



NOVA

University of Newcastle Research Online

nova.newcastle.edu.au

Kelly, Michelle; McDonald, Skye; Frith, Matthew H.; "A survey of clinicians working in brain injury rehabilitation: are social cognition impairments on the radar?". Published in Journal of Head Trauma Rehabilitation Vol. 32, Issue 4, pp. e55-e65 (2017)

Available from: <http://dx.doi.org/10.1097/HTR.0000000000000269>

Accessed from: <http://hdl.handle.net/1959.13/1327528>

A survey of clinicians working in brain injury rehabilitation: Are social cognition impairments on the radar?

Michelle Kelly^{1,2,4} (PhD)

Skye McDonald^{3,4} (PhD)

Matthew HJ Frith^{2,5} (Ma)

¹School of Psychology, University of Newcastle, Newcastle, Australia

²Paediatric Brain Injury Rehabilitation Team, Hunter New England Health, Newcastle, Australia

³School of Psychology, University of New South Wales, Sydney, Australia

⁴Moving Ahead: Centre for Research Excellence in Brain Recovery, Australia

⁵Children Young People & Families, Hunter New England Health, Newcastle, Australia

Funding: This research was funded by Lifetime Care and Support Authority.

Acknowledgements: The authors would like to acknowledge the busy clinicians who took time to complete this survey.

Conflicts of interest: No conflicts of interest are declared.

Ethical adherence: This study was approved by the Hunter New England Local Health District Human Research Ethics Committee (LNR/13/HNE/497; LNRSSA/13/HNE/498).

Corresponding Author:

Dr Michelle Kelly
School of Psychology
University of Newcastle
University Drive
Callaghan NSW 2308
T: +61 2 49216 838
F: +61 2 49216 980
E: Michelle.Kelly@newcastle.edu.au

30 *Objectives:* To examine the social cognition assessment practices of clinicians working
31 with children and adults with traumatic brain injury (TBI). *Main Measures:* Online
32 survey addressing frequency of social cognition impairments, how these are assessed
33 and obstacles to same, and treatment practices. *Participants:* 443 clinicians worldwide
34 working in inpatient and outpatient settings. *Results:* Whilst 84% of clinicians reported
35 that more than half of their clients with severe TBI had social cognition impairments,
36 78% of these reported that they infrequently or never assessed these domains using a
37 formal assessment tool. Lack of reliable tests was most frequently (33% of respondents)
38 cited as the greatest barrier to undertaking social cognition assessment. *Conclusions and*
39 *Implications:* Improvements are needed in the development and norming of instruments
40 capable of detecting social cognition impairments in the TBI population. Additional
41 training and education are needed in the use of social cognition assessment tools.

42

43

44

45

46

47

48 **Keywords:** traumatic brain injury, survey, clinician, staff, social cognition, social
49 function, assessment, assessment practices

Introduction

While various cognitive, social, and physical characteristics associated with traumatic brain injury (TBI) may influence psychosocial outcomes^{1,2}, it is the changes to personality and social functioning that are seen to be most distressing for the person, their family and the community^{3,4}. Changes in social functioning observed after acquired brain injury, particularly trauma-related injury, include impulsive and inappropriate behaviour, conversational difficulties such as failure to initiate speech or to stay on topic, and poor integration of social cues and knowledge⁵⁻⁸. The skills necessary for correctly recognising and comprehending social cues from the environment in order to produce an appropriate response are collectively referred to as social cognition. These skills include the identification of emotions expressed through the face, tone of voice and postures, as well as the ability to empathise with another, to understand that another person has different thoughts than oneself and to predict their intentions (known as ‘theory of mind’), and the ability to synthesize this information in order to form and enact an appropriate response⁹. In normal circumstances and among cognitively intact individuals, these functions typically occur seamlessly in day-to-day life without conscious awareness of the complex processes underlying them. However, failure to interpret social cues can lead to misunderstandings¹⁰, conflict and, with time, irreparable damage to relationships¹¹.

The prevalence of social cognition disorders in adults with moderate-severe TBI is not well-established, but estimates range from 13-39% experiencing emotion perception deficits¹² and up to 70% self-reporting low empathy¹³⁻¹⁵. Similarly in children, deficits in theory of mind and emotion perception are seen following TBI^{16,17};

however, the assessment and management of these impairments in children is further challenged by neurodevelopmental stage ¹⁸.

Examination of social cognition is not traditionally part of a typical battery of cognitive assessment. The two professions most likely to focus on social cognition are clinical neuropsychology and speech pathology. However, the former tends to restrict assessment to non-social functions while the latter tends to restrict assessment to language-based skills. Despite this, there are a number of emerging and established methods for examining social cognition. A practical and simple approach is the use of a self-report questionnaire, such as the Balanced Emotional Empathy Scale (BEES)^{19,20}. This requires the person with TBI to rate their level of agreement or disagreement with statements about real life emotional stimuli, (e.g., “I can almost feel the pain of elderly people who are weak and must struggle to move about”). Another instrument is the Social-emotional Questionnaire (SEQ)^{21,22} which is a 30-item self- and carer-rated report of social behaviour. Although self-report tools have been criticised for their validity and reliability as they are vulnerable to problems with insight and language comprehension that are common following TBI, there is some evidence for their validity even in people with severe injuries²³. While proxy-rated tools are also vulnerable to biases based on carer stress levels and stage of recovery of the person with TBI^{4,24}, informant ratings on instruments such as the BEES and the SEQ have proven to be reliable in research settings^{4,15}.

Performance based assessment tools are also available for use in people with TBI. Many of these attempt to mimic real world stimuli by using items such as still life photographs of faces expressing different emotions or social settings where the person is required to respond with an accurate representation of the feelings or thoughts of

characters in the photograph (e.g., Facial Expressions of Emotion Stimuli and Tests (Ekman⁶⁰)²⁵. Others use text based stories to determine whether participants can understand the thoughts of story characters in order to detect how and why a social faux pas occurred²⁶. While these types of tools provide insight into social cognition impairments, they have not been proven to predict real world behavioural difficulties^{27,28}. On the other hand, The Awareness of Social Inference Test (TASIT)²⁹ is a well-validated assessment tool that requires the person with brain injury to view a series of vignettes of trained actors depicting real-life situations. The person is asked to identify the emotions the actors are expressing, report on the characters' thoughts and identify sarcasm and white lies. TASIT is sensitive to social cognition impairments and also predictive of real world difficulties³⁰. For a review of all instruments available for social cognition assessment in TBI see ^{9,31}.

Whilst instruments such as those mentioned above are available to clinicians working in brain injury rehabilitation, it is unclear whether clinicians are aware of these tests and utilise them in everyday practice. Indeed, there is very little research into what influences assessment choices for clinicians. Evidence-based guidelines are available to clinicians through various governing bodies and might be expected to be the single most important factor influencing decision-making regarding assessment approaches. Many guidelines, including those from Australia, New Zealand, and United Kingdom³²⁻³⁴, recommend that the clinician note changes in behaviour, personality and mood, as well as barriers to social participation ³⁴. However, these guidelines do not direct the assessor to test social cognition or provide guidance on available instruments. The discipline specific guidelines produced by the Academy of Neurologic Communication Disorders and Sciences³⁵ do review a social cognition assessment tool (TASIT); however, these

guidelines are not well cited³⁶ and it is unclear whether they are available to those who are not members of the academy. Overall, there seems little explicit information available to clinicians with regard to the assessment of social cognition, despite its central importance in interpersonal function and psychosocial rehabilitation.

The aims of the following study were to survey clinicians working in brain injury rehabilitation and identify:

- 1) the frequency with which:
 - a) patients and families complain of social cognition impairment
 - b) social cognition is assessed by clinicians working in TBI and the prompts to undertake this assessment
 - c) various domains of social cognition are assessed
- 2) the process undertaken to assess social cognition and whether this is dependent on the clinician's years of experience and/or level of qualification
- 3) the perceived obstacles to the assessment of social cognition in the TBI population as reported by clinicians
- 4) the frequency with which clinicians engage in social cognition rehabilitation with clients who report social cognition impairment

Given the lack of comprehensive clinical guidelines publicly available for assessing social cognition, we hypothesise that the frequency with which social cognition is assessed will be less than the frequency with which social cognition impairments are reported/observed, and subsequently treated in people with TBI. Given the paucity of standardised assessment tools identified for the assessment of social cognition, we

predict the majority of clinicians would utilise clinical interviewing skills when they do
examine social cognition, rather than standardised tests.

Methods

Survey Development (see supplemental digital content for full detail)

The survey was composed using the following strategy, 1) A review of the literature to identify areas of social cognition being investigated in experimental and clinical research; 2) Consultation with a multidisciplinary brain injury rehabilitation team; and, 3) Consultation with a social cognition and TBI research group (see Table 5 for final list of social cognition domains). The survey was then constructed with input from the coinvestigators and piloted with clinicians. Demographic and workplace setting data was collected. Questions were carefully ordered to avoid expectation bias.

Fixed anchor points are posited as being more reliable when making quantitative comparisons³⁷ and accordingly were used for the majority of survey questions. For example, the percentage of clinical time spent assessing an area of social cognition was rated on a scale with anchor points; never (0%), infrequent (<25%), somewhat frequent (25-50%), frequently (51-85%), and routinely (>85%). Open-ended questions were also utilised, for example, to determine what would prompt a clinician to assess for social cognition impairments. Ranking style questions were also used; for example, respondents were asked to rank a prescribed list of barriers to assessment.

Survey Dissemination

Clinicians working in TBI rehabilitation were identified via a number of professional networks as well as local brain injury services (see Table 1 for source of

clinicians). These clinicians were invited to complete an online survey via email invitation which included a web link to Survey Monkey (www.Surveymonkey.com). This link was not personalised for any one participant, and as a result, was forwarded by clinicians to other potential respondents. A welcome consequence of the various recruitment strategies was that the survey was disseminated worldwide, but this meant that response rate could not be deduced. The survey remained open for one month, and one reminder email was sent during this time. This study was approved by the Hunter New England Local Health District Human Research Ethics Committee (LNR/13/HNE/497; LNRSSA/13/HNE/498).

TABLE 1 ABOUT HERE

Definitions

The respondents were provided with the following definition of **social cognition** to assist with validity of responses and to encourage respondents to think broadly about the concept.

Social cognition is defined as: the capacity to understand and interact with others in contextually appropriate ways, that is, the storage and processing of social information, along with the ability to produce appropriate responses with social partners.

Analyses

Responses from Survey Monkey software were downloaded into IBM Statistical Package for the Social Sciences Version 23 (SPSS-23). Procedures were executed to ensure that each clinician contributed only one survey response. Descriptive statistics are presented for most responses. Chi-square analyses were conducted on categorical

and ordinal data³⁸ to determine which responses were driving group differences³⁹. For this purpose, years of experience was classified into 10 years or fewer and greater than 10 years. Level of qualification was classified into postgraduate (Masters, Professional Doctorate or PhD) or undergraduate (Honours or less).

Results

Participants

Demographic characteristics of the sample are presented in Table 2. Of the total of 535 survey responses collected, 92 were removed due to duplication or abandonment, leaving a total of 443 participants. Of respondents, 77.9% were female. 58.7% were from Australia, with the United Kingdom (13%) and the United States of America (7.5%) being the next largest contributors. Nearly all (96.8%) of participants had completed a Bachelor's degree, with 58.6% of these also having completed a Master's degree, Professional Doctorate or PhD. The majority of respondents were employed as Speech and Language Pathologists (21.7%), Clinical Neuropsychologists (18.5%) or Occupational Therapists (15.6%). The range of experience varied greatly with the minority (8.6%) having worked in brain injury rehabilitation for fewer than 12 months and a large proportion (46%) having worked in this field for over 10 years. On average respondents were spending 26.37 hours ($SD = 13.55$) per week working in brain injury rehabilitation; however, again this varied greatly (range = 1-80 hours).

TABLE 2 ABOUT HERE

Characteristics of TBI client population

The population and setting that respondents work in are presented in Table 3. Of respondents 42.2% reported working predominately in in-patient settings, 40.6% in out-patient or community rehabilitation, 11.3% in private practice, and 5.9% in university or clinical research centres. Most respondents (81.7%) reported that their work was predominately with adults (18-64 years of age). Furthermore, the majority of respondents worked with some combination of mild, moderate, severe and very severe TBI client groups, with only 89 (20%) participants working with one group only.

TABLE 3 ABOUT HERE

Rationale for assessment of social cognition following TBI

This section of the survey was completed by 88% (390) of respondents. Approximately 37% estimated that more than half of their patients with mild-moderate TBI had social cognition impairments. Not surprisingly, this estimate increased with severity of injury. Approximately 84% of respondents reported that more than half of their patients with severe-very severe TBI had these impairments, and 37% of these clinicians suggested that more than 90% of this population exhibited social cognition impairment. Moreover, people with TBI also complained of social cognition impairment with 39% of clinicians reporting that more than half of their patients voiced such complaints, and 64% of clinicians reported that more than half of their patients' families also reported social cognition difficulties in the person with TBI. This is astounding, given that this estimate was found across all levels of brain injury severity, not just those with severe injuries. Clearly patients, their families, as well as clinicians

working in this population were very aware of social cognition impairment following TBI. Therefore, the next step was to determine how well it was assessed and treated.

Clinician practices when assessing social cognition

The many reasons cited as prompts for social cognition assessment are listed in Table 4¹. The two most commonly cited reasons for undertaking social cognition assessment were: 1) family reports of change to personality/behaviour (31%), and 2) client reports of difficulties with relationships with partner/family (29%).

TABLE 4 ABOUT HERE

Whilst many domains fall under the umbrella of ‘social cognition’, *insight* and *disinhibition* were most commonly cited as part of a clinician’s ‘routine’ assessment. However, almost half (45%) of the clinicians reported that they never assessed *theory of mind*, whilst one quarter (24.7%) reported that they never assessed *facial affect recognition*. Other neglected areas of assessment included *alexithymia* (55%), *understanding body language* (27%), *social faux pas* (30%) and *sarcasm* (30%). See Table 5 for frequency of assessment of each social cognition domain. Please note, for this analysis only those who might be expected to conduct social cognition assessment were included. That is, only data from social workers, clinical/psychologists, clinical neuropsychologists, speech and language pathologists and occupational therapists were included.

¹60% of clinicians provided appropriate responses to this question. A proportion of respondents ($N = 47$) misinterpreted the question, instead responding with the barriers to them undertaking social cognition assessment. These are addressed later.

TABLE 5 ABOUT HERE

Interestingly, even when social cognition was assessed, the assessment method that clinicians most routinely utilised was '*structured or semi-structured interview*' with the client and/or family. '**Formal assessment using a standardised test**' was the least commonly employed method of assessing social cognition with 78% of respondents reporting that they *never* or *infrequently* utilised this method (See Figure 1). Of importance, a Pearson Chi-Square revealed that the frequency with which clinicians used '*semi-structured or structured interview*' with family/client depended on years of experience [$\chi(4) = 19.79, p = .001$]. An adjusted standardized residual of 4.0 indicated that those clinicians with greater than 10 years' experience were significantly more likely to routinely assess social cognition using '*semi-structured or structured interview*' with family/client than were clinicians with fewer than 10 years' experience. Furthermore, significant differences were noted for the use of '**formal assessment tools with normative data**', dependent on level of qualification [$\chi(4) = 12.06, p = .017$]. An adjusted standardised residual of 2.2 indicated that those clinicians with postgraduate training were significantly more likely to routinely undertake social cognition assessment using a '**formal assessment tool with objective normative data**' than those without postgraduate training. No other differences were revealed between years of experience or level of qualification and other assessment methods.

FIGURE 1 ABOUT HERE

Failure to assess social cognition with an empirically validated assessment tool was not without reason. The lack of ‘availability of reliable tools/tests’ was most frequently (33% of respondents) rated as the largest barrier to the assessment of social cognition. In addition, respondents reported that this was potentially even more problematic in countries where English was not the first language. ‘Confidence (lack of training)’ to conduct the assessment and ‘time to conduct assessment’ were the next most commonly cited reasons for not assessing social cognition (19% and 17.5% respectively). See Figure 2. Furthermore, the Diagnostic and Statistical Manual of Mental Disorders version 4 (DSM-IV) was a perceived barrier, as it does not include social cognition impairments amongst the sequelae of TBI (although the DSM-V does). Another common response was that the assessment of social cognition was another team member’s (discipline’s) role. It is interesting to note that respondents who stated this identified as Speech and Language Pathologists, Clinical Neuropsychologists, Clinical Psychologists and Occupational Therapists. Furthermore, these disciplines were all viewed by another discipline to be the one responsible for social cognition assessment. Despite the infrequency of social cognition assessment undertaken by clinicians, 34% reported (agreed or strongly agreed) that standardised assessment was useful for the provision of information for goal setting around social cognition rehabilitation needs, and 78% strongly/agreed that informal assessments (interview with client/family) were most useful for informing social cognition rehabilitation planning². Of concern, the majority (63%) of clinicians estimated that social cognition impairments were left untreated in half of all patients that present with these difficulties.

FIGURE 2 ABOUT HERE

² Please note that these were two separate questions; hence, the figures add to greater than 100%.

Discussion

The primary objective of this study was to identify the assessment practices of clinicians working in traumatic brain injury (TBI) rehabilitation with a specific focus on the assessment of social cognition.. This international survey of clinicians is the first (to the authors' knowledge) that aimed to determine whether there is a gap between evidence and practice with regard to social cognition assessment, and therefore stands as an unmet need in the area of TBI rehabilitation.

Survey respondents represented a range of clinicians working in varying disciplines on brain injury teams, with more than half having achieved postgraduate level education. Clinicians reported mainly working with those over the age of 18 years with only 12% of respondents working with children. This is consistent with the prevalence of brain injury across age groups¹⁷. The majority of respondents reported working with clients with all levels of brain injury severity. Approximately half of these were in community rehabilitation settings or private practice with just under half in in-patient settings. Thus, we were reasonably assured that we had a representative sample of TBI rehabilitation clinicians in the current sample.

Overall clinicians working in this field reported that social cognition impairment was present both from their perspective and those of the person with TBI and their family, consistent with the growing literature in this field^{6,9,40-46}. Not surprisingly, prompts for the clinician to assess social cognition included reports from the family of changes to personality and behaviour and reports from the person with TBI about relationship difficulties. Despite the high frequency of social cognition impairment

complaints from the client and awareness from the clinical team, particularly within the severe TBI group, the frequency with which social cognition assessment in this population was undertaken was low. In fact, the majority of clinicians reported that social cognition did not form a part of their standard assessment battery. For example, 45% of clinicians reported that they never assessed theory of mind (ToM: the ability to think about others' thoughts) using faux pas or other tasks. This is despite the fact that people with severe TBI are known to experience moderate-severe ToM deficits⁴⁷. Also, one-quarter of respondents reported that they never assessed facial affect recognition or comprehension of body language, despite the fact that it is estimated that 13-39% of adults with moderate to severe TBI have facial affect recognition impairments¹². The prevalence rates are unclear for body language comprehension⁴⁸ but are presumably similar. Approximately 24-30% of clinicians reported never assessing pragmatic language or the capacity to detect sarcasm. Again, research has shown that approximately one-third of people with TBI are impaired in these domains⁴³. Finally, more than half of clinicians reported that they never assess alexithymia, a condition characterised by poor emotional self-awareness and inability to describe emotions, which is seen in around 60% of people following TBI⁴⁹. Therefore, there was a clear distinction between the prevalence of social cognition impairment in this group and the provision of social cognition assessment by clinicians working in this field. Insight and disinhibition were most commonly cited as being assessed, though notably, these could be classified as more 'cognitive' rather than 'social-cognitive' domains, again supporting the assumption that clinicians spend more time focused on other areas of assessment. Whilst significant differences in social cognition assessment practices might be predicted between those disciplines from allied health backgrounds

(occupational therapy, psychology) versus those from medicine (e.g., rehabilitation physicians, nurses), frequency data presented in Table 5 reveal little difference regardless of whether the entire sample or just those who might be expected to conduct this form of assessment were included in analyses.

Most clinicians reported that they infrequently or never use standardised tests of social cognition. Rather, the most common method was interview with the patient and/or their family, an approach favoured by experienced clinicians. This suggests that those with more experience are potentially more mindful of problems with social functioning following TBI, but are also either unaware of validated assessment tools available for use in this population (e.g., TASIT), and/or are wary of the limitations of available instruments. Indeed clinicians reported that the lack of reliable and appropriate standardised tests for assessing social cognition was the biggest barrier to undertaking social cognition assessment. This could be a result of either the tools not yet being easily accessible or a lack of awareness of what tools are commercially or otherwise available.

Another commonly reported barrier was the lack of tools available in languages other than English. Whilst parts of the TASIT have now been translated into languages such as Danish⁵⁰ and Dutch⁵¹, these are not yet standardised and available for clinical use. This could be rectified through further international collaborations.

Another barrier highlighted by clinicians was their lack of confidence in their ability to assess social cognition due to a lack of training in this domain. Whilst some brain injury research groups and professional associations are working to rectify this through the provision of professional development workshops, webinars etc. (for

example see <http://www.assbi.com.au/workshops.html>, <http://www.biausa.org/biaa-events.htm>, <http://ukabif.org.uk/events/>), it is unclear whether the skills for assessing social cognition are being covered in tertiary education programs, and this question is in need of further investigation.

It was not surprising that time was also noted to be a significant barrier to undertaking social cognition assessment. There are many competing areas of assessment both within in-patient brain injury rehabilitation settings and transitional living units (longer-term rehabilitation facilities) as well as out-patient settings. Clinicians are under pressure to support the person with educational and occupational reintegration in addition to return to independent living. These goals, whilst important, often necessitate the treatment focus on physical rehabilitation. When general cognition and language are addressed, the focus is often on the assessment of memory, attention, and functional communication skills (cognitive communication/aphasia) rather than social domains^{36,52}. If rehabilitation services are fragmented and under-staffed, clinicians struggle to provide comprehensive rehabilitation services in core areas, let alone new, or hitherto unrecognised areas of assessment⁵³. Paradoxically, the social factors, the inability to understand the feelings and intentions of family members have a larger detrimental impact on the quality of life for the person with brain injury than memory impairment or physical disability^{3,4}. This lack of priority placed on the assessment of social cognition may soon change as tertiary education begins to align with the updated diagnostic manual, the DSM-5⁵⁴. The DSM-5, as opposed to the DSM-IV, now highlights social cognition changes as a sequelae of brain injury⁵⁵ and it is anticipated that these changes will filter into formal training settings.

As a logical consequence of the barriers highlighted above, the majority of clinicians reported that social cognition impairments were left untreated in at least half of all patients reporting these difficulties. This aligns with the historical paucity of evidence for treatments of social cognition in TBI. Despite this, empirical studies are emerging⁵⁶⁻⁶⁰ in the TBI literature, and there is a wealth of evidence for similar treatments in other populations such as those with schizophrenia⁶¹. Similarly, there is evidence for the efficacy of social skills training in TBI⁶²⁻⁶⁴ as well as social communication training⁶⁵. Overall, however, research into social cognition remediation in TBI is under-developed, especially in comparison to the schizophrenia field. Whilst this finding was anticipated, it is not acceptable. Given the level of social isolation in this group^{66,67} we as clinicians and researchers should be focused on the skill set that is pivotal to social reintegration. Future research should focus on increasing the level of systematic evidence for social skills remediation programs and actively disseminating any currently available tools to clinicians who are equipped to work in this area.

Limitations

Whilst this survey has provided much needed information from the clinicians' perspective on social cognition assessment practices with people with TBI, there are limitations. As a consequence of keeping it brief, the survey lacked depth into explanations of responses. For example, it would have been useful to collect data from rehabilitation teams (with identifiers) and request information regarding who on each team was perceived to be responsible for social cognition assessment. Whilst this was addressed informally through open responses, a formal question would have enabled this data to be crosschecked and quantified. Whilst we were unable to do this, what did become clear from the responses available was that most thought it was another

discipline's role. The fact that social cognition assessment is "falling between the cracks" is a major concern. Indeed, there is also a very clear possibility that members of a multidisciplinary team do not have a reliable understanding of what other disciplines do as part of their role⁶⁸. The team member responsible for social functioning assessment is also likely to vary somewhat between teams. Future research should also ascertain more detail about barriers to treating social cognition, although many of the same barriers may be relevant. Moreover, it would have been useful to know whether clinicians are being guided in their assessment by particular locally produced or national guidelines. One final limitation was the over representation of Australian clinicians, with only small contributions from other countries including United Kingdom and United States of America. Future studies could endeavour to attract greater representation from other countries.

Conclusion

This study is the first to report on the assessment practices of a multidisciplinary, international group of clinicians working in brain injury rehabilitation. A number of clinical and research implications have been discussed. However, the outstanding issue is that rehabilitation services need to be matched to the needs, strengths and capacities of each individual and modified as that person's needs evolve. Impairments in social functioning are clearly cited as a need, yet are not currently being addressed adequately by either standardised assessment or evidence-based rehabilitation. The gap between need and practice can be addressed through a collaborative approach of clinicians and researchers in this field. Only then can we be sure that we are bridging the gap between current and best practice in TBI rehabilitation.

440

441

442

443

444

445

References

1. Tate RL, Broe GA. Psychosocial adjustment after traumatic brain injury: what are the important variables? *Psychological Medicine*. 1999;29(03):713-725.
2. Vilkki J, Ahola K, Holst P, Ohman J, Servo A, Heiskanen O. Prediction of psychosocial recovery after head injury with cognitive tests and neurobehavioral ratings. *Journal of Clinical and Experimental Neuropsychology*. 1994;16:325-338.
3. Brooks N, McKinlay W. Personality and behavioural change after severe blunt head injury - A relative's view. *Journal of Neurology, Neurosurgery, and Psychiatry*. 1983;46:336-344.
4. McKinlay W, Brooks N, Bond MR, Martinage DP, Marshall MM. The short-term outcome of severe blunt head injury as reported by relatives of the injured persons. *Journal of Neurology, Neurosurgery, and Psychiatry*. 1981;44:527-533.
5. Bond F, Godfrey HP. Conversation with traumatically brain-injured individuals: a controlled study of behavioural changes and their impact. *Brain injury*. 1997;11(5):319-329.
6. Hoofien D, Gilboa A, Vakil E, Donovan PJ. Traumatic brain injury (TBI) 10-20 years later: a comprehensive outcome study of psychiatric symptomatology, cognitive abilities and psychosocial functioning. *Brain injury*. 2001;15(3):189-209.
7. Levin HS, Grossman RG, Rose JE, Teasdale G. Long-term neuropsychological outcome of closed head injury. *J Neurosurg*. 1979;50(4):412-422.
8. McDonald S. Communication disorders following closed head injury: new approaches to assessment and rehabilitation. *Brain Injury*. 1992;6(3):283-292.

- 470 9. McDonald S. Impairments in social cognition following severe traumatic brain
471 injury. *J Int Neuropsychol Soc.* 2013;19(3):231-246.
- 472 10. Hooker C, Park S. Emotion processing and its relationship to social functioning
473 in schizophrenia patients. *Psychiatry Res.* 2002;112(1):41-50.
- 474 11. Morton MV, Wehman P. Psychosocial and emotional sequelae of individuals
475 with traumatic brain injury: a literature review and recommendations. *Brain Inj.*
476 1995;9(1):81-92.
- 477 12. Babbage DR, Yim J, Zupan B, Neumann D, Tomita MR, Willer B. Meta-
478 analysis of facial affect recognition difficulties after traumatic brain injury.
479 *Neuropsychology.* 2011;25(3):277-285.
- 480 13. Williams C, Wood RL. Alexithymia and emotional empathy following traumatic
481 brain injury. *Journal of Clinical and Experimental Neuropsychology.*
482 2010;32(3):259-267.
- 483 14. Wood RL, Williams C. Inability to empathize following traumatic brain injury.
484 *Journal of the International Neuropsychological Society.* 2008;14:289-296.
- 485 15. de Sousa A, McDonald S, Rushby J. Changes in emotional empathy, affective
486 responsivity, and behavior following severe traumatic brain injury. *J Clin Exp*
487 *Neuropsychol.* 2012;34(6):606-623.
- 488 16. Schmidt AT, Hanten GR, Li X, Orsten KD, Levin HS. Emotion Recognition
489 Following Pediatric Traumatic Brain Injury: Longitudinal Analysis of Emotional
490 Prosody and Facial Emotion Recognition. *Neuropsychologia.* 2010;48(10):2869-
491 2877.

- 492 17. Tate RL, McDonald S, Lulham JM. Incidence of hospital-treated traumatic brain
493 injury in an Australian community. *Aust N Z J Public Health*. 1998;22(4):419-
494 423.
- 495 18. Ryan NP, Catroppa C, Cooper JM, et al. The emergence of age-dependent social
496 cognitive deficits after generalized insult to the developing brain: a longitudinal
497 prospective analysis using susceptibility-weighted imaging. *Hum Brain Mapp*.
498 2015;36(5):1677-1691.
- 499 19. Mehrabian A. Manual for the Balanced Emotional Empathy Scale (BEES).
500 (Available from Albert Mehrabian, 1130 Alta Mesa Road, Monterey, CA
501 93940). 2000.
- 502 20. Mehrabian A, Epstein N. A measure of emotional empathy. *Journal of*
503 *Personality & Social Psychology*. 1972;40(4):525-543.
- 504 21. Bramham J, Morris RG, Hornak J, Bullock P, Polkey CE. Social and emotional
505 functioning following bilateral and unilateral neurosurgical prefrontal cortex
506 lesions. *Journal of neuropsychology*. 2009;3(Pt 1):125-143.
- 507 22. Hornak J, Bramham J, Rolls ET, et al. Changes in emotion after circumscribed
508 surgical lesions of the orbitofrontal and cingulate cortices. *Brain*. 2003;126(Pt
509 7):1691-1712.
- 510 23. Kinsella G, Moran C, Ford B, Ponsford J. Emotional disorder and its assessment
511 within the severe head injured population. *Psychological Medicine*.
512 1988;18(1):57-63.
- 513 24. Green P, Rohling ML, Lees-Haley PR, Allen LM, 3rd. Effort has a greater effect
514 on test scores than severe brain injury in compensation claimants. *Brain injury*.
515 2001;15(12):1045-1060.

- 516 25. Ekman P, Friesen WV. Constants across cultures in the face and emotion.
517 *Journal of Personality and Social Psychology*. 1971;17(2):124-129.
- 518 26. Stone VE, Baron-Cohen S, Knight RT. Frontal lobe contributions to theory of
519 mind. *Journal of Cognitive Neuroscience*. 1998;10:640-656.
- 520 27. Milders M, Fuchs S, Crawford JR. Neuropsychological impairments and
521 changes in emotional and social behaviour following severe traumatic brain
522 injury. *Journal of Clinical & Experimental Neuropsychology*. 2003;25(2):157-
523 172.
- 524 28. Milders M, Ietswaart M, Crawford JR, Currie D. Social behavior following
525 traumatic brain injury and its association with emotion recognition,
526 understanding of intentions, and cognitive flexibility. *Journal of the*
527 *International Neuropsychological Society*. 2008;14:318-326.
- 528 29. *The Awareness of Social Inference Test Revised (TASIT-R)* [computer program].
529 Sydney: Pearson Assessment; 2011.
- 530 30. McDonald S, Flanagan S, Martin I, Saunders C. The ecological validity of
531 TASIT: A test of social perception. *Neuropsychological Rehabilitation*.
532 2004;14:285-302.
- 533 31. McDonald S, Honan C, Kelly M, Byom L, Rushby J. Disorders of social
534 cognition and social behaviour in adults with TBI. In: McDonald S, Togher L,
535 Code C, eds. *Social and communication disorders following traumatic brain*
536 *injury*. 2 ed. United Kingdom: Hove; 2013:119-159.
- 537 32. Motor Accidents Authority. *The Neuropsychological assessment of children and*
538 *adults with traumatic brain injury: Guidelines for the NSW Compulsory Third*
539 *Party Scheme and Lifetime Care and Support Scheme*. New South Wales 2013.

- 540 33. New Zealand Guidelines Group. *Traumatic Brain Injury: Diagnosis, Acute*
541 *Management and Rehabilitation*. Wellington, NZ New Zealand Guidelines
542 Group;2006.
- 543 34. Royal College of Physicians and British Society of Rehabilitation Medicine.
544 *Rehabilitation following acquired brain injury: National clinical guidelines*.
545 London: RCP, BSRM2003.
- 546 35. Turkstra LS, Ylvisaker M, Coelho C, et al. *Standardized Assessment for Persons*
547 *with Traumatic Brain Injury: Technical Report*. Unpublished2003.
- 548 36. Frith M, Togher L, Ferguson A, Levick W, Docking K. Assessment practices of
549 speech-language pathologists for cognitive communication disorders following
550 traumatic brain injury in adults: an international survey. *Brain Inj*. 2014;28(13-
551 14):1657-1666.
- 552 37. Hofmans J, Theuns P, Van Acker F. Combining quality and quantity. A
553 psychometric evaluation of the self-anchoring scale. *Quality & Quantity*.
554 2009;43(5):703-716.
- 555 38. Howell DC. *Statistical methods for psychology* 6ed. Belmont, California:
556 Wadsworth; 2007.
- 557 39. Agresti A. *Categorical Data Analysis*. 3 ed. Hoboken, NJ: Wiley; 2013.
- 558 40. Knox L, Douglas J. Long-term ability to interpret facial expression after
559 traumatic brain injury and its relation to social integration. *Brain and Cognition*.
560 2009;69(2):442-449.
- 561 41. Rushby JA, McDonald S, Randall R, de Sousa A, Trimmer E, Fisher A.
562 Impaired emotional contagion following severe traumatic brain injury. *Int J*
563 *Psychophysiol*. 2013;89(3):466-474.

- 564 42. McDonald S, Bornhofen C, Shum D, Long E, Saunders C, Neulinger K.
565 Reliability and validity of The Awareness of Social Inference Test (TASIT): a
566 clinical test of social perception. *Disabil Rehabil.* 2006;28(24):1529-1542.
- 567 43. McDonald S, Flanagan S. Social perception deficits after traumatic brain injury:
568 interaction between emotion recognition, mentalizing ability, and social
569 communication. *Neuropsychology.* 2004;18(3):572-579.
- 570 44. McDonald S, Li S, De Sousa A, et al. Impaired mimicry response to angry faces
571 following severe traumatic brain injury. *Journal of Clinical and Experimental*
572 *Neuropsychology.* 2011;33(1):17-29.
- 573 45. Ryan NP, Catroppa C, Cooper JM, et al. Relationships between acute imaging
574 biomarkers and theory of mind impairment in post-acute pediatric traumatic
575 brain injury: A prospective analysis using susceptibility weighted imaging
576 (SWI). *Neuropsychologia.* 2015;66:32-38.
- 577 46. Ubukata S, Tanemura R, Yoshizumi M, Sugihara G, Murai T, Ueda K. Social
578 cognition and its relationship to functional outcomes in patients with sustained
579 acquired brain injury. *Neuropsychiatr Dis Treat.* 2014;10:2061-2068.
- 580 47. Martin-Rodriguez JF, Leon-Carrion J. Theory of mind deficits in patients with
581 acquired brain injury: A quantitative review *Neuropsychologia.* 2010;48:1181-
582 1191.
- 583 48. Jackson HF, Moffat NJ. Impaired emotional recognition following severe head
584 injury. *Cortex.* 1987;23(2):293-300.
- 585 49. Wood RL, Williams C. Neuropsychological correlates of organic alexithymia. *J*
586 *Int Neuropsychol Soc.* 2007;13(3):471-479.

- 587 50. Bliksted V, Fagerlund B, Weed E, Frith C, Videbech P. Social cognition and
588 neurocognitive deficits in first-episode schizophrenia. *Schizophr Res.*
589 2014;153(1-3):9-17.
- 590 51. Westerhof-Evers HJ, Visser-Keizer AC, McDonald S, Spikman JM.
591 Performance of healthy subjects on an ecologically valid test for social
592 cognition: The short, Dutch Version of The Awareness of Social Inference Test
593 (TASIT). *Journal of Clinical and Experimental Neuropsychology.*
594 2014;36(10):1031-1041.
- 595 52. Lezak M, Howieson DB, Bigler E, Tranel D. *Neuropsychological Assessment.* 5
596 ed. US: Oxford University Press; 2012.
- 597 53. Umeasiegbu VI, Waletich B, Whitten LA, Bishop M. Community-based
598 Rehabilitation Needs: Perceptions of Individuals with Brain Injury and Their
599 Families in the Midwestern United States. *Australian Journal of Rehabilitation*
600 *Counselling.* 2013;19(2):155-163.
- 601 54. APA. *Diagnostic and Statistical Manual of Mental Disorders Fifth Edition.*
602 American Psychiatric Association; 2013.
- 603 55. Simpson JR. DSM-5 and neurocognitive disorders. *J Am Acad Psychiatry Law.*
604 2014;42(2):159-164.
- 605 56. Bornhofen C, McDonald S. Comparing strategies for treating emotion
606 perception deficits in traumatic brain injury. *Journal of Head Trauma*
607 *Rehabilitation.* 2008;23:103-115.
- 608 57. Bornhofen C, McDonald S. Treating deficits in emotion perception following
609 traumatic brain injury *Neuropsychological Rehabilitation.* 2008;18(1):22-44.

- 610 58. McDonald S, Bornhofen C, Hunt C. Enhancing emotion recognition after severe
611 traumatic brain injury: the role of focused attention and mimicry
612 *Neuropsychological Rehabilitation*. 2009;7:1-9.
- 613 59. McDonald S, Togher L, Tate R, Randall R, English T, Gowland A. Trialing a
614 brief intervention for deficits in recognising emotional prosody following severe
615 ABI. *Neuropsychological Rehabilitation*. 2013;23(2):267-286
- 616 60. Neumann D, Babbage DR, Zupan B, Willer B. A Randomized Controlled Trial
617 of Emotion Recognition Training After Traumatic Brain Injury. *J Head Trauma*
618 *Rehabil*. 2015;30(3):E12-E23.
- 619 61. Kurtz MM, Richardson CL. Social cognitive training for schizophrenia: A meta-
620 analytic investigation of controlled research. *Schizophrenia Bulletin*.
621 2012;38(5):1092-1104.
- 622 62. Dahlberg CA, Cusick CP, Hawley LA, et al. Treatment efficacy of social
623 communication skills training after traumatic brain injury: a randomized
624 treatment and deferred treatment controlled trial. *Archives of physical medicine*
625 *and rehabilitation*. 2007;88(12):1561-1573.
- 626 63. Braden C, Hawley L, J. N, Morey C, Gerber D, Harrison-Felix C. Social
627 communication skills group treatment: A feasibility study for persons with
628 traumatic brain injury and comorbid conditions *Brain Injury*. 2010;24(11):1298-
629 1310.
- 630 64. McDonald S, Tate RL, Togher L, et al. Social skills treatment for people with
631 severe, chronic acquired brain injuries: A multicenter trial. *Archives of Physical*
632 *Medicine and Rehabilitation*. 2008;89(9):1648-1659.

65. Helffenstein DA, Wechsler FS. The use of interpersonal process recall (IPR) in the remediation of interpersonal and communication skill deficits in the newly brain-injured. *Clinical Neuropsychology*. 1982;4(3):139-142.
66. Kozloff R. Networks of social support and the outcome from severe head injury. *Journal of Head Trauma Rehabilitation*. 1987;2:14-23.
67. Tate RL, Lulham JM, Broe GA, Strettles B, Pfaff A. Psychosocial outcome for the survivors of severe blunt head injury: The results from a consecutive series of 100 patients. *Journal of Neurology, Neurosurgery, and Psychiatry*. 1989;52:1128-1134.
68. Jenkins VA, Fallowfield LJ, Poole K. Are members of multidisciplinary teams in breast cancer aware of each other's informational roles? *Qual Health Care*. 2001;10(2):70-75.

654 Table 1. *Source of respondents*

Source	No. of responses	% of sample
ASSBI	130	34.5
OT Australia	3	0.8
QLD Physiotherapy Network	10	2.7
Email from colleague	187	49.6
Speech Pathology Australia Brain Injury Research Group	4	1.1
Synapse - Brain Injury Network	14	3.7
Special Interest Group in Neuropsychological Rehabilitation	14	3.7
Victorian Brain Injury Recovery Association	1	0.3
Other	14	3.7
Total	337	85.1*

**85% of participants responded to this question.*

655

656

657

658

659

660

661

662

663

664

665

666

667

668 Table 2. *Demographic and workplace data*

Sample characteristics			
		<i>N</i> = 443	
		<i>N</i>	(%)
Gender	Female	345	77.9
	Male	98	22.1
Location	Australia	260	58.6
	<i>NSW</i>	82	18.5
	<i>VIC</i>	60	13.5
	<i>WA</i>	44	9.9
	<i>QLD</i>	32	7.2
	<i>SA</i>	28	6.3
	<i>TAS</i>	8	1.8
	<i>ACT</i>	4	0.9
	<i>NT</i>	2	0.5
	Country other than Australia	183	41.3
Role	Psychology	116	26.2
	<i>Clinical Psychology / General</i>	34	7.7
	<i>Clinical Neuropsychology</i>	82	18.5
	Occupational therapy	69	15.6
	Speech pathology	96	21.7
	Physiotherapy	26	5.9
	Social work	10	2.3
	Rehabilitation physician / Medico	60	13.5
	Nursing	8	1.8
	Case Manager / Rehabilitation Coordinator	32	7.2
	Academia	24	5.4
	Other	2	0.5
Highest qualification attained	PhD	68	15.3
	Doctorate	74	16.7
	Masters	118	26.6
	Honours	43	9.7
	Bachelor	126	28.4
	Diploma	11	2.5
Length of time	None completed / Still studying	3	0.7
	<12 months	38	8.6

working in	1-3 years	71	16
TBI	4-10 years	130	29.3
rehabilitation	>10 years	204	46

669

670

671

672

673

674

675

676

677

678

679

680

681

682

683

684

685

Table 3. *Population and workplace setting of respondents*

		Total sample	
		(N = 443)	
		<i>N</i>	(%)
Location	Inpatient	187	42.2
	Outpatient/community	180	40.6
	Private practice	50	11.3
	University/research centres	26	5.9
Clientele	Paediatric (0-17yrs)	51	11.5
	Adult (18-65yrs)	362	81.7
	Older Adult (>65yrs)	30	6.8
Injury Severity*	Mild	267	60.3
	Moderate	364	82.2
	Severe	368	83.1
	Very severe	281	63.4

**Note: Respondents were asked to mark all that apply*

Table 4. *Prompts to undertake social cognition assessment*

	N = 265
Concerns reported by client:	%
Relationship problems family/friends/partner	28.68
Altered mood	1.13
Poor quality of life	1.51
Concerns reported by others:	
<i>Family report changes in personality / behaviour</i>	31.32
<i>Clinical team and others</i>	
Identified social skills impairment	17.36
Socially inappropriate behaviour	19.25
Socialisation/communication difficulties observed in group setting	16.60
Clinician noticed social skills a barrier to participation/rehab/goal planning	11.70
Social avoidance (isolating self)/less social network	6.79
Clinician noticed lack of insight	2.26
Inconsistency between cognitive and functional assessment	0.38
Referrer requested	1.13
imaging shows damage/mechanism of injury/severity	5.28
Legal and/or funder request	2.64

697

698

699

700

701

702

703

704 Table 5. *Frequency of assessment of each social cognition domain*

	Total sample (N = 274-290)				
	Never (0% of clinical time)	Infrequent (<25% of clinical time)	Somewhat frequent (25- 50% of clinical time)	Frequently (51-85% of clinical time)	Routinely (>85% of clinical time)
Area of social cognition					
Identity recognition	31	36.9	13.6	10.8	7.7
Facial affect recognition	24.7	36.9	16.0	12.9	9.4
Theory of Mind	45.2	28.3	15.1	7.9	3.6
Alexithymia	55.1	24.5	10.6	5.8	4.0
Prosody	33.7	27.7	14.7	12.6	11.2
Knowledge of social norms	10.8	25.4	23.7	23.7	16.4
Interoceptive awareness	47.1	22.8	11.2	12.0	6.9
Sarcasm	29.9	27.4	20.8	14.6	7.3
Social problem solving	7.3	17	21.8	27.7	26.3
Social adjustment	10.5	16.4	20.6	24.4	28.2
Empathy	20.7	24.6	22.8	20.4	11.6
Pragmatic language	23.9	19.4	16.9	19.0	20.8
Apathy	19.5	24.7	19.9	19.9	16.0
Social faux pas	29.9	28.9	19.0	14.8	7.4
Body language recognition	27	27	18.9	14.0	13.0
Insight	2.1	5.9	17.6	26.9	47.6
Anger	10.8	16.8	24.1	18.9	29.4
Disinhibition	6	10.5	16.8	25.3	41.4

Note. Not all respondents responded to each of these questions. At least 94% responded to all questions.

The percentages reported above are valid percentage.

