15]; promote carry-over and generalisation of skills; and involve communication partners / significant others [15,29]. Consequently, we must first look to the literature and then to expert opinion to identify the evidence base and "best practice" recommendations for reading interventions. Utilising both ABI and TBI populations to investigate cognitive-communication and rehabilitation outcomes and provide a synthesis of findings is supported in the literature [14,30].

Health professionals including SLPs use evidence based practice to support decision making for clinical management [31]. Dollaghan [32] suggests that SLPs should use three types of "best available" evidence, including "external" evidence from systematic research, evidence "internal" to clinical practice, and evidence concerning patient preferences [32]. External evidence can further be classified into different levels (I-V) [33] indicating different strengths and comparability of the evidence to specific client populations.

In applying these models to CCRC interventions, the best available external evidence is currently in the form of published articles and a recently published systematic review that critically evaluated discourse level reading deficits following ABI [17] (see below); articles included in the review provided level I - IV evidence. This study aims to collect "internal" evidence by identifying clinicians' experiences in CCRC management to provide "expert opinion" (Level V evidence) for CCRC interventions. This information could then be used to

6

assist clients to be fully informed and identify preferences to facilitate participation in evidence-based interventions.

The recent systematic review [17] investigated the evidence for interventions for discourse level reading comprehension deficits following ABI. The authors defined discourse reading comprehension deficits as those occurring at a paragraph level and above. It included subjects with discourse level reading deficits related to CCD and / or aphasia following ABI, and investigated interventions that involved discourse level reading comprehension across all phases of recovery. The review reported on intervention effectiveness and generalisation, treatment dosage and assessment measures [17].

Twenty-three papers were identified for inclusion in the systematic review [17]. These included eleven group studies (three randomised controlled trials, eight cohort studies) and twelve case studies (including one repeated measures and one alternating treatment experimental design) [17]. The methodological quality of studies were examined using the PEDro-P [34] scale (for RCT studies), the SCED [35] scale (for experimental single case studies) and an informal rating scale (for cohort and case studies). Readers are referred to the systematic review paper [17] for further details.

Of the 261 subjects identified in the systematic review, discourse level reading deficits were experienced following stroke (69.4%), TBI (26.8%) and other ABI (3.8%). The majority of subjects (94.3%) were more than twelve months post injury. Discourse-level reading severity of subjects varied across the 23 papers, ranging from severe reading deficits (related to aphasia) to high level reading deficits (reading changes with high school / university level

reading). Discourse level reading deficits were reported as related to aphasia, cognitive deficits, or both for all aetiologies (i.e., TBI, stroke and other ABI) [17].

Six different types of discourse-level reading comprehension interventions were identified from the studies in the systematic review [17]. These included:

(i)   Oral reading treatments – pwABI read aloud (assisted or joint reading with SLP or computer) then made a comprehension decision about the text.

(ii)   Hierarchical reading – pwABI read progressively harder information on a computer (from matching to reading texts) and performed comprehension tasks (e.g., answer questions about the text).

(iii)   Cognitive treatments with a reading focus – cognitive skills (e.g., attention, memory, visual skills, cognitive-linguistic tasks, problem solving) were treated using personalised hierarchical cognitive rehabilitation, strategy-based reading interventions were part of the cognitive rehabilitation.

(iv)   Mixed interventions (multimodal language interventions, discourse treatment) – reading strategies were used alongside whole language / multimodal language approaches and hierarchical discourse therapy.

(v)   Compensatory devices – reading comprehension was supported via compensatory / facilitative measures, including text-to-speech technology and use of pictures related to the text.

(vi)   Solely strategy-based interventions – a range of reading strategies were used, including visual, content, cognitive and meta-cognitive strategies. Strategy interventions included individualised strategy treatments and specific strategy interventions.

8

Strategies were also used alongside other interventions, (i.e., cognitive and mixed interventions). Several papers investigated multiple reading interventions.

The systematic review identified that 18 of the 23 studies (78.3%) reported improvements in outcome measures of reading comprehension for at least one participant group; improvements were demonstrated for all six intervention types and across all severities of reading deficit [17]. Seven of these studies reported statistically significant changes in reading comprehension; these involved oral reading, hierarchical reading, cognitive treatments with a reading focus, strategy based interventions and compensatory interventions. Studies that did not demonstrate change in reading comprehension outcomes (n=5) involved oral reading, compensatory, strategy based and mixed (multimodal language) interventions [17]. The lowest treatment dosage occurred in the compensatory and strategy-only intervention groups.

1.3 Sub-acute rehabilitation and reading

The evidence to support early (sub-acute), coordinated team-based rehabilitation for pwABI has been well demonstrated in the literature. Reported benefits have included improvements in patient outcome, length of stay and patients achieving earlier functional gains [36,37]. This early rehabilitation has been found to impact the future recovery and rehabilitation of pwABI, and significantly improve social cognition, functional outcomes, and return to work [38]. A small study of pwTBI (n=10) identified that the maximum recovery of reading skills occurred within the first four months of sub-acute rehabilitation [18]. Currently, the evidence base for rehabilitation of CCRC deficits for pwABI during sub-acute rehabilitation is limited. Studies report that SLPs provide rehabilitation for reading [25] and that patients make improvements in reading comprehension [28] during sub-acute or inpatient rehabilitation for pwABI/TBI, however intervention types, treatment dosage and service delivery methods are unknown.

9

Within the systematic review [17], only three of the 23 papers involved participants that were less than 12 months post injury (involving 5.7% of participants across the papers). These three papers involved the treatments of oral reading and cognitive treatments with a reading focus (including reading strategies) [22,39,40]. Statistically significant improvements in reading comprehension and generalisation to other language skills were found following the Oral Reading for Language in Aphasia (ORLA) treatment [39]. Positive changes to outcome measures were reported following a combined oral reading / cognitive treatment (involving Modified Multiple Oral Re-reading and sequenced exercises for working memory) however the participant did not report functional changes to reading [40]. The final study involved cognitive rehabilitation via a hierarchical component approach, with functional reading and reading strategies part of the intervention [22]. Unfortunately, the study did not separate the results of participants < 12 months post onset from more chronic participants (up to 184 months post onset). The group findings included improvements in functional participation with 81% of participants returning to work or study; a subgroup from the study underwent additional assessments and demonstrated significant gains in reading comprehension assessment measures. While treatment dosage was not fully specified across the three studies [22,39,40], mean treatment time ranged from 18.3 hours to 32.8 hours, with intervention sessions lasting between 30 and 120 minutes.

Service delivery of SLPs providing specialised, sub-acute rehabilitation for adults with ABI / TBI in Australia has previously been investigated [41,42]. The majority of specialised SLP services reported that patients with CCD typically received one to three individual interventions per week, with additional service models used including independent tasks and group therapy [41]. Currently, how clinical SLPs provide services to pwABI with CCRC

10

deficits during sub-acute rehabilitation is unknown. Increasing our knowledge in this area may assist pwABI to better engage in rehabilitation and influence rehabilitation gains.

1.4 Rehabilitation context

The World Health Organization's International Classification of Functioning, Disability and Health (ICF) model [43] provides a framework (including set terminology and criteria) for the classification of a range of health disorders, from the level of body structure and function to an individual's participation. The ICF framework is used worldwide in health care and rehabilitation services. The influence of the ICF model can be seen within the Australasian Faculty of Rehabilitation Medicine [44] Standards which govern the provision of dedicated multi-disciplinary sub-acute rehabilitation services in Australia. These dedicated rehabilitation services entail "the prevention and reduction of functional loss, activity limitation and participation restriction arising from impairments, the management of disability in physical, psychosocial and vocational dimensions, and improvement of function." (p2) [44].

It should be noted that within Australia, brain injury specific sub-acute services continue to be comparatively small. Previous research identified 10 specialised sub-acute brain injury rehabilitation facilities across Australia [41]. These services primarily manage TBI, however some also admit adults with ABI. In the study, SLP staffing levels were reported by eight of the services, totalling 15.1 full-time equivalent SLPs working in specialised sub-acute ABI/TBI rehabilitation in Australia [41].

Other facilities across the country also provide sub-acute rehabilitation to adults with CCD arising from ABI / TBI. This typically is in the context of a broader general rehabilitation

service, stroke unit, or as an ad-hoc hospital ward-based clinical service. This is supported by recent national survey-based studies that investigated Australian SLP practice in cognitive-communication and brain injury rehabilitation. Steel [45] identified 16 respondents (SLPs) who reported working in specialist TBI facilities, with the majority of respondents (60 %, n = 27) working in a generalist setting [45]. Short [46] identified 24 respondents (SLPs) who reported working in sub-acute rehabilitation across Australia; Steel [45] identified 29 respondents (SLPs) who providing inpatient rehabilitation; 23 respondents (SLPs) provided services primarily focussed on cognitive-communication (versus dysphagia management). As such, the number of SLP clinicians identifying as being "experienced" or "specialists" in sub-acute brain injury rehabilitation may be low.

1.5 Research framework

Research into CCRC deficits and management is still in its infancy. There is no current recommended rehabilitation framework for managing CCRC deficits, and causative factors and theories are still being investigated [9,11,47]. The ICF model [43] has been used as the underlying framework for this study. It is a model that is accessible to both clinicians and researchers, with a shared language and terminology [48].

The ICF [43] has been applied to rehabilitation services [49], brain injury rehabilitation [50], sub-acute TBI rehabilitation [51] and TBI outcomes [52], SLP research [48] and practice [53-55], and to CCD following TBI [56]. Further, the ICF is reflected in clinical goal setting in inpatient cognitive rehabilitation [57], and in SLP clinical practice with interventions categorized as either "impairment" focused (i.e., related to body function and structure), or "functional" and / or "activity" based (i.e., targeting activity / participation) [48,58,59].

12

The ICF framework allows for the categorization and clinical comparison of a range of interventions that may belong to different schools of rehabilitation theory (e.g., cognitive rehabilitation; linguistic based tasks; restorative versus compensatory activities), and compare these within the context of providing clinical services.

The aims of this study were two-fold. Firstly, the study aimed to identify the current clinical practice of experienced SLPs working with pwABI, specifically adults who exhibited discourse-level reading comprehension deficits related to CCD, during sub-acute rehabilitation in Australia. Secondly, the study aimed to compare the clinical practice findings with the best available evidence for reading interventions as categorized by the ICF (e.g., impairment vs. activity based), via direct comparison with findings from a systematic review investigating discourse level reading comprehension interventions for pwABI [17]. In comparing these two sources of data, we acknowledge there will likely be differences between the clinical management pwABI and CCRC deficits and those involved within a research study, including differences in service delivery, interventions and population.

2. MATERIALS AND METHODS:

This study has ethical clearance from both the Metro South Human Research Ethics Committee and the University of Queensland Medical Research Ethics Committee.

2.1 Participants and procedure

Target participants were SLPs with experience in providing sub-acute brain injury rehabilitation for adults in Australia following ABI and TBI. The survey did not limit itself to SLPs only working with TBI, and aimed to include SLPs working with all types of ABI that

13

result in CCRC deficits. Participants were recruited over a three month period in 2013. Recruitment occurred through a scripted email message that was distributed via gatekeepers to a range of SLP professional networks and special interest groups. Recruitment also occurred via printed handouts and word-of-mouth at two national conferences.

An online electronic survey system (i.e., SurveyMonkey ®) was used for this study. The survey was anonymous, individual participants and their responses were not identifiable, and participants were informed that completion of the survey would be taken as informed consent to participate in the research.

2.2 Survey development

The survey was designed to investigate SLP clinical practice and service delivery in a specific clinical context. Survey items were derived from a number of sources, including published literature on reading interventions in ABI, rehabilitation and service delivery in sub-acute ABI; published reading intervention resources for pwABI; and published literature on evidence-based reading interventions from other clinical populations (i.e., strategy-based interventions) [60-65]. In addition, the clinical practice and feedback from experienced SLPs working in tertiary-level brain injury and neuro-rehabilitation services helped to inform the survey.

Intervention tasks were categorised according to the ICF model [43], and tasks were categorised based on the underlying target or focus of the intervention as having an "impairment" or "functional / activity" focus [48,58]. Hence "impairment based" treatment would be those interventions (e.g., follow directions, sentence picture matching) that directly target reading comprehension and whose effects would be expected to generalize to improved reading

14

comprehension across different types of activities versus functional or activity-based interventions that target reading comprehension for restricted activities and would not be expected to generalize (e.g., social media/digital communication; community outings). Strategy based interventions were investigated separately, as they can target either or both intervention groups. Definitions of these terms were provided to survey respondents as a glossary (see Appendix A).

The survey was piloted by three experienced clinical SLPs with 6 – 16 years experience in ABI rehabilitation and took 30-60 minutes to complete. Each clinician provided feedback on the survey (including content, wording, time and effort). Following their feedback, minor changes to the wording of three questions in the survey were made to further clarify the questions.

The final version of the survey consisted of 47 questions across 6 areas; (i) participant demographics, (ii) assessment, (iii) impairment based interventions, (iv) functional interventions, (v) strategy use and (vi) service delivery. A glossary was included to provide definitions of terms used in the survey and their suggested interpretation to aid in consistency of survey responses (see Appendix A). Frequency rating scales and multiple-choice questions were used to aid in comparison of responses [66]. Free text boxes were used to capture broader information and were also available in each section for participants to provide additional comments if desired. All content questions in the survey required a response; participants could exit the survey at any time. The survey is included in Appendix B.

2.3 Data analysis

15

Individual and summary data were collated by the online survey tool; this included free text data, counts, and overall summary data. These data were entered into a Microsoft ® Excel ® for Mac 2011, Version 14.5.2 database by the first author; the responses from respondents who fully completed the survey were further separated and collated. Descriptive analysis of the data occurred, providing percentages and frequency counts; a summative content analysis was used for free-text responses [67]. A random sample of data (235 data points; 26% of data) were reviewed by co-author *de-identified for review*, inter-rater reliability of data transcription and data analysis was 100%.

3. RESULTS

Thirty-two SLPs commenced the survey; nineteen fully completed the reading comprehension section of the survey (59% completion rate). The results reported in this paper include only those who completed the survey (n=19). While small, the number of participants in this study is similar to SLP staffing levels reported in specialised ABI rehabilitation services across Australia [41] and similar to other recent studies investigating Australian SLP TBI practice [45,46].

3.1 Participant demographics

Overall, the participants who responded to this survey were experienced clinicians. Over seventy-three percent (n=14) had worked for six years or more, and 47.4% (n=9) had worked within brain injury services for six or more years (see Figure 1). The SLPs worked across seven different settings, including sub-acute / inpatient rehabilitation (n=10), community services (n=6), outpatient (n=3), acute (n=3), transitional rehabilitation (n=2), private practice (n=3) and other (n=1, postgraduate study). Four participants worked across multiple settings.

16

Seventeen participants worked in solely adult positions, two worked in a mixed caseload. The SLPs worked predominantly in metropolitan areas (n=11), with seven working in regional centres, and one working across metro and regional areas. The current caseload of participants was primarily brain injury specific and / or neurological (78.9%, n=15), a smaller group reported a general / mixed caseload (21.1%, n=4).

3.2 Prevalence of cognitive-communication reading comprehension deficits

Participants reported the percentage of their patients with CCD who demonstrate reading comprehension deficits via a frequency rating scale. Over 47% (n=9) of participants reported 76-100% of CCD patients had associated reading deficits; 31.6% of participants (n=6) reported 51-75% of CCD patients had reading deficits; 21.1% (n=4) identified ≤50% of CCD patients demonstrating reading deficits in sub-acute rehabilitation.

3.3 Assessment of reading comprehension during sub-acute rehabilitation

All participants identified using published / formal assessments of reading comprehension, with eleven different tools identified. The most commonly used assessments of reading were the Measure of Cognitive Linguistic Abilities (MCLA) [68] used by 68.4% of participants (n=13) and the Mt Wilga High Level Language Assessment [69] used by 57.9% of participants (n=11). Assessments included both cognitive-communication and aphasia-based assessments, and are reported in Figure 2.

Formal outcome measures were used by 78.9% of participants (n=15); and included the Australian Therapy Outcome Measure System [78] (n=9), the Functional Independence Measure [79] (n=4), Goal Attainment Scaling [80] (n=2), and the Quality of Communication Life Scale [81] (n=1). Participants reported that outcome measures were not often specific or

17

sensitive enough to measure changes in reading comprehension, and were not used consistently in practice. A range of other assessment tools were reported by SLPs, including client interviews, case history and self report (n=5); assessment via functional reading tasks (n=12) or reading therapy materials (n=3), online assessments from other sources (n=1) and informal assessments (n=1). Assessing against SMART goals (n=1), target behaviours (n=1) and reassessment with formal and informal measures (n=2) were also utilised.

When compared with the systematic review [17], strong differences are found in formal assessment of discourse level reading comprehension. The most frequent assessments of reading identified in the systematic review [17] were primarily aphasia-based (Reading Comprehension Battery for Aphasia [82], WAB [77], Porch Index of Communicative Ability [83]), or from the educational field (Iowa-Chapman Reading Test [84], Gray Oral Reading Tests [85]). Cognitive-communication assessments of reading were not formally reported in the systematic review studies. Across the systematic review and survey, the use of informal / other measures to assess discourse reading in pwABI was common.

3.4 Interventions for reading comprehension in sub-acute ABI rehabilitation

SLPs reported the types of reading interventions they used in sub-acute rehabilitation. The majority of participants (94.7%; n=18) identified using impairment based interventions, activity based interventions, and strategy based interventions that were clinician driven. Eighty-four percent (n=16) reported using strategies that were client implemented. The majority of SLPs (57.9%, n=11) identified they provided an equal combination of impairment and activity based interventions during sub-acute rehabilitation; with 31.6% (n=6) reporting they provided primarily "activity based" interventions.

Specific types of interventions were investigated in three areas: impairment based interventions (10 activities, reported in Figure 3), activity based / functional reading interventions (6 activities, reported in Figure 4) and strategy-based interventions for reading. The SLPs reported how often they used specific impairment and activity based interventions with the target population, via a five point frequency rating scale. The intervention scale response ratings were: "regular" (used with 76-100% of patients with CCRC difficulties), "common" (used with 51-75% of patients), "sometimes" (person dependent / difficult to implement / 26-50% of patients), "rarely" (1-25% of patients) and "not used" (0% of patients).

When compared with the systematic review [17], similarities were seen with aspects of impairment-based reading rehabilitation in clinical practice. The task of "answering questions about the text" was reported in all six intervention groups in the systematic review, the impairment-based activity of "answering open ended factual questions" from a written text was used by >80% of surveyed SLPs as a regular or common rehabilitation activity. Interventions and activities that involved or facilitated increased processing and comprehension of texts were reportedly used in over half the studies in the systematic review (n=13), including hierarchical reading, strategy-based, cognitive and mixed interventions [17]. This corresponds with survey findings, where tasks including predicting and problem solving, drawing conclusions / giving opinions, inferencing and reasoning were reported as a regular or common impairment-based reading intervention by over 60% of SLPs.

Functional reading tasks or stimuli were only used in 34.8% of the papers in the systematic review (n=8) [17], whereas all survey participants (100.0%) reported using "functional" reading materials as a "regular" or "common" therapy activity. Surveyed SLPs targeted reading skills

required for work / study, self management, and home / community / family; this differs from the systematic review studies which primarily targeted reading for participation in social / leisure pursuits.

The therapy tasks used in the six intervention groups from the systematic review [17] can also be classified with regards to the ICF. The majority of interventions involved both impairment-level and functional tasks. These included oral reading treatments, cognitive interventions with a reading focus, mixed interventions, and some solely strategy-based reading interventions. Hierarchical reading interventions were primarily impairment based; compensatory interventions and some solely strategy-based reading interventions had a functional focus.

3.4.1 Intervention hierarchies

Surveyed clinicians reported they manipulated a range of features to change the complexity of impairment and functional tasks, including manipulating linguistic and cognitive-communication features, as well as functional and participation aspects of tasks. For impairment-based tasks, the most commonly manipulated features were concrete vs abstract items (100.0%, n=19), length of materials (94.7%, n=18), linguistic complexity (78.9%, n=15) and grammatical structure (78.9%, n=15). For functional activity-based tasks, SLPs manipulated the length of materials (84.2%, n=16), number of items in the task (84.2%, n=16), the complexity of the accompanying functional activity (73.7%, n=14) and the environment for the activity (68.4%, n=13).

Within the systematic review [17], intervention hierarchies were not typically combined. Specific formal linguistic-based intervention hierarchies (e.g., reading difficulty, linguistic

complexity, length) were reported for oral reading and hierarchical reading interventions. The mixed discourse intervention [86] demonstrated the most similarities to the hierarchies reported by surveyed SLPs in this study. It utilised the "strategies of observed learning outcomes" (SOLO) [87] hierarchy to facilitate more complex processing and comprehension of texts, via discourse therapy and reading strategies. For interventions utilising functional reading stimulus, treatment hierarchies were not formally reported; typically authors reported types of stimulus materials used.

3.4.2 Strategy based interventions for reading comprehension

Participants identified the individual reading strategies they used with the target population during sub-acute rehabilitation. Visual, content-based, cognitive and metacognitive strategies for reading were investigated. All participants (n=19, 100.0%) reported using reading strategies for sub-acute rehabilitation of reading.

Visual strategies: All SLPs (n=19, 100.0%) identified using visual strategies in reading rehabilitation. These included underlining / highlighting key words or ideas (n=19, 100.0%); reducing visual load (n=18, 94.7%); finger tracing / tracking (n=16, 84.2%); and using a coloured visual marker on the side of the page (n=17, 89.5%). *Content-based strategies:* Content strategies were divided into preparatory strategies (those occurring before reading the text), strategies at a word – sentence level, and paragraph level strategies. Preparatory and word – sentence level strategies were used by 89.5% of SLPs (n=17), with paragraph level strategies used by 100.0% of SLPs (n=19). Specific content strategies are reported in Table 1. *Cognitive and metacognitive strategies:* All SLPs (100.0%, n=19) used cognitive and metacognitive strategies in their clinical practice. These are reported in Table 2.

21

3.4.3 Frequency of strategy use

The majority of surveyed SLPs (n=16, 84.2%) identified that they used reading strategies with 76-100% of their ABI CCRC patients. Three strategies were used by all (100.0%) participants: highlighting or underlining key words, identifying main points / wh-questioning, and re-reading. Over ninety-four percent of participants (n=18) reported using the strategies of summarising and reducing visual load. Participants also reported the strategies they used "most frequently" in rehabilitation. They identified the strategies of highlighting / identifying key words (n=6), summarising and paraphrasing (n=6), re-reading (n=7) and stop and think (n=5). However, SLPs also commented that the strategies employed were patient dependent (n=3), and that multiple strategies were used with patients (n=2).

3.4.4 Rationale for strategy use

SLPs reported their rationale for strategy use by indicating the cognitive and/or linguistic skill(s) the strategy targeted (i.e., attention, memory, impulsivity / speed, comprehension of content, other). Overall, SLPs reported reading strategies targeted multiple areas. For example, the strategy of underlining or highlighting key words was used by all participants (100.0%) with the reported rationale for use identified as addressing comprehension (94.7%), memory (73.7%), attention (63.2%) and impulsivity (36.8%). The strategies that correspond to the most frequently reported rationale are reported in Table 3.

While strategies were the most commonly reported intervention in the systematic review [17], used in 47.8% of papers, reading strategy use was higher in reported clinical practice. All survey participants (n=19, 100.0%) reported using reading strategies in sub-acute rehabilitation. However, only one study from the systematic review utilised strategies with patients in early rehabilitation (i.e., <12 months post onset) [22]. The use of visual, content, cognitive and metacognitive reading strategies was identified in both the systematic review and in survey findings in this study; with content-based strategies used heavily in both studies. The strategies of identifying key points and summarising were two (of the five) most common strategies identified in this study (used by >94% of participants), and two (of the three) most frequently reported strategies identified in the systematic review [17].

3.4.5 Other reading comprehension interventions

Of the six intervention types identified in the systematic review, strategy-based interventions were the only specific intervention reported in clinical practice in this study. Surveyed clinicians did not specifically report using the other five intervention groups (i.e., oral reading, hierarchical reading, cognitive based interventions, mixed interventions, and compensatory devices). However, commonalities were seen between some interventions and aspects of sub-acute clinical practice reported by SLPs in this study. Surveyed SLPs reported using strategies to address specific *cognitive* changes impacting reading. *Hierarchical reading* interventions were not reported specifically, yet similarities were found with treatment hierarchies reported by surveyed SLP for impairment-based tasks (e.g, linguistic complexity, grammatical structure, length). Similarities were also seen with the *mixed interventions* and aspects of interventions reported by survey participants. The *mixed discourse* intervention shared similarities with impairment based tasks reported by surveyed SLPs, including inferencing, reasoning, predicting and problem solving; the *mixed*

multimodal interventions shared treatment elements with the paragraph-level content strategy of reinforcing reading comprehension with auditory-verbal tasks, which was used by 73.7% of surveyed SLPs. The use of *compensatory devices* was not reported by survey participants.

3.5 Service delivery

Surveyed clinicians reported therapy was delivered via individual sessions for both impairment based tasks (84.2%, n = 16) and functional activities (78.9%, n=15). The SLPs reported using a range of additional service delivery methods including group sessions, multi-disciplinary sessions, using assistants and carers as agents of therapy, and utilising independent practice and homework tasks. Treatment dosage, number of sessions and service delivery were reported to be dependent upon patient need, other caseload demands, and the model employed within the clinic / service facility.

While many services were "needs" dependent, service delivery ranged from daily (five times per week) interventions (7 services, 36.8%) including one service that could provide twice daily sessions using therapy assistants; three times per week (6 services, 31.6%); and one to two times per week supplemented with additional work / tasks (5 services, 26.3%); one participant did not provide his / her treatment intensity. The majority of services (n=13, 68.4%) could provide three or more interventions per week targeting reading comprehension.

Participant SLPs reported CCRC rehabilitation was often provided in conjunction with other rehabilitation interventions as part of broader therapy sessions for pwABI. The duration of reading interventions ranged from 15 to 60 minutes. Participants identified that reading may not be a priority for all patients during sub-acute rehabilitation given possible concomitant communication or swallowing impairments and other sub-acute rehabilitation goals (e.g. oral

or social language goals, verbal expression, auditory comprehension). Reported experiences with reading rehabilitation were varied. One SLP commented that patients often lose interest in reading therapy. Another commented "it is a significant restriction to have a reading impairment - many of my clients are trying to either get back to work, re-establish friendships using social media or have a very important role in running the household so functional reading comprehension is necessitated - I don't think the importance of reading comprehension is necessarily always acknowledged by third party funders or private payers."

When comparing survey findings with the systematic review [17], individual therapy was the most common method of reading rehabilitation across both studies; survey participants also used additional service delivery methods (i.e., groups, individual practice), and treated CCRC deficits as part of a broader communication rehabilitation programme where necessary. Variations in dosage were present across both studies, with treatment dosage ranging from 1-5 sessions per week. Session duration ranged from 15 – 60 minutes in clinical practice and between 30 -150 minutes within the systematic review. Total treatment time ranged between 2.5 to 78 hours with total duration ranging from one session to 17 months in the systematic review; total treatment time or duration were not reported in the survey.

When reviewing the three studies in the systematic review that included participants <12 months post onset [22,39,40], wide variation was found both within and between studies. Treatment dosage varied from 30 minutes to two-hour sessions, daily to weekly interventions, and total mean treatment time ranging from 18.3 hours to 32.8 hours. The strongest similarities in dosage to the clinical practice of surveyed SLPs were found with an oral reading intervention during inpatient rehabilitation [39], where dosage was reported as 3-5 x 30 minute sessions per week, over 20-80 treatments. Within clinical practice, 68.4% of

surveyed SLPs provided 3+ sessions per week for CCRC deficits, and overall intervention time ranged from 15 – 60 minutes.

4. DISCUSSION

This paper identifies how experienced SLPs address CCRC deficits in pwABI during sub-acute rehabilitation, which constitutes one of the three types of best available evidence (i.e., clinical practice) in the EBP triangle[32]. Overall, SLPs provided multiple-component interventions to address CCRC deficits. Cognitive-communication therapy was provided via impairment and activity-based reading tasks, and included clinician-directed and patient-implemented reading strategies. Providing interventions targeted at multiple levels (e.g., both the impairment and activity level) is recommended when providing cognitive rehabilitation following brain injury [59].

When comparing survey findings to the current best evidence in the form of a systematic review, specific differences were identified in assessment of discourse reading and clinical SLPs not utilising compensatory interventions; specific similarities were present for the use of strategy-based interventions and service delivery via individual therapy sessions. Broad similarities were present for clinical treatment hierarchies and aspects of impairment and functional reading tasks.

Potential diagnostic challenges for reading impairment following ABI were highlighted within the systematic review. Across the papers, participants were classified as having discourse level reading deficits arising from aphasia, cognitive changes, or both; all of these were reported following TBI, stroke and other ABI [17]. Additionally, the differential diagnosis

26

of the underlying communication disorder (e.g., aphasia vs CCD) is questioned for some papers. Several papers reported patients with a range of clinical features including cognitive reading deficits and reading deficits at a high school / university level; some of these patients were diagnosed with a mild aphasia. Communication difficulties arising from "other ABI" (e.g., sub-arachnoid haemorrhage) can include word finding difficulties and high level reading deficits [88]; whether this is representative of a mild anomic aphasia or a cognitive communication disorder is questioned. Differential diagnosis may depend, to an extent, upon the clinical or research context. Perhaps future terminology and diagnosis will better represent the scope of CCRC deficits in the future.

The majority of the papers involved in the systematic review came from the aphasia literature, this has likely influenced all aspects of these studies, including assessment methods, diagnosis, terminology and intervention planning. This has had an overarching effect on the comparisons drawn between clinical practice for CCD / CCRC and the systematic review findings for the management of discourse level reading comprehension deficits following ABI. Yet the diagnostic questions raised in the systematic review and above indicate that results from the review may be interpreted in a broader context and can be applied to individuals with CCRC deficits.

4.1 Assessment measures

Differences in the assessment of reading were identified between clinical practice and the systematic review findings [17], which likely reflects the clinical population as well as differences between research design and clinical practice. Surveyed clinicians primarily used cognitive-communication assessments of reading, whereas the studies in the review used assessments from the fields of aphasia, education and neuropsychology. Both survey

27

participants and the research literature [89] identified that outcome measures for reading were often not sensitive in identifying functional changes. The importance of using informal / other measures to assess reading in pwABI was identified in both the systematic review and the clinical survey. These findings suggest current assessment tools do not meet the requirements of clinicians or researchers, and support the need for an assessment of discourse level reading for pwABI that is clinically relevant, translatable across contexts (e.g., clinic, home, community), and possesses strong psychometric properties, for use across clinical and research domains.

4.2 Interventions

Surveyed clinicians provided sub-acute CCRC rehabilitation to pwABI using a cognitive-communication framework. They provided multiple-component interventions for CCRC deficits, across a number of environments, via a range of service delivery options including groups. These intervention features correspond with current best-practice CCD rehabilitation and management guidelines [15,29]. The treatment hierarchies reported by surveyed clinicians addressed both the cognitive-communication and participation aspects of reading after ABI; however this was not commonly demonstrated within the literature. This may reflect the population(s) being investigated, the intervention framework being used and interventions provided within a research framework (e.g., investigating one specific intervention) compared with multiple-component interventions provided in clinical practice.

The differences in functional reading activities identified between the literature[17] and reported clinical practice likely reflect the needs of the client at the time. As the majority of studies in the systematic review involved pwABI with chronic reading deficits, it is unsurprising that functional materials mostly targeted social / leisure pursuits. Patient goals

and needs during early, sub-acute rehabilitation were reflected in the survey findings, where functional activities commonly targeted work, study and self management, in addition to home, community and family activities.

4.2.1 Use of reading strategies in rehabilitation

The use of strategies in CCRC rehabilitation for pwABI are supported by findings from this study and the systematic review. Strategies have been used in ABI reading rehabilitation for over 30 years [90], and their use in both clinical practice and research has previously been recommended [14]. In other populations (including education, learning difficulties and adult literacy) [60-65] reading strategies are well researched and have a strong evidence base. Within ABI cognitive rehabilitation, strategy use is a common intervention [91,92], with strong evidence for metacognitive strategy instruction [93]. It should therefore not be surprising to see clinicians utilising strategies as common practice in the rehabilitation of CCRC deficits. However, the mismatch between high clinical use and the small literature base is noted. This may reflect that clinical practice is responding to previous recommendations [14] at a faster rate than research practice, or that clinical practice may be influencing research into reading comprehension.

There is a small but growing trend for research into solely strategy-based interventions for discourse reading in pwABI (arising from cognitive-communication deficits and aphasia), with five publications identified in the past six years [47,88,94-96]. All five studies used content-based and cognitive / metacognitive reading strategies, with three also using visual strategies [88,94,95]. The strategies used across these five papers were also identified by the participants in our survey. These included preparatory content strategies (previewing text, headings, identifying key words, activating background knowledge), active content strategies (i.e.,

29

occurring during reading: identifying key words or ideas, writing notes or key points, summarising, paraphrasing, discussion, drawing conclusions), cognitive / metacognitive strategies (re-reading, active strategy use, reviewing, recalling, checking, problem solving, reflecting), and visual strategies (highlighting, underlining, finger tracing, blocking text).

The high-use strategies identified by clinicians in this study (used by >94% SLPs) corresponded with evidence-based strategies from other populations. Using wh- questions, summarising, and identifying main points were all identified as reading comprehension instruction methods with a firm scientific basis by the National Reading Panel [64], and as evidence based interventions with large effect sizes for students with learning difficulties [61], as were visual or content enhancement strategies [61]. Reading strategy use is not age limited, and is common within older populations, to facilitate complex text reading in secondary and tertiary populations [97]. In addition, reading strategies have been found to be effective for high functioning readers as well as for readers with difficulties [62,64]. As such, using reading strategies with adults with CCRC deficits is supported, across a range of discourse level reading deficits and severity.

4.3 Service delivery

The differences in service delivery identified between the survey and the systematic review likely reflect the differences between sub-acute service provision and research based interventions for predominantly chronic populations, particularly for intervention length, frequency and duration. The service delivery models identified in this study are similar to previous findings for SLP service provision in specialised sub-acute brain injury rehabilitation units in Australia [41], involving the use of individual service provision plus additional service delivery methods (e.g., independent work, groups). However, differences

30

are noted in treatment dosage. Within the specialised units, the majority of SLP services reported patients with CCD received 1-3 individual sessions per week [41]. In this study, the majority of participants reported providing up to 3-5 sessions per week, with clinicians identifying reading rehabilitation may occur as part of a broader communication intervention, and that patient participation in reading rehabilitation varied in the sub-acute setting. This indicates that greater frequency of services may be available for pwABI with reading deficits, across a range of sub-acute rehabilitation service providers, than previously identified.

Surveyed clinicians commonly identified CCRC deficits in pwABI during sub-acute rehabilitation. Over 78% of survey participants (n=15) reported 50-100% of patients with CCD demonstrated discourse level reading comprehension deficits. Whether this figure reflects actual prevalence is unknown, as there is currently no published data in this area. Not all pwABI receive sub-acute rehabilitation, and patients with severe communication and swallowing disorders may have other intervention priorities and goals during early rehabilitation. The priority of CCRC skills in sub-acute rehabilitation (for assessment and intervention) is unknown.

4.4 Diagnostic and terminology considerations in discourse reading

The use of terminology specific to CCD is common within professional guidelines [14,15], and was also reflected in clinical practice via the survey findings. However, differences in terminology within the literature and systematic review were noted. The papers identified in the systematic review [17] reported participants to have reading changes related to aphasia and / or cognitive deficits, however none of the papers reported participants to have a cognitive-communication disorder. The systematic review [17] identified that some study participants had characteristics suggestive of cognitive-communication changes (e.g., WAB Aphasia Quotient

(AQ) within the normal range; cognitive reading deficits; reading skills at a high school / tertiary level), however this diagnostic term was not used. There are two possible reasons for the lack of CCD terminology in this literature. Firstly, as previously identified, the majority of studies came from the aphasia literature, influencing all aspects of the research, including assessment methods, differential diagnosis and treatment selection. Secondly, the relative recency of dedicated research into CCD including assessment, interventions and management [15] may have impacted terminology use within the literature. Perhaps a diagnosis of a CCD is more common in clinical practice than is reflected in the literature. Given this, utilising the results from the systematic review for comparison with clinical practice into cognitive-communication deficits is valid. Further, while reading has been reported to improve following SLP intervention in right hemisphere disorder [27], no intervention papers were identified by the review for this population.

4.5 Limitations

While providing preliminary data on this area, the survey findings report clinicians' perceptions of practice, not necessarily actual practice. Additionally, it represents only one type of best available evidence (e.g., clinicians perspectives) in the EBP triangle[32]. It does not address other types of internal evidence such as the preferences of the pwABI. Not all survey respondents were working in sub-acute services at the time of the survey. Despite highlighting a focus on sub-acute service delivery (at the start and throughout the entire survey), it is unknown whether participants' responses were partially influenced by their current workplace practices. The clinical practice of newer graduates is under-represented; newer clinicians may provide services to this group differently to experienced clinicians. The study provided the views of only a small number (n=19) of SLPs. However this number is representative of SLPs currently working in this specialised population within Australia [41], is

similar to numbers reported in other studies for this SLP population [45,46], and respondents were, for the most part, experienced clinicians. This study investigated services only within one country, however these rehabilitation services are provided under guidelines that utilise the ICF framework. These factors enable the comparison of results to SLP practice and services within other countries.

5. CONCLUSIONS

This study has identified how experienced SLPs provide rehabilitation for CCRC deficits during sub-acute rehabilitation in Australia. Overall, clinicians utilised cognitive-communication assessments of reading and provided multiple-component cognitive-communication interventions, utilising impairment and activity based reading tasks and reading strategies. Strong similarities with the current evidence-base as reported in the systematic review included the high use of reading strategies as an intervention and individual therapy with varied intervention dosage; broad similarities were found for treatment hierarchies, use of functional reading interventions, and facilitating comprehension and more complex processing for text-level reading via impairment-based tasks. Strong differences were present for assessment of reading. These differences likely reflect the management of cognitive-communication reading deficits versus an aphasia and / or research-based framework, and providing interventions in a sub-acute setting versus research driven interventions for chronic populations. Overall, when comparing SLP CCRC management with the evidence base, clinicians are found to provide evidence-based rehabilitation.

Future research should begin to identify the incidence and prevalence of CCRC deficits in pwABI; investigate actual clinical practice of experienced SLPs and the impact of CCRC

interventions on patient outcomes; and begin to identify the effectiveness of different

strategy-based interventions during sub-acute rehabilitation.

Appendix A: Reading Survey Glossary

To assist in completing the survey, the following terms and meanings have been utilised.

Definitions:
- Impairment: problem in body function / structure
- Activity Limitation: difficulty executing task / action (ie performing activity)
- Participation Restriction: problem experienced in involvement in real life situations

(World Health Organisation)

- Strategy: An adaptation of behaviour that serves a function in achieving success

(Merriam-Webster Dictionary)

Interpretation:
These terms have been interpreted in the following way for this survey:

For example:
Impairment: Difficulties comprehending written information at a paragraph level.
Activity Limitation: Unable to read a novel.
Participation Restriction: No longer participating in bookclub.

Within a therapy context, these have been interpreted to mean:

- 'Impairment' based therapy: focus on remediation of skill
- 'Activity' based therapy: focus on increasing ability to perform a functional task
- 'Participation': patient engagement and involvement, and satisfaction with their engagement and involvement in tasks.

- Strategy: An activity done in addition to normal processing to help improve performance (i.e. comprehension). Some are simple, some may be complex or remedial in nature.

Please note:
For the purpose of the survey, clinical interventions have been categorised as either direct therapy tasks or as strategies. We are aware that some clinicians may disagree with the classification utilised in this survey. We request that you complete the survey indicating whether you utilise a specific intervention in your clinical practice, regardless of its categorisation.

A reminder:
The survey lists a range of treatments used in reading comprehension (RC) rehabilitation; please indicate those treatments you use in subacute (inpatient) rehabilitation for adults with cognitive-communication disorders following ABI / TBI. It is assumed patients are medically stable, and able to engage in a rehabilitation programme.

35

Appendix B: Reading Comprehension Survey Questions

Demographics

1. I am a Speech Pathologist currently working in the following setting(s) (tick all that apply):

Acute Hospital	
Subacute / post acute / inpatient rehabilitation	
Transitional Rehabilitation	
Outpatient / Day Hospital	
Community Based Rehabilitation	
Community Health Centre	
Vocational Rehabilitation Service	
Private practice	
Other: please list	

2. My caseload involves:

Paediatrics	
Adults	
Mixed	
Other: please list	

3. My caseload is:

General / Mixed	
Neurological	
Brain Injury Specific	
Other: please list	

4. My workplace setting is (tick all those that apply):

Metropolitan	
Regional	
Remote	
Other: please list	

5. I have been working as a clinical Speech Pathologist for (please tick one):

0-2 years	
3-5 years	
6-10 years	
11+ years	

6. I have been working with adults with ABI / TBI for (please tick one):

0-2 years	
3-5 years	
6-10 years	
11+ years	

7. Please comment on your experience in working with adults with cognitive communication disorders:

36

Assessment of reading comprehension in cognitive communication disorders

8. When assessing for deficits in reading comprehension, what formal and informal assessment measures do you use?

9. Which level of function (impairment, activity, participation) do you investigate via these assessments?

10. Please add any additional comments regarding assessing reading comprehension during sub-acute rehabilitation for adults with cognitive-communication disorders related to TBI / ABI.

11. How do you measure / quantify changes in reading comprehension? Does this differ for impairment vs activity? Please list / comment.

12. Do you utilise outcome measures?   Please list / comment.

Therapy and Intervention

13. When treating deficits in reading comprehension following cognitive-communication changes during sub-acute rehabilitation, please tick the following types of interventions that you provide:

	Yes	No	Unsure
Interventions targeting impairment (i.e. interventions that are 'restorative' and aim to improve reading ability / skill).			
Interventions targeting activity (i.e. ability to perform a functional reading task)			
Interventions that are compensatory based (utilising strategies) that are directed by the SP.			
Interventions that utilise strategies / self monitoring tasks that are implemented and directed by the individual / patient.			

14. Please add any additional comments:

15. The interventions I use are (please tick one)	
Primarily restorative / targeting 'impairment'	
Primarily targeting 'activity'	
An equal combination of impairment and activity interventions	

16. The interventions I use are (please tick one)	
Primarily therapy based (impairment and / or activity interventions)	
Primarily strategy based	
An equal combination of direct therapy and use of strategies	

Impairment Based Interventions for Reading Comprehension

17. Please identify / tick the following impairment based RC therapy tasks you utilise in subacute ABI/TB rehabilitation, and their frequency of use in your rehabilitation setting:

Frequency rating scale:
- **Rarely used** (< 25% of RC) patients
- **Sometimes used**
  - E.g. for 25% - 50% of RC patients
  - Useful for specific patients only (e.g. very high level / low level pts)
  - Useful for most patients but difficult to perform regularly (e.g. time constraints; availability)
- **Common technique** – used for many patients (51-75%)
- **Regular technique** - used for most patients (>75%)

Therapy	Not used	Rarely used	Sometimes used				Common	Regular
		25% of pts	25-50% of pts	Specific pts only	Difficult to implement	51-75% of pts	>75% of pts
Matching phrases / short sentences to pictures.								
Matching sentence halves / phrases.								
Following written directions of increasing length / complexity.								
Sequencing written information								
Comprehension of written information: Answering forced – choice questions (e.g. Yes/No; multiple choice).								
Comprehension of written information: Answering open ended factual questions (e.g. wh- questions).								
Re-telling information from a written text.								
Complex comprehension of written information involving inferencing or reasoning								
Comprehending and synthesising written information to create answers that involve conclusions or opinions related to the information.								
Predicting or problem solving from written information / scenarios.								
Other:								

18. Are there other impairment based interventions you utilise for subacute interventions? Please list / comment:

19. When treating Reading Comprehension using impairment based activities, is there a treatment hierarchy you would commonly utilise?   Please comment:

20. To change the difficulty / complexity of impairment based reading comprehension tasks, please identify which aspects you commonly alter. Tick all that apply to your regular practice.	
Length	
Grammatical Structure	
Linguistic complexity	
Number of items in the task	
Concrete versus abstract items	
Complexity of vocabulary	
Type of written information (e.g. expository vs narrative)	
Environment for activity	
Increasing background noise	
Other – please list	

__Service Delivery – Impairment based RC interventions__

21. Please tick the answer that best corresponds with how you deliver impairment based reading comprehension tasks:	
Mostly in individual session	
Mostly in group therapy	
Equally in individual and group sessions	
Other – please comment	

22. Do you have any further comments on impairment based therapy for reading comprehension?

__Activity based interventions for Reading Comprehension__
Please identify / tick the following therapy tasks you utilise in subacute rehabilitation, and comment on the frequency of use of these specific tasks in your rehabilitation setting:

Frequency rating scale:
- **Rarely used** (< 25% of RC) patients
- **Used sometimes**
  - o E.g. for 25% - 50% of RC patients
  - o Useful for specific patients only (e.g. very high level / low level pts)
  - o Useful for most patients but difficult to perform regularly (e.g. time constraints; availability)
- **Common technique** – used for many patients (51-75%)
- **Regular technique** - used for most patients (>75%)

23. Please identify / tick the following activity based therapy tasks you utilise in subacute rehabilitation, and the frequency of use:

Therapy	Not used	Used rarely	Used sometimes				Common technique	Used Regularly
		< 25% of pts	25-50% of pts	Specific pts only	Difficult to implement	51-75% of pts	>75% of pts
Reading tasks utilising functional stimulus (e.g. bills, newspapers, advertising, timetables).								
Reading tasks related to a patient's vocation (work / study) (e.g. checklists, reports, emails)								
Reading tasks related to self management (e.g. diary, calendar, phone)								
Reading tasks related to home / community / family activities (e.g. reading to children; reading aloud at church; reading movie timetable)								
Utilising social media and social communication (e.g. facebook, twitter, emails)								
Reading tasks during functional / community outings (e.g. reading signs at shopping centre; reading menu at cafe)								
Please list any other activity based interventions you commonly use (and rate frequency of use)								

24. When treating Reading Comprehension using activity based interventions, is there a treatment hierarchy you would commonly utilise?   Please comment:

25. To change the difficulty / complexity of activity based reading comprehension tasks, please identify which aspects you commonly alter. Tick all that apply to your regular practice.	
Length	
Grammatical Structure	
Linguistic complexity	
Number of items in the task	
Concrete versus abstract items	
Complexity of vocabulary	
Complexity of accompanying functional activity	
Type of written information (e.g. expository vs narrative vs functional)	
Environment for activity	
Increasing background noise	
Other – please list	

Service Delivery – Activity Based RC Interventions

26. Please tick the answer that best corresponds with how you deliver activity based reading comprehension tasks:	
Mostly in individual sessions	
Mostly in group therapy	
Equally in individual and group sessions	
Other – please comment	

27. Do you have any further comments on activity based interventions for reading comprehension?

Strategies for Reading Comprehension

Visual Strategies

28. Please indicate whether you utilise the following visual strategy RC interventions in subacute rehabilitation. Please tick / select the strategies you use.

Underlining / highlighting key words or ideas	
Finger tracing when reading / Finger tracking on the side of text to keep place (e.g. for longer paragraph reading)	
Use of a coloured line on one side of the page (e.g. to aid visual deficits)	
Reducing visual load (e.g. covering future text with blank sheet)	
I do not use any of these strategies	

29. Please identify your clinical reasons for using the strategies above. Tick all that apply.

	N/A Not used	Comprehension / understand content	Memory	Attention	Impulsivity / speed	Unsure of reason	Other
Underlining / highlighting key words or ideas							
Finger tracing when reading / Finger tracking on the side of text to keep place (e.g. for longer paragraph reading)							
Use of a coloured line on one side of the page							
Reducing visual load							

41

Content Based Strategies – Preparation Strategies

30. Please indicate which Content-based 'preparation' strategies you utilise in therapy for reading comprehension, and select all that apply.

Activate background knowledge prior to reading task (e.g. identifying known information about the topic)	
Vocabulary review: discuss upcoming new / unfamiliar vocabulary	
Set purpose / establish context or message before reading (e.g. setting learning goals) **OR** Previewing text / headings / structure	
I do not use any of these strategies	

31. For the strategies selected above, please indicate your main clinical reasons for using the strategies identified for reading comprehension interventions.

	N/A Not used	Comprehension / understand content	Memory	Attention	Impulsivity / speed	Unsure of reason	Other
Activate background knowledge prior to reading task (e.g. identifying known information about the topic)							
Vocabulary review: discuss upcoming new / unfamiliar vocabulary							
Set purpose / establish context or message before reading (e.g. setting learning goals) **OR** Previewing text / headings / structure							

Content Based Strategies – Word-Sentence Level

32. Please identify the Content-based strategies (word-sentence level) that you utilise in therapy for reading comprehension. Tick all that apply.

Dictionary use / clarifying word meanings	
Feedback for reading aloud / reading fluency (word decoding; word meaning)	
Clarifying sentence meaning, simplifying complex sentences	
I do not use any of these strategies	

33. From the strategies you identified above, please indicate the clinical reasons you would utilise the strategy in therapy. Tick all that apply.

	N/A Not used	Comprehension / understand content	Memory	Attention	Impulsivity / speed	Unsure of reason	Other
Dictionary use / clarifying word meanings							
Feedback for reading aloud / reading fluency (word decoding; word meaning)							
Clarifying sentence meaning, simplifying complex sentences							

Content Based Strategies – Paragraph Level

34. Please identify the paragraph level Content-based strategies you utilise in therapy for reading comprehension, and select all that apply.

Identifying main points **OR** Questioning / Use of Wh- strategy (e.g. who, what, where, when, why, how) to identify main points / ideas	
Summarising: Stopping during reading and summarizing information throughout a paragraph / Summarising at the end of a paragraph	
Review and sequence information **OR** Establishing relationships across text / connecting information to prior text	
Using oral language / auditory-verbal tasks to reinforce comprehension of written information	
Predicting outcomes	
Inferencing	
"Skimming" – fast reading for basic gist **OR** "Scanning" – searching for key words / phrases in text	
Use of highlighting to colour-code information (e.g. different themes) **OR** Use of "graphic organisers" to summarise / group information (usually for complex reading tasks) e.g. mind map, cognitive maps, story maps / outlines	
I do not use any of these strategies	

35. For the strategies selected above, please identify your clinical reasons for utilising these strategies in reading comprehension. Select all that apply.

	N/A Not used	Comprehension / understand content	Memory	Attention	Impulsivity / speed	Unsure of reason	Other
Identifying main points **OR** Questioning / Use of Wh- strategy (e.g. who, what, where, when, why, how) to identify main points / ideas							
Summarising: Stopping during reading and summarizing information throughout a paragraph / Summarising at the end of a paragraph							
Review and sequence information **OR** Establishing relationships across text / connecting information to prior text							
Using oral language / auditory-verbal tasks to reinforce comprehension of written information							
Predicting outcomes							
Inferencing							
"Skimming" – fast reading for basic gist **OR** "Scanning" – searching for key words / phrases in text							
Use of highlighting to colour-code information (e.g. different themes) **OR** Use of "graphic organisers" to summarise / group information e.g. mind map, cognitive maps, story maps / outlines							

Cognitive & Metacognitive Strategies + Other Strategies

36. Please identify the cognitive / metacognitive / other strategies you utilize in therapy for reading comprehension in subacute rehabilitation. Select all that apply.

Re-reading information	
Chunking	
Stop and think	
Use of visualisation / visual imagery	
Explicit / overt strategy teaching, cueing and practice	
Internal questioning strategies / self checking (e.g. Have I understood it?)	
Active strategy monitoring by client patient	
Reading aloud to reduce rate / slow down	
Use of external prompting (e.g. from SP) to slow down	
I do not use any of these strategies	

37. For the cognitive / metacognitive / other strategies you identified as using above, please select your main clinical reasons for using the strategy in therapy. Select all that apply.

	N/A Not used	Comprehension / understand content	Memory	Attention	Impulsivity / speed	Unsure of reason	Other
Re-reading information							
Chunking							
Stop and think							
Use of visualisation / visual imagery							
Explicit / overt strategy teaching, cueing and practice							
Internal questioning strategies / self checking (e.g. Have I understood it?)							
Active strategy monitoring by client patient							
Reading aloud to reduce rate / slow down							
Use of external prompting (e.g. from SP) to slow down							

38. For what percentage of your RC patients would you utilise strategies for, at some point during their rehabilitation?

0-25%	26-50%	51-75%	76-100%

39. Which strategies do you utilise the most / most frequently in RC rehabilitation?

40. Do you have any further comments on strategy use in RC in ABI / TBI sub-acute rehabilitation?

Service delivery for RC interventions:

41. What percentage of your caseload has patients with cognitive-communication disorders?			
0-25%	26-50%	51-75%	76-100%

42. What percentage of your patients with cognitive communication disorders have associated changes to reading comprehension?			
0-25%	26-50%	51-75%	76-100%

43. What percentage of these patients would you provide intervention / rehabilitation for reading comprehension for?			
0-25%	26-50%	51-75%	76-100%

44. When treating patients with RC deficits, how often would you provide intervention / rehabilitation for RC with these patients? (please comment on frequency and amount)

45. Do you have any comments on your service delivery for RC interventions?

Education & Information Provision

46. What education do you provide to patients regarding their reading comprehension difficulties and strategies? (e.g. type, amount, frequency)

47. What education do you provide to families of patients regarding their reading comprehension difficulties and strategies? (e.g. type, amount, frequency)

REFERENCES

1. Roman SP. Illiteracy and Older Adults: Individual and Societal Implications. Educational Gerontology 2004;30(2):79-93.
2. Baker DW, Parker RM, Williams MV, Pitkin K, Parikh NS, Coates W, Imara M. The Health Care Experience of Patients With Low Literacy. Archives of Family Medicine 1996;5(June):329-334.
3. Kahn AR, Kelly LJ. Impact of Illiteracy on Rehabilitation of Communication Disorders: Preliminary Considerations. Educational Gerontology 1991;17(6):581-589.
4. Roozenbeek B, Maas AI, Menon DK. Changing patterns in the epidemiology of traumatic brain injury. Nature Reviews Neurology 2013;9(4):231-6.
5. Kendeou P, van den Broek P, White MJ, Lynch J. Comprehension in preschool and early elementary children: skill development and strategy interventions. In: McNamara DS, editor. Reading comprehension strategies: Theories, interventions and technologies. New York: Lawrence Erlbaum Associates; 2007. p 27-45.
6. Ciuffreda KJ, Han Y, Kapoor N, Ficarra A. Oculomotor rehabilitation for reading in acquired brain injury. NeuroRehabilitation 2006;21(1):9-21.
7. Pollock A, Hazelton C, Henderson C, Angilley J, Dhillon B, Langhorne P, Livingstone K, Munro F, Orr H, Rowe F and others. Interventions for visual field defects in patients with stroke (Review). The Cochrane Collaboration 2011;10.
8. Kapoor N, Ciuffreda KJ, Han Y. Oculomotor rehabilitation in acquired brain injury: a case series. Archives of Physical Medicine and Rehabilitation 2004;85(10):1667-1678.
9. Ferstl EC, Guthke T, von Cramon DY. Text comprehension after brain injury: Left prefrontal lesions affect inference processes. Neuropsychology 2002;16(3):292-308.
10. Sohlberg MM, McLaughlin KA, Pavese A, Heidrich A, Posner MI. Evaluation of Attention Process Training and Brain Injury Education in Persons with Acquired Brain Injury. Journal of Clinical and Experimental Neuropsychology 2000;22(5):656-676.
11. Holliday R, Hamilton S, Luthra A, Oddy M, Weekes BS. Text comprehension after traumatic brain injury: Missing the gist? Brain and Language 2005;95(1):74-75.
12. Kiran S, Sandberg C. Treating communication problems in indiviuals with disordered language. In: Peach RK, Shapiro LP, editors. Cognition and acquired language disorders. St Louis: Elsevier; 2012. p 298-325.
13. Graesser AC. An Introduction to Strategic Reading Comprehension. In: McNamara DS, editor. Reading Comprehension Strategies: Theories, Interventions and Technologies. New York: Lawrence Erlbaum Associates; 2007. p 3-26.
14. MacDonald S, Wiseman-Hakes C. Knowledge translation in ABI rehabilitation: A model for consolidating and applying the evidence for cognitive-communication interventions. Brain Injury 2010;24(3):486-508.
15. Togher L, Wiseman-Hakes C, Douglas J, Stergiou-Kita M, Ponsford J, Teasell R, Bayley M, Turkstra LS. INCOG recommendations for management of cognition following traumatic brain injury, part IV: cognitive communication. Journal of head trauma rehabilitation 2014;29(4):353-68.

16.   Meteyard L, Bruce C, Edmundson A, Oakhill J. Profiling text comprehension impairments in aphasia. Aphasiology 2015;29(1):1-28.

17.   Watter K, Copley A, Finch E. Discourse level reading comprehension interventions following acquired brain injury: A systematic review. Disability & Rehabilitation 2016 (in press).

18.   Kaplan CP. Differential reading recovery in patients with severe to moderate closed head injury. American Journal of Physical Medicine and Rehabilitation 1990;69(6):297-301.

19.   Hinchliffe F, Murdoch B, Chenery H. Towards a conceptualization of langauge and cognitive impairment in closed-head injury: use of clincial measures. Brain Injury 1998;12(2):109-132.

20.   Schmitter-Edgecombe M, Bales JW. Understanding text after severe closed-head injury: assessing inferences and memory operations with a think-aloud procedure. Brain and Language 2005;94(3):331-46.

21.   Malec JF, Smigielski JS, DePompolo RW, Thompson JM. Outcome evaluation and prediction in a comprehensive-integrated post-acute outpatient brain injury rehabilitation programme. Brain Injury 1993;7(1):15-29.

22.   Laatsch L, Guay J. Rehabilitation of reading comprehension fluency in adults with acquired brain injury. Journal of Cognitive Rehabilitation 2005;23(2):5-12.

23.   Jacobs H. The Los Angeles head in jury survey: procedures and initial findings. Archives of Physical Medicine & Rehabilitation 1988;69(6):425-431.

24.   Ryan TV, Sautter SW, Capps CF, Meneese W, Barth JT. Utilizing neuropsychological measures to predict vocational outcome in a head trauma population. Brain Injury 1992;6(2):175-182.

25.   Shiel A, Burn J, Henry D, Clark J, Wilson B, Burnett M, McLellan D. The effects of increased rehabilitation therapy after brain injury: results of a prospective controlled trial. Clinical Rehabilitation 2001;15(5):501-514.

26.   Leon-Carrion J, Dominguez-Morales MR, Barroso y Martin JM, Leon-Dominguez U. Recovery of cognitive function during comprehensive rehabilitation after severe traumatic brain injury. Journal of Rehabilitation Medicine 2012;44(6):505-11.

27.   Blake ML, Frymark TB, Venedictov R. An evidence-based systematic review on communication treatments for individuals with right hemisphere brain damage. American Journal of Speech-Language Pathology 2013;22(February):146-160.

28.   Coelho CA, DeRuyter F, Stein M. Treatment efficacy: cognitive-communicative disorders resulting from traumatic brain injury in adults. Journal of Speech and Hearing Research 1996;39(5):S5-S17.

29.   American Speech-Language-Hearing Association. n.d. 21.06.2015. Traumatic Brain Injury in Adults (Practice Portal).   <http://www.asha.org/Practice-Portal/Clinical-Topics/Traumatic-Brain-Injury-in-Adults/%3E. Accessed 2015 21.06.2015.

30.   Cicerone KD, Dahlberg C, Malec JF, Langenbahn DM, Felicetti T, Kneipp S, Ellmo W, Kalmar K, Giacino JT, Harley JP and others. Evidence-based cognitive rehabilitation: updated review of the literature from 1998 through 2002. Archives of Physical Medicine and Rehabilitation 2005;86(8):1681-92.

31.   Sackett DL, Straus SE, Richardson WS, Rosenberg WMC, Haynes RB. Evidence-based medicine: How to practice and teach EBM. Edinburgh: Churchill Livingstone; 2000.

32. Dollaghan C. The handbook for evidence-based practice in communication disorders. Baltimore: Paul H. Brookes; 2007.

33. Howick J, Chalmers I, Glasziou P, Greenhalgh T, Heneghan C, Liberati A, Moschetti I, Phillips B, Thornton H, Goddard O and others. The Oxford 2011 Levels of Evidence. Oxford Centre for Evidence-Based Medicine; 2011.

34. Perdices M, Savage S, Tate RL, McDonald S, Togher L. Rater's Manual for Between-Group Studies (RCTs and NonRCTs). Introduction to the Physiotherapy EvidenceDatabase (PEDro) Scale for Rating Methodological Quality, Adapted for PsycBITE (PEDro-P). Sydney: University of Sydney; 2009.

35. Tate RL, Mcdonald S, Perdices M, Togher L, Schultz R, Savage S. Rating the methodological quality of single-subject designs and n-of-1 trials: introducing the Single-Case Experimental Design (SCED) Scale. Neuropsychological Rehabilitation 2008;18(4):385-401.

36. Turner-Stokes L. Evidence for the effectiveness of multi-disciplinary rehabilitation following acquired brain injury: A synthesis of two systematic approaches. Journal of Rehabilitation Medicine 2008;40:691-701.

37. Turner-Stokes L, Nair A, Sedki I, Disler PB, Wade DT. Multi-disciplinary rehabilitation of acquried brain injury in adults of working age (Review). Cochrane Database of Systematic Reviews 2005;3.

38. Cullen N, Meyer M, Aubut J, Bayley M, Teasell R. 2011 19.06.2015. Efficacy and models of care following an acquired brain injury. . <http://www.abiebr.com/module/3-efficacy-and-models-care-following-acquiredbrain-injury%3E. Accessed 2015 19.06.2015.

39. Cherney LR, Merbitz CT, Grip JC. Efficacy of oral reading in aphasia treatment outcome. Rehabilitation Literature 1986;47(5-6):112-118.

40. Mayer JF, Murray LL. Approaches to the treatment of alexia in chronic aphasia. Aphasiology 2002;16(7):727-743.

41. Watter K, Addis P, Copley A, Finch E. Speech pathology clinical practice in sub-acute brain injury rehabilitation. Journal of Clinical Practice in Speech Language Pathology 2014;16(1):7-13.

42. Watter K, Addis P, Copley A, Finch E. Consumer-focused practice and service perceptions in brain injury rehabilitation units. Journal of Clinical Practice in Speech Language Pathology 2014;16(2):50-57.

43. World Health Organization. International classification of functioning, disability and health. Geneva: Author; 2001.

44. Australasian Faculty of Rehabilitation Medicine. Standards for the provision of inpatient adult rehabilitation medicine services in public and private hospitals. Sydney: Royal Australian College of Physicians; 2011.

45. Steel J, Ferguson A, Spencer E, Togher L. Speech pathologists' current practice with cognitive-communication assessment during post-traumatic amnesia: A survey. Brain Injury 2013;27(7-8):819-830.

46. Short J, McCormack J, Copley A. The current practices of speech-language pathologists in providing information to clients with traumatic brain injury. International Journal of Speech-Language Pathology 2014;16(3):219-30.

47. Sohlberg MM, Griffiths GG, Fickas S. An evaluation of reading comprehension of expository text in adults with traumatic brain injury. American Journal of Speech-Language Pathology 2014;23(2):160-75.

48.   Worrall LE, Hickson L. The use of the ICF in speech-language pathology research: Towards a research agenda. International Journal of Speech-Language Pathology 2008;10(1-2):72-77.

49.   Stucki G. International Classification of Functioning, Disability, and Health (ICF). American Journal of Physical Medicine & Rehabilitation 2005;84(10):733-740.

50.   Bilbao A, Kennedy C, Chatterji S, Ustun B. The ICF: Applications of the WHO model of functioning, disability and health to brain injury rehabilitation. NeuroRehabilitation 2003;18:239-250.

51.   Koskinen S, Hokkinen EM, Sarajuuri J, Alaranta H. Applicability of the ICF checklist to traumatically brain-injured patients in post-acute rehabilitation settings. Journal of Rehabilitation Medicine 2007;39(6):467-72.

52.   Ptyushkin P, Vidmar G, Burger H, Marincek C. Use of the International Classification of Functioning, Disability and Health (ICF) in patients with traumatic brain injury. Brain Injury 2010;24(13-14):1519-27.

53.   McCormack J, Worrall LE. The ICF Body Functions and Structures related to speech-language pathology. International Journal of Speech-Language Pathology 2008;10(1-2):9-17.

54.   O'Halloran R, Larkins B. The ICF Activities and Participation related to speech-language pathology. International Journal of Speech-Language Pathology 2008;10(1-2):18-26.

55.   Threats TT. Use of the ICF for clinical practice in speech-language pathology. International Journal of Speech-Language Pathology 2008;10(1-2):50-60.

56.   Larkins B. The application of the ICF in cognitive-communication disorders following traumatic brain injury. Semin Speech Lang 2007;28(4):334-42.

57.   Turkstra LS. Inpatient cognitive rehabilitation: is it time for a change? Journal of head trauma rehabilitation 2013;28(4):332-6.

58.   Croot K, Nickels L, Laurence F, Manning M. Impairment‐and activity/participation‐directed interventions in progressive language impairment: Clinical and theoretical issues. Aphasiology 2009;23(2):125-160.

59.   Wade DT. Applying the WHO ICF framework to the rehabilitation of patients with cognitive deficits. In: Halligan PW, Wade DT, editors. The Effectiveness of Rehabilitation for Cognitive Deficits. Oxford: Oxford University Press; 2005. p 31-42.

60.   Crowe LK. Comparison of Two Reading Feedback Strategies in Improving the Oral and Written Language Performance of Children with Language-Learning Disabilities. American Journal of Speech-Language Pathology 2003;12(1):16-27.

61.   Gajria M, Jitendra AK, Sood S, Sacks G. Improving Comprehension of Expository Text in Students With LD: A Research Synthesis. Journal of Learning Disabilities 2007;40(3):210-225.

62.   Guthrie JT, McRae A, Coddington CS, Lutz Klauda S, Wigfield A, Barbosa P. Impacts of comprehensive reading instruction on diverse outcomes of low- and high-achieving readers. Journal of Learning Disabilities 2009;42(3):195-214.

63.   Kim A, Vaughn S, Wanzek J, Wei S. Graphic Organizers and Their Effects on the Reading Comprehension of Students with LD: A Synthesis of Research. Journal of Learning Disabilities 2004;37(2):105-118.

64.   National Reading Panel. Teaching children to read: an evidence-based assessment of the scientific research literature on reading and its implications for reading instruction. Reports of the subgroups. Washington: National

Institution of Child Health and Human Development, US Department of Education; 2000.

65. Snow C. Reading for understanding : toward a research and development program in reading comprehension. Santa Monica: RAND Corporation, Library of Congress; 2002.

66. Rattray J, Jones MC. Essential elements of questionnaire design and development. Journal of Clinical Nursing 2007;16(2):234-43.

67. Hsieh H-F. Three approaches to qualitative content analysis. Qualitative Health Research 2005;15(9):1277-1288.

68. Ellmo W, Graser J, Krchnavek B, Calabrese D, Hauck K. Measure of Cognitive-Linguistic Abilities (MCLA). Vero Beach, FL: The Speech Bin; 1995.

69. Christie J, Clark W, Mortensen L. Mt Wilga High Level Language Assesssment. Sydney: Mount Wilga Hospital & Commonwealth Rehabilitation Service; 1985.

70. Holland A. Communicative Abilities in Daily Living. Baltimore: University Park Press; 1998.

71. Sweetow R, Sabes JH. The Communication Confidence Profile: A vital, but overlooked subjective domain. The Hearing Journal 2010;63(12):17-24.

72. Goodglass H, Kaplan E, Baressi B. Boston Diagnostic Aphasia Examination, 3rd Ed. Baltimore: Lippincott Williams & Wilkins; 2001.

73. Helm-Estabrooks N. Cognitive Linguistic Quick Test (CLQT). Bloomington: Pearson; 2001.

74. MacDonald S. Functional Assessment of Verbal Reasoning and Executive Strategies. Guelph, Ontario: CCD Publishing; 2005.

75. Speech Pathology Departments. Informal Language Processing Screen (ILPS). Sydney: The Prince Henry & Prince of Wales Hospitals; 1999.

76. Kay J, Lesser R, Coltheart M. Psycholinguistic Assessments of Language Processing in Aphsaia (PALPA). Hove: Lawrence Erlbaum Associates; 1992.

77. Kertesz A. Western Aphasia Battery - Revised. San Antonio: Pearson; 2007.

78. Perry A, Skeat J. AusTOMs for Speech Pathology, 2nd Edition. Melbourne: La Trobe University; 2004.

79. Keith RA, Granger CV, Hamilton BB, Sherwin FS. The functional independence measure: a new tool for rehabilitation. Advances in Clinical Rehabilitation 1987;1:6-18.

80. Turner-Stokes L. Goal attainment scaling (GAS) in rehabilitation: a practical guide. Clinical Rehabilitation 2009;23:362-370.

81. Paul DR, Frattali CM, Holland A, Thompson CK, Caperton CJ, Slater SC. Quality of Communication Life Scale (ASHA QCL). Rockville: American Speech-Language-Hearing Association; 2005.

82. LaPointe L, Horner J. Reading comprehension battery for aphasia - 2. Austin: Pro-Ed; 1998.

83. Porch BE. Porch Index of Communicative Ability (3rd Edition). Palo Alto: Consulting Psychologists Press; 1981.

84. Manzel K, Tranel D. Development and standardization of a reading test for brain-damaged patients. Developmental Neuropsychology 1999;15(3):407-420.

85. Wiederholt JL, Bryant BR. Gray oral reading tests (4th edition). Austin: Pro-Ed; 2001.

86. Penn C, Jones D, Joffe V. Hierarchical discourse therapy: A method for the mild patient. Aphasiology 1997;11(6):601-613.

87. Biggs JB, Collins KF. Evaluating the quality of learning: The SOLO Taxonomy (Structure of the Observed Learning Outcome). New York: Academic Press; 1982.

88. Cocks N, Matthews N, Barnett L, Phillips E, Middleton R, Gregoire-Clarke J, Cruice M. Functional reading therapy for individuals with acquired reading difficulties: A preliminary investigation exploring its effectiveness. Australian Communication Quarterly 2010;12(1):37-41.

89. Katz RC, Wertz RT. The efficacy of computer-provided reading treatment for chronic aphasic adults. Journal of Speech, Language and Hearing Research 1997;40(3):493-507.

90. Gold PC, Freeman EA. Remediation of Alexia: A Case Study. Reading Psychology 1984;5(1-2):65-73.

91. Sohlberg MM, Turkstra L. Optimizing cognitive rehabilitation: effective instructional methods. London: The Guilford Press; 2011.

92. Ownsworth T, Quinn H, Fleming J, Kendall M, Shum D. Error self-regulation following traumatic brain injury: a single case study evaluation of metacogntiive skills training and behavioural practice interventions. Neuropsychological Rehabilitation 2010;20(1):59-80.

93. Kennedy MR, Coelho C, Turkstra L, Ylvisaker M, Moore Sohlberg M, Yorkston K, Chiou HH, Kan PF. Intervention for executive functions after traumatic brain injury: a systematic review, meta-analysis and clinical recommendations. Neuropsychological Rehabilitation 2008;18(3):257-99.

94. Cocks N, Pritchard M, Cornish H, Johnson N, Cruice M. A "novel" reading therapy programme for reading difficulties after a subarachnoid haemorrhage. Aphasiology 2013;27(5):509-531.

95. Webster J, Morris J, Connor C, Horner R, McCormac C, Potts A. Text level reading comprehension in aphasia: What do we know about therapy and what do we need to know? Aphasiology 2013;27(11):1362-1380.

96. Griffiths GG, Sohlberg MM, Kirk C, Fickas S, Biancarosa G. Evaluation of use of reading comprehension strategies to improve reading comprehension of adult college students with acquired brain injury. Neuropsychological Rehabilitation 2015:1-30.

97. Robinson FP. Effective study. New York: Harper & Row; 1970.

Figure 1. Participant Demographics
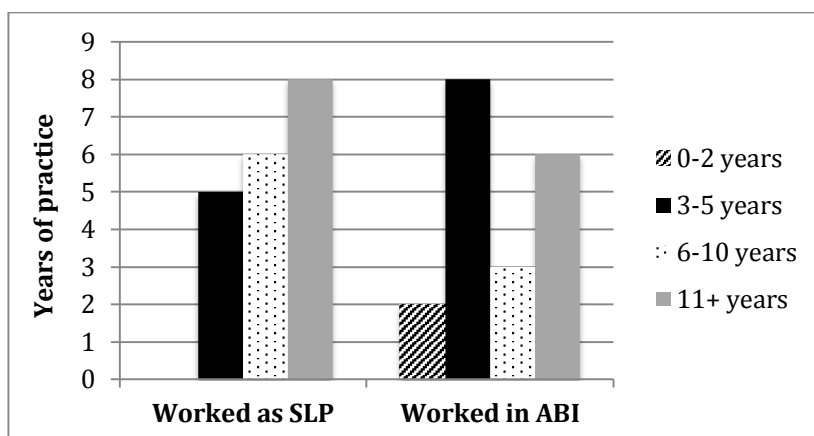
Figure 2. Reading Assessment During Sub-Acute Rehabilitation
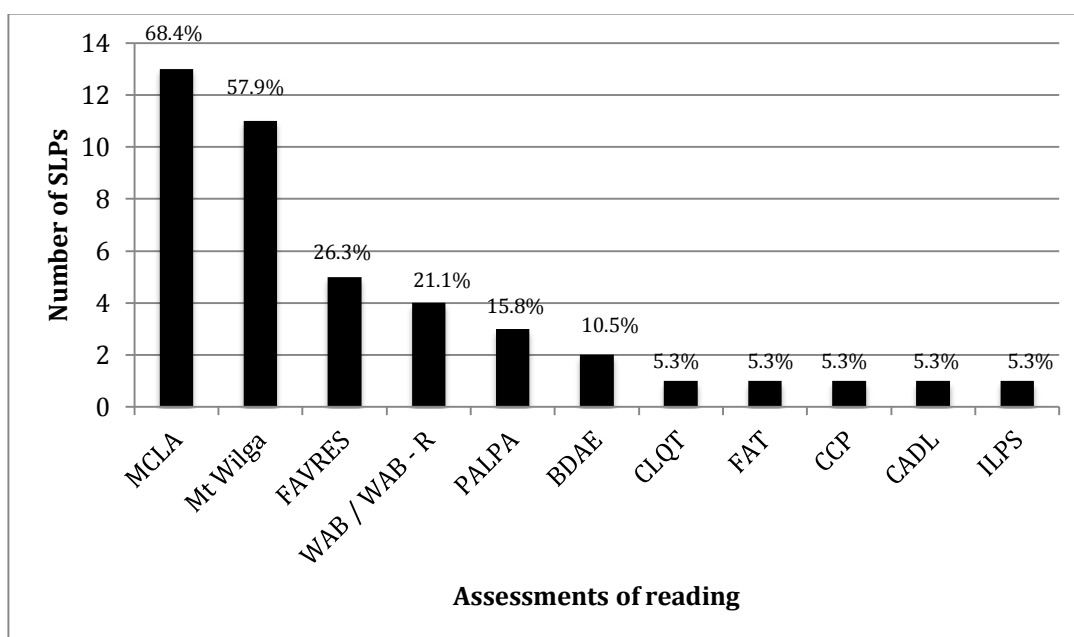
Key: CADL: Communication assessment of daily living [70]; CCP: Communication confidence profile [71]; BDAE: Boston diagnostic aphasia examination [72]; CLQT: Cognitive linguistic quick test [73]; FAT: Functional assessment tool; FAVRES: Functional assessment of verbal reasoning and executive strategies [74]; ILPS: Informal language processing screen [75]; MCLA: Measure of cognitive linguistic abilities [68]; Mt Wilga: Mt Wilga high level language assessment [69]; PALPA: Psycholinguistic assessment of language processing in aphasia [76]; WAB / WAB-R: Western Aphasia Battery – Revised [77].
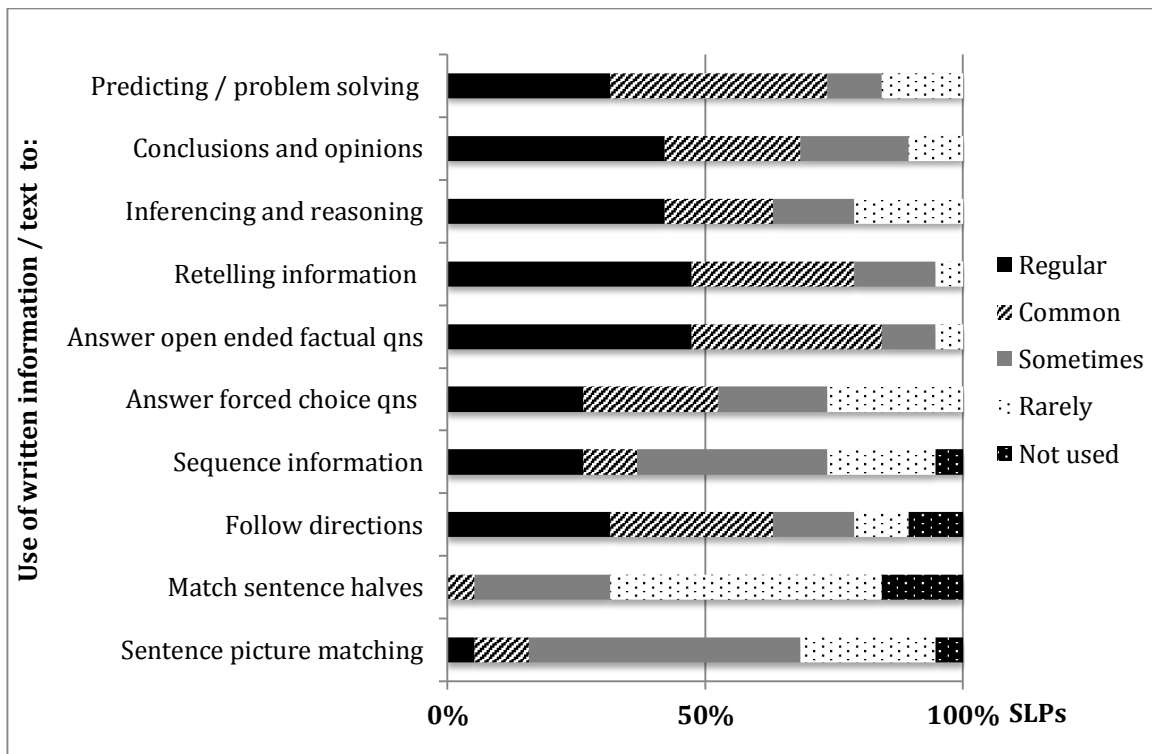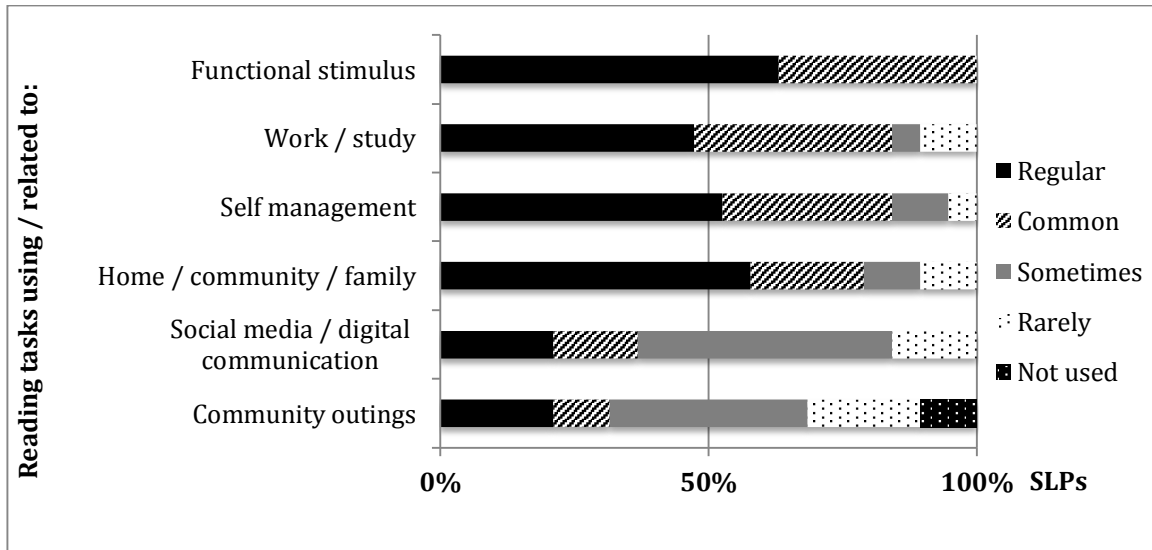
Figure 3. Impairment Based Reading Comprehension Interventions

Figure 4. Activity Based / Functional Interventions For Reading Comprehension

53

Table 1. Content-based strategy use in reading comprehension

Content based strategies	% SLPs (Number)
Preparatory strategies	
Set purpose / establish context or message before reading; Previewing text / headings / structure	89.5% (17)
Activate background knowledge prior to reading task	73.7% (14)
Review and discuss upcoming new / unfamiliar vocabulary	42.1% (8)
Word – sentence level strategies	
Clarifying sentence meaning, simplifying complex sentences	78.9% (15)
Dictionary use / clarifying word meanings	73.7% (14)
Feedback for reading aloud / reading fluency (word decoding; word meaning)	63.2% (12)
Paragraph level strategies	
Identifying main points; Questioning / Use of Wh- strategy to identify main points	100.0% (19)
Summarising throughout / at the end of a paragraph	94.7% (18)
Inferencing	84.2% (16)
Review and sequence information; Establishing relationships across text / connecting information to prior text	73.7% (14)
Using oral language / auditory-verbal tasks to reinforce comprehension of written information	73.7% (14)
Highlighting / colour-code information (e.g. themes); Graphic organisers to summarise / group information (e.g. mind map)	73.7% (14)
Predicting outcomes	63.2% (12)
Skimming	31.6% (6)

Table 2. Cognitive and metacognitive strategy use in reading comprehension

Cognitive / metacognitive strategy	% SLPs (Number)
Re-reading information	100.0% (19)
Chunking	84.2% (16)
Use of external prompting to slow down	78.9% (15)
Stop and think	78.9% (15)
Reading aloud to reduce rate / slow down	73.7% (14)
Active strategy monitoring by client patient	68.4% (13)
Internal questioning strategies / self checking (e.g. Have I understood it?)	68.4% (13)
Explicit / overt strategy teaching, cueing and practice	68.4% (13)
Visualisation / use of visual imagery	57.9% (11)

Table 3. Rationale for reading strategy use

Area targeted	Reading strategy and overall use by SLPs	Strategy type	% of all SLPs identifying strategy with area targeted (number)
Comprehension of content	Underlining / highlighting key words or ideas (n=19)	Visual	94.7% (18)
	Identifying main points / questioning / wh- (n=19)	Content paragraph	94.7% (18)
	Re-reading information (n=19)	Cognitive	94.7% (18)
	Summarising (n=18)	Content paragraph	89.5% (17)
	Set purpose / preview text (n=17)	Content preparatory	84.2% (16)
	Inferencing (n=16)	Content paragraph	84.2% (16)
Memory	Re-reading (n=19)	Cognitive	84.2% (16)
	Chunking (n=16)	Cognitive	78.9% (15)
	Highlighting / graphic organisers (n=14)	Content paragraph	73.7% (14)
	Summarising (n=18)	Content paragraph	73.7% (14)
	Underlining / highlighting key words or ideas (n=19)	Visual	73.7% (14)
Attention	Reducing visual load (n=18)	Visual	84.2% (16)
	Finger tracing (n=16)	Visual	78.9% (15)
	Set purpose / preview text (n=17)	Content preparatory	78.9% (15)
	Highlighting / graphic organisers (n=14)	Content paragraph	57.9% (11)
Impulsivity / speed	External prompts to slow down (n=15)	Cognitive / metacognitive	73.7% (14)
	Read aloud to reduce rate (n=14)	Cognitive / metacognitive	63.2% (12)
	Finger tracing (n=16)	Visual	57.9% (11)
	Feedback for reading aloud, reading fluency, decoding (n=12)	Content word-sentence	52.6% (10)
Other			
Visual deficits	Use of coloured line (n=17)	Visual	36.8% (7)
Visual processing deficits (scan, neglect, attention)	Reducing visual load (n=18)	Visual	21.1 % (4)