The Predictive Utility of Social Cognitive Measures in Determining Functional Outcomes After Acquired Brain Injury

A report submitted as a partial requirement for the degree of Bachelor of Psychological Science with Honours in Psychology at the University of Tasmania, 2016.

Statement of Sources

I declare that this report is my own original work and that the contributions of others have been duly acknowledged

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Madelaine Lodge Date

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List of Acronyms

ABI	Acquired Brain Injury
EEM	Emotion Evaluation Task
HADS	Hospital Anxiety and Depression Scale
IRI	Interpersonal Reactivity Index
PTA	Post-traumatic Amnesia
SEQ	Social Emotional Questionnaire
SIE	Social Inferences Enriched
SIM	Social Inferences Minimal
SPRQ	Sydney Psychosocial Reintegration Scale
TABIS	Tasmanian Acquired Brain Injury Service
TAIST-S	The Awareness of Social Inferences Test Shortened
TBI	Traumatic Brain Injury
ToM	Theory of Mind
TOPF	Test of Premorbid Functioning

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Abstract

Previous studies indicate that social cognition is impaired after an acquired brain injury (ABI). Social cognition refers to the ability to interpret and understand emotions, social settings and interpersonal exchanges. The present study examined impairments in social cognitive ability, and the predictive utility of social cognition in determining functional outcomes after an ABI. Thirty participants with an ABI (m= 18, f= 12) were recruited, and 30 healthy controls matched for similar sex, age and premorbid IQ. A series of independent samples *t*-tests compared the ABI and control participants on social cognitive measures. The relationship between the ABI participant's social cognitive ability and their functional outcomes were examined using eight hierarchical regressions. *t*-test results indicated that the ABI group performed significantly worse on the objective and informant measures of social cognition, while no significant differences on the self-reported social cognition measures were observed. Social cognition significantly predicted 43.5% of the variance in living skills on the participants rated outcome measure. The other regression models showed trends where social cognition predicted functional outcomes, however were non-significant. Clinical implications of the current study include facilitating assessments, by identifying individuals and their families who would benefit from more assistance and education.

Acquired brain injury (ABI) can result in physical, neuropsychological, social, and psychosocial deficits (Lezak, 1987). Such factors can affect lifestyle adjustments and community reintegration post-injury (McDonald, 2013). Psychosocial refers to an interrelation of individual, psychological and social factors, which influence thoughts and behaviour (Hellawell, Taylor & Pen, 1999). Psychosocial changes after an ABI can occur in multiple domains, from occupational activities, interpersonal relationships to independent functional living skills (Tate et al., 2011), and are the focus of the current study. These problems are well documented in studies that monitor short and long term functioning after ABI (Ponsford, Draper & Schonberger, 2008; Zumstein et al., 2011). Psychosocial difficulties are important to recognise in ABI populations, as they often persist longer than physical impairments, and can impact receptiveness and participation in rehabilitation (Morton & Wehmant, 1995). ABI is also associated with poor social skills, which have associations with poor social outcomes in regards to relationships, social isolation and internalising disorders, such as depression (McDonald et al., 2006; Morton & Wehmant, 1995). Research has focused on psychosocial outcomes and social abilities in ABI populations, however, less research has examined whether social abilities are predictive of functional sequelae.

1.1 Acquired Brain Injury

ABI is a term that includes a wide range of individuals with various types and degrees of damage, and associated deficits. ABI refers to cerebral impairment, as opposed to a head injury alone (Cattelani, Zettin & Zoccolotti, 2010). ABI occurs after birth and can result from sudden insult or injury, for example, traumatic brain injury (TBI), cerebral vascular accident or oxygen deprivation to the brain, such as

hypoxia (Taub, Maino & Bartuccio, 2012). Alternatively, ABI can have an insidious onset, from causes such as prolonged alcohol or substance abuse, brain tumours or degenerative neurological disease (Man, Soong, Tam & Hui-Chan, 2006).

ABI can be further classified into primary and secondary injuries. Primary injuries are caused by the initial moment of trauma, which result in a direct impact on the skull and intracranial contents (Murthy, Bhatia, Sandhu, Prabhakar, & Gogna, 2005). The initial neurological and vascular damage has potential to lead to further impairments and deterioration of condition. Damage after the initial trauma is a consequence of a secondary injury, which refers to indirect injury effects (Murthy et al., 2005). For example, increased intracranial pressure, cerebral oedema, which may result in damage to the blood-brain barrier, and cerebral ischemia, where blood flow is restricted (Moore & Stambrook, 1995; Murthy et al., 2005). An ABI with traumatic aetiology, for example, motor vehicle accidents and assaults, are often characterised by primary and secondary injuries. However, many types of ABI such as, hypoxia, encephalitis and toxicity can occur in gradual processes (see Figure 1; Man, Soong, Tam & Hui-Chan, 2006).

Brain injuries can result in focal and diffused neuropathy, which have potential to affect many of the different brain regions (McDonald, 2013). Focal brain injuries refer to an insult to a specific location, whereas diffused injuries have widespread damage (Lezak et al., 2012). Despite the centrality of focal injuries, deficits tend to be inconsistent due to the intercommunicating system (Lezak et al., 2012). This potentially results in a complex interplay of deficits, with permutations to cognitive, emotional, linguistic, physical, behavioural and psychosocial functioning (McDonald, Togher & Code, 2014).

In some circumstances, defining ABI is difficult due to it being heterogeneous and overlapping with other disabilities. For example, a brain injury attained during birth or at a young age may be classified as an intellectual disability (Fortune & Wen, 1999). The scope and overlap also make it difficult to estimate the prevalence of ABI. Fortune and Wen (1999) estimated that approximately 100 to 377 individuals per 100,000, sustain an ABI per year in Australia. These figures are based on data from hospitalisations, which has the potential for underestimation, as not all individuals who sustain an ABI seek medical attention, especially those with mild injuries (Flanagan, Cantor & Ashman, 2008). Alternatively, the opposite can occur, where the same individuals repeatedly present to hospitals with multiple brain injuries. Furthermore, hospital admission data is prone to local differences in socioeconomic status, which influence prevalence and type of ABI (Fortune & Wen, 1999). Thus, while determining ABI prevalence rates is challenging, the estimates cited above nonetheless indicate that ABI is relatively common.

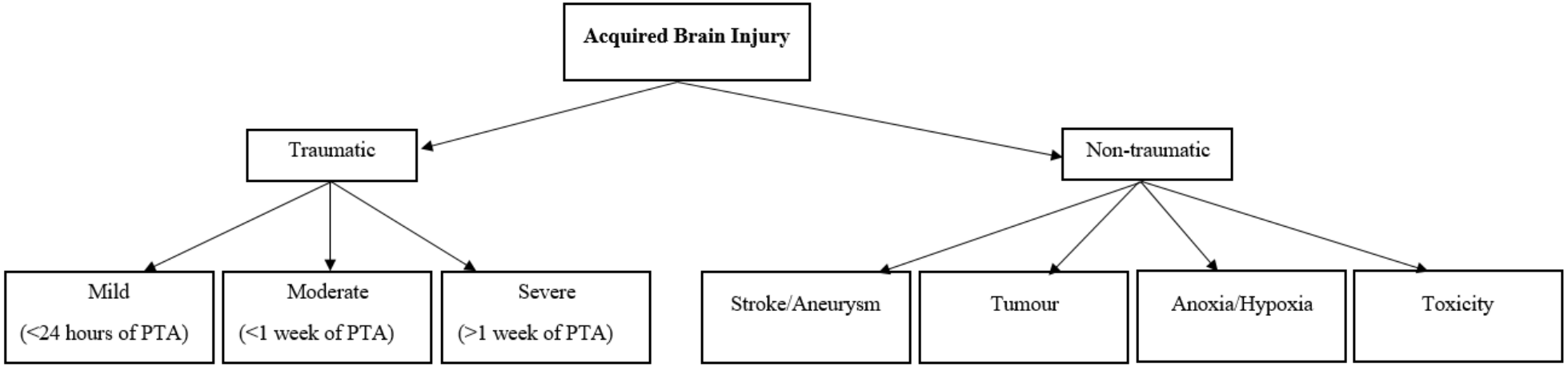

Figure 1. Classification of ABI

There are demographic factors, such as age and gender, which are generally associated with the prevalence and aetiology of ABI (Fortune & Wen, 1999). Within the Australian population, the proportion of males with an ABI is higher than in females (2.2% and 1.6%, respectively; Fortune & Wen, 1999). There are also significant differences, where males are more likely to sustain an ABI across all age groups, except for children aged 0-4 and those over 75 (Helps, Henley & Harrison, 2008). Hospital separation data indicates that the highest prevalence of traumatic injuries occurs for individuals aged 15 to 19 years old (284 per 100,000), followed by children aged under four (244 per 100,000; Fortune & Wen, 1999). In older individuals, stroke is the most commonly occurring ABI in developed countries, with between 160-200 individuals per 100,000, each year, experiencing their first stroke (Fortune & Wen, 1999). In Australia, a diagnosis of TBI is predominantly caused by; falls (42%), motor accidents (29%) and assault (14%; Helps et al., 2008). The prevalence estimations of non-traumatic brain injuries are more difficult to obtain due to many injuries being undiagnosed. For example, alcohol related ABI, which is most common in middle-adult years, but are not diagnosed until autopsy (Fortune & Wen, 1999).

1.2 Impairments and Functional Outcomes After ABI

ABI is commonly associated with impairments to social cognition, for example, difficulties detecting social cues, understanding social situations and norms, and recognise the intentions of others (Milders, Fuchs, & Crawford, 2003). These deficits may affect an individual's integration into the community and consequently their psychological adjustment (Milders et al., 2003). Difficulties in adjustment after an ABI may be indicated by less social interaction, fewer

friendships, changes to employment status and disengagement in leisure activities (Man, et al., 2006). These social cognitive deficits may impact communication skills, which can in turn lead to ineffective interpersonal exchanges. Finset et al. (1995) found that 57% of individuals with a TBI reported a decline in their social networks, which demonstrates an outcome of social deficits. Furthermore, this is a problem as many individuals' lack insight into their adjustment difficulties and are often unable to recognise their social cognition deficits and consequently the actions of their behaviour (Powell, Al-Adawi, Morgan, & Greenwood, 1996).

ABI can result in deterioration of mental, physical, and independent functioning, which can be temporary or permanent, and potentially result in partial or total disability (Fortune & Wen, 1999). ABI is associated with changes in cognition, mood and behaviour, which may remain after somatic and physical recovery (Cattelani et al., 2010). Medical professionals generally focus upon physical impairments after an ABI, while disabling cognitive and behavioural factors may not be recognised (Flanagan et al., 2008). An individual's cognitive, social and behavioural impairments are important to recognise, as they are likely to influence their receptiveness to treatment and rehabilitation.

ABI can result in a variety of pathophysiological changes and impairments. Such changes, among other direct and indirect effects, influence functional status, disability and limitations in everyday life (Temkin, Corrigan, Dikmen, & Machamer, 2009). Functional impairments after an ABI can have significant implication in cognitive, physical and psychosocial domains of life. Cognitive impairments include: memory deficits, poor planning and problem solving, difficulties in concentration, slowed processing speed, lack of insight, and depleted motivation (Felmingham, Baguley, & Green, 2004; McDonald, Flashman & Saykin, 2002; Prigatano, 1991).

Physical functional outcomes refer to impairments to motor skills, sense perception and balance (Basford et al., 2003; Biernaskie, Chernenko & Corbett, 2004). Psychosocial outcomes impaired after an ABI include, difficulties with inhibition and impulsivity, understanding what is socially appropriate and regulating their behaviour and emotions (Beer, Heerey, Keltner, Scabini, & Knight, 2003; Honan, McDonald, Sufanic, Hined & Kumfore, 2016). In addition, functional outcomes include aspects of social functioning, for instance, capacity to learn and understand new information, communicating and interacting with others (Hall, Bushnik, Lakisic-Kazazic, Wright & Cantagallo, 2001; Temkin et al., 2009).

As multiple domains of functioning can be affected by an ABI, a range of negative outcomes may result. From simple activities of daily life, including basic living skills, personal care and mobility, to higher order skills and abilities, such as psychosocial functioning, employment status, engagement in leisure activities, wellbeing, independence and self-regulation (Man et al., 2006; Temkin et al. 2009).

Individuals with an ABI often self-report challenges with psychosocial outcomes post injury (Hoofien et al., 2001). Temkin (2009) found that TBI participants rated their level of social functioning much lower than their abilities on non-social domains of functioning. The main difficulties individuals with a TBI reported were in areas of communication, alertness, emotional behaviour, and social interaction (Temkin et al., 2009). Functional outcomes after an ABI tend to be poorer than other acquired disabilities (Temkin et al., 2009). For example, individuals with an ABI were likely to cease work, and if they returned, it was to a less skilled position (Temkin et al., 2009). Temkin et al. also found that one year after a TBI, psychosocial problems were more prominent than issues with basic living activities.

This highlights the need to identify functional impairments early, so intervention and rehabilitation can maximise outcomes.

The ability to predict functional outcomes from an individual's performance on social cognitive measures has potential to help rehabilitation, community settlement and integration. This knowledge could potentially help professionals and service providers in making more sustainable goals, treatment plans and implementing lifestyle changes. Vogenthaler, Smith and Goldfader (2009) states that it is impossible to match brain injury patients with similar characteristics to predict their outcome, which demonstrates the need for a more individualised approach, if predictions are to occur.

1.3 Social Outcomes

Dijkers, Whiteneck and El-Jaroudi (2000) define social outcomes as the changes to social functioning, caused by the direct and indirect impairments and functional limitations an individual experiences. Social outcomes encompass many facets, including social acceptance, social competence, participation and isolation (Yeates et al., 2004). Social outcomes also include employment status, engagement and quality of social relationships, independent living skills, leisure engagement, global functioning status and quality of life (Temkin et al., 2009). Couture, Penn and Roberts (2006) found that measures of social cognition, specifically emotion perception and theory of mind (ToM), directly related to social outcomes in a schizophrenic population. Individuals with schizophrenia, who were more competent in understanding the social situation and interactions, were more likely to respond appropriately. This is most likely because they give responses that are more fitting, which results in more successful social interactions (Couture et al., 2006). Poor

social skills after brain injury most likely reflect acquired changes to cognition and personality (McDonald & Kinch, 2003), similar to schizophrenia (Fett et al., 2011), and likewise predict social outcomes.

Emotional displays and social interactions are often more complicated than they appear (Harvey & Penn, 2010), for example, daily conversations often include sarcasm and emotional demeanours (Honan et al., 2016). This potentially explains how social cognitive ability determines the quality of social outcomes. The relationship between social cognition impairments, in areas such as ToM and emotion perception, have been found to correlate with poor social functioning among schizophrenic populations (Couture et al., 2006; Harvey & Penn, 2010). Similarly, Kalin et al. (2015) examined social cognition in a schizophrenic population. Kalin et al. (2015) found that social cognition, social competence and motivation, accounted for 32% of the variance in social outcomes. This indicates that social cognition has some predictive utility in determining social outcomes for other clinical populations. It is probable that the same relationship would occur among ABI populations, as social cognitive deficits have also been reported (McDonald, 2013). In addition, as social ability correlates with coping capacity, anxiety and problem-solving skills (Bastian, Burns, & Nettelbeck, 2005), it is plausible that social cognition, may be related to and predict functioning in daily life after an ABI.

1.4 Social Cognition

Social cognition refers to the capacity to attend to, recognise and understand social cues (McDonald, 2013). Social cognition is a superordinate term, which comprises of many interpersonal skills and abilities. For example, detection of facial emotions, ToM ability, and capacity to understand and interpret social inferences and

subtle social cues (Honan et al., 2016; Ubukata et al., 2014). Social cognition facilitates interpersonal skills, such as empathy, perception and social awareness, which influence an individual's ability to communicate, cooperate and compete with others (McDonald, 2013). This indicates how social cognition is essential for effective functioning in society, as social ability influences social outcomes, such as social participation and relationship maintenance (Harvey & Penn, 2010; McDonald, 2013).

Frith and Frith (2010) distinguish between two forms of social cognition, a mentalising system and a mirror system. The mentalising system is consistent with the concept of cold social cognition, which refers to interpretations that are independent of emotional state. The mentalising system relates to ToM ability, which refers to the process of inferring the feelings, beliefs and intentions of others (Frith & Frith, 2010; McDonald, 2013). The mirror system is involved in hot social cognition, which uses motivated reasoning and current emotional state to form an interpretation. This includes emotion perception and emotional empathy (McDonald, 2013). Empathy is a salient part of social cognition, as it relates to an individual's ability to understand and respond to their environment (Spreng, McKinnon, Mar, & Levine, 2009). Empathy includes interpreting others' emotions and engaging in pro-social behaviour, which determines whether successful emotional communication occurs (Spreng et al., 2009).

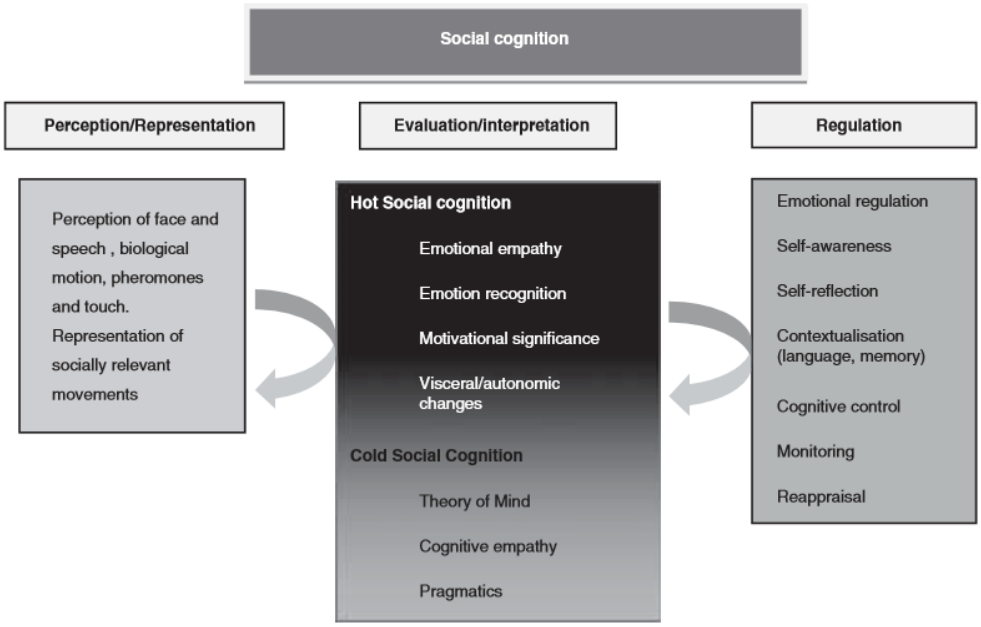

Figure 2. The elements of social cognition as describes by Adolphs (2010), image from McDonald (2013). Impairments in Social Cognition Following Severe Traumatic Brain Injury. *Journal of the International Neuropsychological Society*, *19*, p. 232.

There are different processes, neural networks and brain regions associated with social cognition (McDonald, 2013). These processes differ neuroanatomically from cognitive processes and other social cognitive processes (Adolphs, 2010). Social cognition can be broken down into three main components; perception, cognition, and regulation. Perception of social stimuli is a fundamental aspect of social cognition, which involves explicit processing (i.e. from the visual cortex) and rapid coarse processing (i.e. in the superior colliculi; McDonald, 2013). Within perception, there are domain-specific processes, as certain stimuli trigger different patterns of brain activity (Adolphs, 2010). For example, detection of facial

expressions, somatosensation, prosody and movement are all perceptual processes, however each is associated with different brain regions (Adolphs, 2010).

Cognitive ability is the second component, this refers to the process where the individual evaluates and interprets the information (McDonald, 2013). Regions such as the orbital and ventromedial frontal cortex, cingulate cortex, striatum, insula, and amygdala, are all used in implicit processing of mental states and emotion recognition (McDonald, 2013). Examples of the cognitive component include social and moral judgements, ToM and empathy (Adolphs, 2010). The third constituent of social cognition is effortful regulation of responses and behaviour. Examples of which include, emotion regulation, cognitive control, self-reflection and the ability to correct perceived errors (Adolphs, 2010). These functions are associated with activation of the hippocampus, temporo-parietal areas and the dorsal regions of the lateral and medial prefrontal cortex (Lieberman, 2007; Phillips et al., 2003).

Research in the area of ABI and social cognition indicates that there are deficits in domains of social cognition, including emotion recognition (Babbage et al., 2011), particularly detection of fear, sadness and anger (Adolphs, 2002). In addition, TBI studies report deficits in ToM (McDonald, 2013). In studies of emotional empathy and physiological responses, de Sousa et al. (2011) found that TBI was associated with less emotional empathy, when compared to healthy controls. This decrease related to reduced physiological responses to the emotions of others. In regards to understanding social situations, individuals with an ABI have a tendency to understand sincere interpersonal interactions, however, have difficulty understanding non-literal meanings, such as sarcasm and lies (Honan et al., 2016).

Shamay-Tsoory, Aharon-Peretz and Perry (2009) used the Interpersonal Reactivity Index (IRI), which is a multifaceted empathy scale, in individuals with

brain lesions. The sample comprised of healthy controls, and individuals with ventromedial prefrontal cortex, inferior frontal gyrus and posterior lesions. Shamay-Tsoory et al. (2009) found that those with inferior frontal gyrus lesions performed most similar to controls on the subscales that comprise the general empathy factor, while those with posterior lesions rated their empathy ability lower, followed by those with ventromedial prefrontal cortex lesions rating their ability the lowest. These results are likely to vary because different anatomical brain regions affect social cognition, specifically empathy, as measured by the IRI and that level of insight varies (Levin et al., 1987; McDonald, 2013; Powell et al., 1996).

To date, Ubukata et al. (2014) is the only study to examine the utility of social cognition in predicting functional outcomes in a TBI population. Ubukata et al. measured social cognition with a facial emotion perception and ToM tasks. One of which was the Matsumoto and Ekman set of 48 faces, as a measure of emotion detection. For each photo, they selected which emotion, out of six options, best describes the expression. They also employed the Faux Pas test, which assesses ToM ability. Participants read 20 short stories and were asked to identify any awkward interactions. The Moving Shape Paradigm was also implemented; this assessed ToM by interpreting interaction patterns of shapes. Lastly, Ubukata et al. employed an eye expression test, where participants had to determine mental state from a photo of someone's eyes, which also measured ToM. Ubukata et al. measured functional outcomes on the Revised Craig Handicap Assessment and Reporting Technique, which assesses physical and cognitive independence, mobility, occupation status, social integration and economic self-sufficiency. Ubukata et al. found a strong, positive correlation between eye expression identification and functional outcomes, where participants who obtained a low score on the eye expression task, were also

likely to have difficulty communicating in everyday life. This was the only significant finding by Ubukata et al. regarding the relationship between social cognition and functional outcomes.

1.5 Justification for the Current Study

Several studies have found social cognitive impairments in ABI populations (Adolphs, 2010; Milders et al., 2003; Spikman et al., 2011). These deficits have potential to impact outcomes after an ABI, such as, social disengagement, impaired insight, loss of interpersonal skills and social understanding, which may in turn, influence functioning in other areas of daily life (Ubukata et al., 2014). As an individual's social functioning may influence adjustment and reintegration into the community, establishing whether measures of social cognition predict functional outcomes would be beneficial. Understanding functional outcomes is a vital part of establishing treatment plans and monitoring an individual's progress (Brahmstadt, 2012). If social cognition is found to be a predictor of functional outcomes, there is potential to influence rehabilitation, treatment, and daily life functioning, which may improve quality of life.

Despite the high prevalence of social cognition deficits in ABI populations, social cognitive ability is not commonly assessed (Honan et al., 2016). This may result in such deficits being undiagnosed and their relationship with functional outcomes being unknown. In the past, social cognitive ability has commonly been inferred from self and informant reports (Honan et al., 2016). Such measures are subject to bias. As suggested by McDonald (2013), ABI is associated with impaired cognitive ability, deficits in self-awareness and lack of insight. Furthermore, Fleming, Strong and Ashton (1995) and Levin et al. (1987), state that this diminished

ability, such as insight, reduces the validity of self-report measures. However, this is not always the case, as Kinsella, Moran, Ford and Ponsford (1988) found that self-report measures were valid in detecting emotional changes after a TBI. In addition to problems with self-reported social cognition, Hart et al. (2004) state that individuals with brain damage overestimate their functional abilities. This notion is consistent with the findings of Leathem, Murphy and Flett (1998), who indicate that as injury severity worsened, the discrepancy scores on the measures of functional outcomes also increased.

In general, informant ratings are accepted as more accurate in reflecting changes after an ABI (Bramham, Morris, Hornak, Bullock, & Polke, 2009). Furthermore, they tend to be more closely aligned to objective measures of social cognition. Despite being a better measure than self-report (for ABI populations), they may also be subject to both intentional and unintentional biases, where they over or underestimate their functioning (Bramham et al., 2009). Therefore, a combination of objective, self and informant reports are needed, and will be employed by the current study.

The only study examining the predictive utility of social cognition in determining functional outcomes after an ABI is Ubukata et al. (2014), which has many methodological limitations. According to Temkin et al. (2009), a common limitation in study design is that no control group was included for comparisons. Similarly, Ubukata et al. did not employ a control group, so comparisons between a healthy population and TBI group on social cognitive measures could not be obtained. In addition, another limitation of the study by Ubukata et al. was the small sample size (n = 20). Furthermore, the measures employed by Ubukata et al. were potentially a limitation of the study. The measures included still photographs for

emotion perception, and the Moving Shape paradigm, which has unknown reliability and validity (Ahmadi, Jalaie & Ashayeri, 2015).

While Ubukata et al. (2014) relied on photographic stimuli to measure social cognition, audio-visual recordings have been found to; (1) more accurately reflect everyday interactions; (2) provide additional social information; (3) have greater ecological validity; and (4) measure social cognition objectively (Honan et al., 2016). The current study will employ measures that have been validated in ABI populations, with good psychometric properties. These measures include the IRI, the Awareness of Social Inferences Test Shortened (TASIT-S), Social Emotional Questionnaire (SEQ) and the Sydney Psychosocial Reintegration scale (SPRS). Two of the measures have both self-report and informant versions, to give a more accurate reflection of ability and functional status. The TASIT-S uses audio-visual recordings to objective measures social cognition (Honan et al., 2016). This provides a measurement that is less subject to bias, and gives more detail into social interactions and emotional displays. By employing a combination of self and informant reports, and an objective measure, the present study should obtain an overall understanding and good measurement of social cognitive ability.

1.6 Aims and Hypotheses

The current study aims to compare individuals with an ABI, to healthy controls on measures of social cognition and functional outcomes. Furthermore, the current study aims to determine whether social cognition, when measured in different forms, predicts functional outcomes after an ABI. Previous studies indicate that self-report measures in ABI populations produce inconsistent results, arguably due to insight being impaired in some more than others (Prigatano, 1991). As this is the case, and that

the sample of interest has variation in injury type and severity, differences between the ABI and control groups self-reported measures were not examined. Consistent with previous research in the area of social cognition and ABI, it was hypothesised that individuals with an ABI would perform significantly worse on the objective and informant, but not self-rated, measures of social cognition, when compared to healthy controls. Secondly, based on Ubukata et al. (2014), it was hypothesised that there would be a relationship where social cognitive ability predicted functional outcomes on the SPRS subscales and total, after an ABI. Thirdly, given that social cognition has been shown to be integral in relationship formation and maintenance (Harvey & Penn, 2010), it was hypothesised that the social cognitive measures would predict the most amount of variance on the relationship subscale of the SPRS.

Method

2.1 Participants

ABI participants were recruited through the Tasmanian Acquired Brain Injury Service; an organisation that provides rehabilitative access and support to individuals with an ABI. Healthy controls were recruited through word of mouth. The ABI participants were all currently living in the community, and all participants had English as their first language. ABI participants were excluded if they had severe communication deficits to speech, vision and hearing. In comparison, exclusion criteria were more conservative for healthy controls. Controls were excluded if they indicated that they had a past or present physical, psychiatric or neurological condition, had sustained loss of consciousness, had an estimated IQ of less than 75 on the TOPF, and if English was not their first language. Current levels of anxiety and depression were measured for all participants, as high levels can impact social

cognition (Cusi et al., 2011; Langenecker et al., 2005). There were no significant differences between the ABI and control group on current levels of anxiety and depression (see Table 1).

The sample comprised of 60 participants, 30 with an ABI and 30 healthy age, sex, and education matched controls. A power analysis, based on the study by Ubukata et al. (2014), estimated that 30 participants per group should permit the detection of moderate effects (.80). The demographic characteristics of the ABI and control group are shown in Table 1, and as can be seen, there were no significant differences between groups on age, sex, and years of education. There was a significant difference in estimated premorbid IQ; however, this difference was unlikely to be meaningful as the ABI group mean still performed within the average range.

The ABI groups injury-related characteristics are shown in Table 2. Injury severity was determined by duration of post-traumatic amnesia (PTA), which was classed as mild (less than 24 hours), moderate (less than one week) and severe (longer than one week; Lezak, Howieson, & Bigler, 2012). The majority of ABI participants had sustained a severe brain injury, with 80% having PTA for longer than 1 week. All ABI participants, except one, had sustained their ABI for longer than a year, which should be a sufficient period for functional impairments to be accurately displayed (Ubukata et al., 2014). Medication usage and psychiatric conditions are common in brain injury populations (Temkin et al., 2009) and are reported in Table 3.

Table 1

Demographic Information for ABI and Control Groups

Characteristic	ABI	Control	t/F /χ^2	*p*-value	Cohen's *d*/ Cramer's V
Sex n (%)					
Male	18 (60%)	19 (63.3%)			
Female	12 (40%)	11 (36.7%)	.07	.791	.034
Age					
Mean (SD)	47 (14.28)	46 (12.06)	.26	.793	.076
Premorbid IQ					
Mean (SD)	92.53 (16.52)	104.13 (12.49)	3.07	.003	.792
HADS Anxiety					
Mean (SD)	6.90 (4.82)	7.40 (4.36)	.18	.675	.109
HADS Depression					
Mean (SD)	4.77 (3.70)	3.67 (3.11)	1.53	.220	.322
Education Level					
< Year 10	4 (13.3%)	2 (6.7%)			
Year 10-12	13 (43.3%)	12 (40.0%)			
Tafe	6 (20.0%)	12 (40.0%)			
University	7 (23.3%)	4 (13.3%)	3.50	.318	.242

Table 2

Injury-Related Data and Prevalence of Mental Illness

Characteristic	*n* (%)
Years since Injury	
0-3 years	5 (16.7%)
3-6 years	5 (16.7%)
6-9 years	5 (16.7%)
Greater than 9 years	15 (50%)
Injury Severity (PTA)	
Mild (< 24 hours)	2 (6.7%)
Moderate (< 1 week)	4 (13.3%)
Severe (> 1 week)	24 (80%)
Injury Severity (GCS)	
Not reported	25 (83.3%)
Mild (13-15)	1 (3.3%)
Moderate (9-12)	1 (3.3%)
Severe (3-8)	3 (10%)
Injury Mechanism	
Motor accident	12 (40%)
Stroke/Aneurysm	7 (23.3%)
Tumour	3 (10%)
Assault	2 (6.7%)
Other	4 (13.3%)
More than one ABI	2 (6.7%)

Table 3

Medication use and Mental Illness Prevalence in ABI sample

Medication	*n* (Percentage using/with)
Anti-epileptics	16 (53.3%)
Psychiatric	9 (30%)
Analgesic	6 (20%)
Sleeping	3 (10%)
Headaches, dizziness and brain swelling	3 (10%)
Other	20 (66.7%)
Poly drug users	18 (60%)
Prevalence of Mental Illness	
None	18 (60%)
Depression	9 (30%)
Anxiety	5 (16.7%)
PTSD	3 (10%)
Other	4 (13.3%)

2.2 Materials

2.2.1 Demographic Questionnaire

Demographic questionnaires were developed for the control and ABI groups (see Appendix B), in which, participants reported year of birth, sex, the highest level of education they completed and medical history, including any experience of loss of consciousness. The ABI participants also reported how and when they sustained their ABI, length of PTA and medication usage. To estimate PTA, questions from the

Galveston Orientation and Amnesia Test were used, which has shown to be an accurate predictor of duration of PTA (Lezak et al., 2012). The demographic questionnaires took ABI participants approximately 10 minutes to compete, and control participants less than five minutes. The ABI participants also completed a medical release form, which permitted the access to medical documents from TABIS and their general practitioners.

2.2.2 The Test of Premorbid Functioning (TOPF)

The TOPF (Wechsler, 2009) is a revised version of the Wechsler Test of Adult Reading. The TOPF gives an estimation of premorbid IQ that relies on previous learning, as opposed to comprehension or knowledge. This means that it is not as sensitive to neurological changes in the ABI sample, and is recommended as an appropriate measure to estimate pre-morbid intelligence in this population (Delis et al., 2009; Lezak et al., 2004). The TOPF is a list of 70 words with atypical grapheme to phoneme translations. For each word item participants incorrectly pronounce, they are scored 0, and each correct pronunciation is awarded a score of 1. The words increase in difficulty as the list continues, after five consecutive scores of 0, the test is discontinued. The TOPF generally estimates premorbid IQ scores ranging from 78–128 (M = 102.16, SD =10.45; Norton, Watt, Gow, & Crowe, 2016). The TOPF is suitable for ages 16 to 90 years, and takes approximately five minutes for each participant to complete. It has been re-normed with the WAIS-IV (Holdnack, Drozdick & Maccow, 2009) and has good concurrent validity with the verbal comprehension index (r = .75; Delis et al., 2009). The TOPF also has high split-half reliability (r = .92 to r = .99; Delis et al., 2009). Furthermore, the TOPF has

an increased prediction accuracy and range when compared to the WTAR (Delis et al., 2009).

2.2.3 The Hospital Anxiety and Depression Scale (HADS)

The HADS is a 14-item screening tool that measures current levels of anxiety and depression related symptomatology (Zigmond & Snaith, 1983). It comprises of a depression and anxiety subscale, both with 7-items. On each item, the participants reported the frequency in which they have experienced a specific emotional or behavioural event in the past week (for example, "I feel tense or 'wound up'"). Each item is rated on a scale from 0, which indicates low or no symptom occurrence, to 3, which describes a frequently occurring symptoms. The independent subscale scores can be classified as normal (0-7), mild (8-10), moderate (11-14) and severe (15-21). The HADS excludes somatic symptoms, to avoid potential confounds associated with physical illness and acquired disabilities (Snaith & Zigmond, 1994). The HADS has been validated for screening purposes in hospital, primary care practice and community settings (Snaith, 2003). Bjelland, Dahl, Haug and Neckelmann (2002) demonstrated that both subscales of the HADS produce high Cronbach's alpha ($\alpha = .83$), and have good sensitivity and specificity. The HADS generally takes less than five minutes to complete.

2.2.4 Interpersonal Reactivity Index (IRI)

The IRI (Davis, 1980) is a multi-dimensional questionnaire that assesses empathy. It contains 28 items, with seven items per subscale. The IRI is multi-faceted and measures both cognitive and emotional components of empathy (Pulos, Elison & Lennon, 2004). On each item, participants rate their degree of fit on a 5-

point Likert scale (A= *does not describe me well*, to E= *describes me very well*). It comprises of four subscales; perspective taking, fantasy, empathetic concern, and personal distress. The fantasy subscale reflected how strongly participants identified with fictitious characters. The perspective-taking items measured the amount and perceived ability that participants' have to adopt the perspectives of others. The empathic concern questions assessed the degree of compassion and concern for others. The personal distress subscale asked questions relating to levels of anxiety and distress in stressful situations and emergencies.

Factor analysis has demonstrated that the IRI produces a general empathy factor, where the items on the fantasy, empathetic concern and perspective-taking subscales load onto one factor (Pulos et al., 2004). The personal distress subscale did not load onto the general empathy factor, which potentially indicates that it is a separate construct. As the personal distress subscale may not measure empathy, the other subscales were utilised, which together comprised the general empathy factor. The IRI has good intra-scale and test-retest reliability (Pulos et al., 2004). The Scale has shown to have high internal reliability for the subscales (Pulos et al., 2004) Fantasy (α = .82), Empathetic Concern (α = .80), Personal Distress (α = .75) and Perspective Taking (α = .79), and an overall Cronbach's alpha value of .70 to .78 (Konrath, 2013). Davis (1980) has indicates that the IRI has convergent validity with other empathy scales. The IRI takes approximately 10 minutes to complete.

2.2.5 The Awareness of Social Inference Test Shortened (TASIT-S)

The TASIT-S (Honan et al., 2016) assesses basic emotion perception and understanding of social situations objectively. It assesses an individual's ability to interpret displays of emotion, emotional demeanours and contextual cues. The

TASIT-S is employed to measure social cognition objectively, as it assesses an individual's ability to convey social meaning, sarcasm and non-literal meanings (Honan et al., 2016) in 30 to 60 second vignettes. The TASIT-S comprises of three subtests, the emotion evaluation test (EET; 10 items), social inferences minimal (SIM; nine items) and social inferences enriched (SIE; nine items). The EET presents a short series of audio-visual recordings of individuals enacting ambiguous scripts, which require the individual to interpret the actor's emotional display. The SIM subscale measures understanding of sincere and sarcastic exchanges, while the SIE assesses comprehension of lies and sarcasm. The SIM and SIE subscales both measure ToM ability. The videos are portrayed in naturalistic scenes with complex expressions, intonations and gestural cues. The participant is required to interpret the conversations and social interaction, and then answer questions about the actor's thoughts, feelings, intentions and behaviours. Each item has four "yes/no/don't know" questions to answer. The TASIT-S has high item reliability, WINSTEPS Rasch analysis has demonstrated that all items in the three subscales have reliability values of above .89 (Honan et al., 2016). The TASIT-S takes approximately 25-35 minutes to administer.

2.2.6 Social Emotional Questionnaire (SEQ)

The SEQ (Bramham et al., 2009) measures an individual's emotion perception, empathy and behaviour in social situations (Nelis et al., 2011). It has two forms; a self-report and informant-report. The participant and informant rate 30 items on a five point Likert scale (where *1= strongly disagree*, and *5= strongly agree*). A subscale total score was obtained from the SEQ with 24 items. The SEQ also contains six-filler items, which are not included in the subscales, or the analyses in

the current study. The SEQ includes nine reversed items, to account for directional biases (Nelis et al., 2011). The SEQ was developed for measuring social and emotional functioning in brain lesion populations. The SEQ is comprised of five subscales (emotion recognition, empathy, social conformity, antisocial behaviour, and sociability), a total of the subscale scores will be used in the analyses.

The questions on the two versions of the SEQ have the same content, however the informant version is phrased in third person and the participant version is in first person, for example, "He/she expresses her feeling appropriately in public," and "I express my feelings appropriately in public". Lower discrepancy scores between the two versions indicate better self-awareness than larger discrepancy scores. Positive scores indicate that the participant overestimates their social and emotional functioning, where their self-rating was higher than their informant rating. The SEQ has an acceptable Cronbach's alpha value (.69), good internal consistency as indicated by a factor analysis, and correlates with similar measures of personal and emotional functioning on the competency rating scale (Bramham et al., 2009). The SEQ takes approximately 10 minutes to administer.

2.2.7 The Sydney Psychosocial Reintegration Scale (SPRS)

The SPRS was specifically designed to measure how people re-integrate in terms of psychosocial functioning after an ABI. The SPRS (Tate et al., 1999) assesses functioning in daily life on three subscales, work and leisure (four items), interpersonal relationships (four items), and living skills (four items). This Scale asks participants and informants to answer 12 questions about functional capacity after they or their significant other sustained an ABI. Each question is answered on a 7-point Likert scale. The options range from 6 = *not at all*, to 0 = *extremely*. Each

option has a numerical value for scoring purposes. Average scores of 0-2 indicate major changes and poor outcomes, while scores of 3-4 indicate some change and limited outcomes, and scores of five and above mean that there are no significant life changes and the individual has good outcomes (Tate, 2011). On some questions, for both the participant and informant version, there is the option *unable to assess*. The SPRS has good psychometric properties among ABI populations. It has higher internal consistency and is more normally distributed in comparison to similar scales, such as the Community Integration Questionnaire (Kuipers, Kendall, Fleming & Tate, 2004). Completion of this Scale takes approximately 10 minutes.

2.3 Procedure

Prior to the commencement of testing, participants were given an information sheet and informed consent was obtained. Participants with an ABI also had the option of giving written consent for the researcher/s to access medical documentation in regards to their ABI (see Appendix A). All participants were informed that they could take breaks when required and were given the opportunity to ask questions about the study. For the ABI participants, all test instructions and questions were presented verbally, unless the participant chose to read for himself or herself. This was because some participants had reading difficulties or fatigued faster from reading. The TOPF, however, was an exception as it relies on the participant reading out aloud. The control group received verbal instructions for each task; however read each item for themselves.

All participants completed the tests in the same order. First, the demographic questionnaire was completed, followed by the TOPF, IRI, SEQ, SPRS and the TASIT-S. The three subtests of the TASIT-S were completed in consecutive order.

The TASIT-S was presented on a 10.1-inch tablet, with the videos on full screen. Participants could adjust the screen angle, location and volume, and had the option of pausing the clip while they answered the questions if they needed more time.

The testing took approximately 75 minutes per participant for the ABI participants, and around 50 minutes for control participants. Participants had the option to take breaks when required throughout the testing. Three ABI participants started and completed the tests on different occasions, due to difficulties in concentration and fatigue. An informant completed the relatives' version of the SPRS and the informant version SEQ for both the control and ABI participants. This took approximately 10 minutes. For ABI participants who did not have a close family member of friend, their TABIS case manager completed the informant report.

2.4 Design and Analyses

A cross sectional between subjects' design was employed to assess group differences, and the relationship between social cognition and functional outcomes for the ABI and control groups. Chi-squares and independent samples *t*-tests compared the demographic information of the ABI and control group (as reported in Table 1 in the participant section). Independent samples *t*-tests were utilised to examine differences between the ABI and control group on each social cognition measure. The predictive utility of the social cognition measures in determining functional outcomes was examined using eight hierarchical multiple regressions. The predictor variables were the IRI, TASIT-S and the participant and informant versions of the SEQ (see material section). The outcome variables were the total and subscales scores on the informant and participant rated SPRS.

Results

All analyses were performed on SPSS version 23, with the exception of the power analysis, which was conducted using G-power version 3.0.5. The alpha level was maintained at $\alpha = .05$, as each *t*-test compared a different social cognitive measure, the type I error rate did not increase. Cohen's *d* effect sizes were calculated and interpreted using the following criteria, .20 for a small effect, .50 a moderate effect and .80 as a large effect (Cohen, 1988). Correlations were interpreted as .1 for a small effect, .3 a medium effect and .5 as a large effect (Cohen, 1988). Field (2013) states that the coefficient of determination (R^2) can be interpreted as 0.2 for a small effect, .13 for a medium effect and .26 for a large effect.

3.1 Data Screening

The assumptions for the *t*-tests were examined. The data set was checked for outliers, which were classed as *z* scores greater than 3.29 (Tabachnick & Fidell, 2013). The SEQ total score for the participant version was negatively skewed (-3.47). As the data had a moderate negative skew, a square root transformation was applied (Tabachnick & Fidell, 2013), which resulted in a normal distribution (Skewness = 0.75). This transformation had no impact on the results, thus for ease of interpretation, the raw data was utilised in the analyses. The regression assumptions were all met. There was a linear relationship between each social cognitive measure and functional outcomes, with no multicollinearity present. No autocorrelations occurred, which was determined by the Durbin–Watson statistic (values ranged from 1.46 to 2.60). The data were normally distributed and checked for homoscedacity. No data transformations were required for the regression analyses. The data set

contained two missing cases, where two of the ABI participants did not complete the SIE subscale of the TASIT-S. The regression analyses were conducted using the option to exclude cases pairwise, so that the participant's data on all other measures was not excluded from the analyses.

3.2 Group Comparisons on Social Cognitive Measures

A series of independent samples *t*-tests were utilised to compare the control and ABI groups on each measure of social cognition (see Table 4). There were no significant differences between the control and ABI group on the subjective measures of social cognition, which were the general empathy factor (IRI) and participant version of the SEQ. The ABI group performed significantly worse than the control group on all objective measures of social cognition (EET, SIM, SIE) and on the informant version of the SEQ. There were significant differences between the groups on both participant and informant versions of the SPRS.

3.3 Discrepancy Scores Between Informant and Participant Responses

There were significant discrepancies between the ABI participants' self-rated social cognitive ability (measured on the SEQ) and functional status (measured on the SPRS), when compared to their informant's responses (see Table 5). In comparison, there were no significant discrepancy scores between the control participants and their informant's responses (see Appendix C for output).

Table 4

t-tests Comparing the ABI and Control Groups on Social Cognitive Measures

	ABI		Control				
	M	*SD*	*M*	*SD*	*t*(58)	*p*	Cohen's *d*
IRI Empathy Factor	45.77	11.55	48.37	8.58	.990	.326	0.26
SEQ Total Participant version	88.47	6.93	87.73	10.63	.317	.753	0.08
SEQ Total Informant version	81.13	10.92	89.77	8.24	-3.46	.001	0.89
Emotion Evaluation Test	4.67	2.04	7.07	1.08	5.70	<.001	1.47
Social Inferences Minimal	24.20	4.48	30.23	4.64	5.13	<.001	1.32
Social Inferences Enriched	24.04	3.88	28.77	3.21	5.07	<.001	1.33
SPRS Participant Version	46.37	11.52	69.23	5.24	9.90	<.001	2.13
SPRS Informant Version	31.33	11.26	69.77	4.78	17.21	<.001	4.44

Table 5

Paired Samples t-tests Comparing the Discrepancy Between Informant and ABI Participant Ratings.

		95% CI		
	t(29)	*LL*	*UL*	*p*
SEQ	3.58	3.14	11.52	.001
SPRS Total	5.65	9.59	20.48	<.001
SPRS Work	5.80	3.88	8.12	<.001
SPRS Relationships	3.85	1.95	6.38	.001
SPRS Living skills	4.98	2.87	6.86	<.001

Note. CI = Confidence Interval; *LL* = lower limit, *UL* = upper limit

3.4 Hierarchical Regressions for Predicting Functional Outcomes

Hierarchical multiple regressions were performed to examine whether the self, informant and objective measures of social cognition predicted functional outcomes after an ABI. Eight regressions were conducted utilising only the ABI group data. Each regression had the same hierarchical sequence, where the predictor variables were entered in the same order. In the first stage, the three subscales of the TASIT-S were entered into the regression model. The second stage had the addition of self-reported social cognitive measures, the SEQ (participant version) and the IRI general empathy factor. In model three, the informant SEQ scores were included. The regression analyses employed a different measurement from the SPRS. Individual regressions were performed for each of the three subscales (work, relationships and living) and the total, for both the participant and informant versions, resulting in eight regressions conducted. The regression models, which utilised the participant versions of the SPRS, are reported in Table 6, while the informant versions of the SPRS are reported in Table 7.

Table 6

Regression Models for Social Cognitive Measures Predicting Participant Rated Functional Outcomes

			Unstandardized Coefficients			
	R^2	ΔR^2	*B*	*SE*	*F*	*p*
Total						
Model 1	.112		53.06	18.36	1.01	.404
Model 2	.304	.146	68.72	30.21	1.92	.131
Model 3	.313	.116	62.84	32.85	1.59	.199
Work						
Model 1	.061		16.40	7.99	.52	.670
Model 2	.330	.178	39.50	12.55	2.17	.095
Model 3	.331	.140	40.47	13.71	1.73	.163
Relationships						
Model 1	.109		21.00	8.62	.98	.420
Model 2	.165	-.025	18.41	15.52	.87	.518
Model 3	.180	-.055	14.73	16.82	.77	.604
Living						
Model 1	.110		15.92	5.76	.99	.415
Model 2	.411	.277	11.09	8.72	3.07	.030
Model 3	.435	.273	7.97	9.34	2.70	.043

Note. Model 1= TASIT-S, Model 2= TASIT-S, IRI and SEQ Participant, Model 3= TASIT-S, IRI, SEQ Participant and SEQ Informant

Note. Predictor variables were the participant version of the SPRS total and subscales.

Table 7

Regression Models for Social Cognitive Measures Predicting Informant Rated Functional Outcomes

			Unstandardized Coefficients			
	R^2	ΔR^2	*B*	*SE*	*F*	*p*
Total						
Model 1	.174		22.51	17.31	1.69	.196
Model 2	.229	.054	5.30	31.08	1.31	.296
Model 3	.285	.080	-9.43	32.76	1.39	.263
Work						
Model 1	.171		3.58	5.01	1.65	.204
Model 2	.323	.169	-1.62	8.42	2.10	.104
Model 3	.324	.131	-2.20	9.20	1.68	.176
Relationships						
Model 1	.126		4.58	7.91	1.15	.350
Model 2	.178	-.009	-2.08	14.26	.95	.468
Model 3	.208	-.018	-6.95	15.31	.92	.499
Living						
Model 1	.138		14.18	7.86	1.29	.302
Model 2	.146	-.048	8.83	14.54	.75	.593
Model 3	.258	.046	-.49	14.83	1.22	.336

Note. Model 1= TASIT-S, Model 2= TASIT-S, IRI and SEQ Participant, Model 3= TASIT-S, IRI, SEQ Participant and SEQ Informant

Note. Predictor variables were the informant version of the SPRS total and subscales.

Out of the eight regression models conducted, one was significant. The outcome variable of the significant regression model was the living subscale of the SPRS (participant version). This model explains 44% of the variance in living skills, which can be predicted by measures of social cognition. Although the other regressions were non-significant, they still predicted medium to large amounts of the variance in functional outcomes by the third model. The participant rated SPRS scores demonstrated that the social cognitive measures predicted 33% of the variance in work related functional outcomes, 18% of relationship outcomes and 31% of overall functional outcomes. On the informant rated SPRS, social cognition predicted 32% of work related outcomes, 21% of relationship outcomes, 26% of living outcomes, and 29% of overall functional outcomes.

Discussion

4.1 Interpretation of findings

The present study aimed to compare individuals who had sustained an ABI, to healthy controls on measures of social cognition and functional outcomes. In addition, the current study aimed to determine whether social cognitive ability predicted functioning in daily life after an ABI. The first hypothesis, that the ABI participants will obtain poorer scores on the objective and informant-reported social cognition measures, when compared to healthy controls, was supported. A series of independent samples *t*-tests indicated that the ABI group performed significantly lower on the objective measures (EET, SIM, SIE) and informant reported (SEQ) social cognition measures, when compared to healthy controls. While the *t*-tests did not produce any significant differences between the ABI and control group's scores

on the self-reported social cognitive measures, the IRI general empathy factor and SEQ. The overall means of the ABI participant's ratings and their informants responses on the SEQ had a difference of seven points. This was a significant discrepancy, as the ABI participants reported their functioning as significantly higher than their informants. In addition, there were significant discrepancies between the informant and ABI participant ratings on all subscales of the SPRS. In comparison, there were no significant discrepancies between the control participants and their informant's ratings on the SEQ and SPRS.

The significant difference between the control and ABI participant's performance on the objective social cognition measures is consistent with previous measurement on the TASIT-S in this population (Honan et al., 2016). The results obtained on the SEQ are similar to research in brain lesion populations by Bramham et al. (2009). Bramham et al. found that the subscale total score for their controls were similar to the current study control group. Similarly, Bramham et al. also found that individuals who had sustained dorsolateral prefrontal cortex damage perceived their social and emotional functioning as slightly higher than controls, which occurred in the present study. In addition, Bramham et al. found that individuals with dorsolateral lesions perceived their social and emotional functioning as significantly higher than their informants' ratings, which is consistent with the present study. The results obtained on the IRI are consistent with Shamay-Tsoory et al. (2009), who found that those with inferior frontal gyrus lesions performed similar to controls on the subscales that comprise the general empathy factor.

The finding that ABI participants rated their social cognitive functioning as high, is common in ABI research. Hart et al. (2004) indicates that individuals who have sustained brain damage, tend to have unrealistic responses and overestimated

their level of functioning. A potential reason why the ABI participants self-rated social cognitive abilities did not significantly differ from healthy controls, may be due to an overestimation of ability. Overestimation may be attributed to impaired insight. This is supported by the literature, which indicates that insight is commonly impaired after brain injury (Prigatano, 1991). Furthermore, lack of insight potentially explains the significant discrepancy scores among the ABI and informant reports on the SEQ and all subscales of the SPRS. Similarly, Fleming et al. (1995) and Levin et al. (1987) state that diminished insight and self-awareness, which can occur after a brain injury, reduces the validity of self-report measures. Therefore, self-report data alone requires caution for interpretations.

Limited support was found for the second hypothesis, regarding the capacity of the social cognitive measures to predict functional outcomes. Among the eight regressions conducted, only one (the living skills subscale on the participant rated SPRS) was statistically significant. In that regression, when all predictor variables added into the model, the social cognitive measures predicted 44% of variance in living skills. This can be interpreted as a moderate to large amount of variance, according to interpretation criteria. As Field (2013) suggests a value above .26 is large, whereas Ferguson (2009) postulates that .25 is moderate. All other regressions were non-significant, however predicted moderate amounts of variance in functional outcomes. This indicates a trend whereby the social cognitive measures account for a reasonable amount of variance, especially on the work and living skills subscales of the SPRS. This trend provides some support to the hypothesis that social cognitive measures will predict variance in functional outcomes.

Given the substantial amount of variance accounted for in the regressions, it is likely that the lack of significant findings is reflective of sample size (n = 30).

Field (2013) states that there should be 10 to 15 participants per predictor variable. The present study employed six predictor variables in each regression model, thus a sample size of 60 to 90 ABI participants may have permitted the detection of more significant results. Despite seven models being non-significant, there were five regressions with large R^2 values, and three with medium R^2 values by the third stage of the model. This potentially indicates that a larger sample, could produce a significant model with a large R^2 value, however further research is required to test this assumption.

Thirdly, the hypothesis that the social cognitive measures would predict the most amount of variance on the relationship subscale of the SPRS, was not supported. Interestingly, the reverse occurred, where the social cognition measures predicted the least amount of variance on relationship subscale. This occurred on the participant and informant versions, where non-significant models with medium sized R^2 values were produced. Therefore, the social cognition measures were related to the ability to maintain and form relationships, however, to a lesser extent than living and work skills. Thus, an individual's ability to detect subtle social cues, and capacity for empathy and ToM, had the least amount of predictive utility for relationship outcomes after ABI. This is potentially due to other factors that determine maintenance and formation of relationships, for example, family education and support services. This finding is contradictory to research examining social cognition and social outcomes in other populations. In schizophrenic populations, studies indicate that there is a significant relationship where social perception, emotion perception and ToM ability is associated with social outcomes (Couture et al., 2006; Harvey & Penn, 2010; Kalin et al. 2015).

A potential reason why social cognitive ability did not predict relationship outcomes in the ABI sample may have been due to a recruitment bias in the present study. The ABI participants were recruited through TABIS and all had contact with a case manager. The case manager's work with the individual who sustained the ABI and their family. The case managers educate and prepare the individual and their families for the lifestyle, behavioural, emotional and physical changes associated with brain injury. This potentially facilitated relationship outcomes among the study's sample, as the families had more realistic expectations and access to support services (Ergh, Rapport, Coleman & Hanks, 2002).

The results of the current study indicate that: (1) social cognition is impaired after an ABI; (2) social cognition measures significantly predict living skill after brain injury; and (3) the social cognition measures account for moderate to large amount of variance in functional outcomes, which most likely would have been significant with a larger sample.

4.2 Clinical Implications

Knowledge of an individual's social cognitive ability allows for psychoeducation and remediation (Rosenberg, McDonald, Dethier, Kessels & Westbrook, 2014). Those identified with impairments may improve if they receive verbal instruction and model appropriate social behaviour of their significant others and carers (Rosenberg et al., 2014). In addition, this has potential to facilitate significant others' understanding, and potentially influence pro-social behaviour in those who sustain an ABI.

The finding that social cognitive ability predicts a moderate to large amount of variance in functional outcomes has potential clinical implications. Measures of

social cognition have potential to be used in assessments of preparedness for admission into the community, and incorporated as part of progress monitoring and living needs assessments. Including social cognitive measures, may facilitate a more comprehensive approach to assessments in ABI populations. Furthermore, as the social cognition measures accounted for the most variance on the living subscale, social cognitive impairments have potential to predict difficulties associated with community access, social skills, accommodation and changes to personal habits (cleanliness, dressing and tidiness) after an ABI. In addition, administering such measures may be useful for giving estimations of functional capacity, skills and behaviour in an occupational setting. This has potential to facilitate the return to work process and enhancement of person-job fit compatibility (Tak, 2011).

4.3 Strengths and Limitations

The present study has numerous strengths. Firstly, to date, there is limited research that examines the predictive relationship of social cognition in determining functional outcomes in ABI populations (Ubukata et al. 2014). Furthermore, Ubukata et al. (2014), currently the only study to examine this phenomenon, did not find any significant results. The present study found that social cognition predicted living skills after an ABI, and indicated a trend, where the other models may have been significant with a larger sample. Secondly, although the sample size in the current study was small for some statistical techniques, such as regression, the sample was large for a clinical population, which is another strength of the present study. The current study employed a larger sample size (n = 30), in comparison to Ubukata et al. (n = 22). This sample size was large enough to permit the detection of significant

differences between the ABI and control participants on the objective and informant social cognition measures, and measures of functional outcomes.

Thirdly, a strength of the current study includes how some of the limitations of Ubukata et al. (2014) have been addressed. The present study employed an age and sex matched control group, so comparisons on the social cognitive measures and functional outcomes could be made. Ubukata et al. did not utilise a control group and consequently could not determine whether their participants had impaired performance. The use of a control group is recommended in the literature (Temkin et al., 2009), this allowed comparisons of the ABI participant's scores to the control group, and to previous studies that employed these measures in TBI, ABI and healthy samples.

Thirdly, the current study utilised objective, self-report and informant report measures of social cognition, in addition to participant and observer ratings of functional outcomes. Utilising an objective measurement of social cognition, improves the present study, as subjective and informant report measures have been criticised for biases and inaccuracies (Ganellen, 2007; Honan et al., 2016). Employing both informant and participant ratings of functional outcomes is an advantage, rather than participant ratings alone. Leathem et al. (1998) found that among TBI populations, an individual's perception of their functional outcomes produced a larger discrepancy with their actual functioning, as injury severity increased. Furthermore, this same association has been found in perceptions of social and emotional abilities (Leathem et al., 1998). Consistent with this, the present study comprised of mainly individuals with a severe brain injury and found significant discrepancy scores on all measures. Furthermore, the measures employed by the

current study have all been validated in ABI populations (Bramham et al., 2009; Honan et al., 2016; Pulos et al., 2004), unlike Ubukata et al..

Fourthly, an advantage of the present study is that the ABI sample comprised mainly of individuals with a severe ABI (80%). Tate et al. (2005) found that PTA duration accounted for a significant proportion of variance in psychosocial outcomes. As the present study's sample mainly consisted of individuals with a severe ABI, it was likely to have variation in functional outcomes, in comparison to a study on mild ABI. A larger range of functional outcomes allows for predictions that are more accurate. This wider scope offers a more comprehensive understanding and better prediction of the variation in functional outcomes after an ABI.

There are a number of limitations in the present study that should be considered when interpreting the results. Firstly, for the ABI condition, there were few exclusion criteria, with the criteria as: speech, visual and hearing deficits, and English as their primary language. This resulted in variability in the sample, including medication use and coherence, comorbid physical, neurological and psychological conditions, treatment received, and injury specificities. Injury characteristics varied greatly regarding aetiology, type of damage, effected neuroanatomical structures, severity, focal and/or diffused injury and time since injury. Such factors have potential to influence their social cognitive ability (McDonald, 2013). This limitation, however, is common in clinical populations. Temkin et al. (2009) highlights that TBI research generally comprises of non-representative and highly varied samples. This limitation prevents some research conclusions and inferences, where observed effects may be inconsistent due to individual differences (Temkin et al., 2009). Furthermore, in the ABI sample, mental illnesses, such as, anxiety and depression were prevalent (see Table 3).

The impact that this may have had on the current study is unknown. Despite the occurrence of mental illness in the ABI sample and no prevalence of mental illness in the controls, there were no significant differences between current levels of anxiety and depression measured by the HADS. However, the impact that this may have had on the ABI sample cannot be disregarded, as social cognition deficits have also been reported in populations with mental illnesses. For example, depression is associated with impaired emotion perception (Langenecker et al., 2005) and empathy (Cusi, MacQueen, Spreng, & McKinnon, 2011). To account for the social cognitive deficits associated with mood disorder, other studies have attempted to match the groups for anxiety and depression; however, these studies still demonstrate more impairment among those with brain injury (Ietswaart et al., 2008; Milders et al., 2008).

Secondly, due to the lack of exclusion criteria, some individuals had sustained paediatric brain injuries, or had obtained their injury decades earlier. This made some comparisons and questionnaires difficult for the participants and their informants. This mainly occurred on the SPRS, as each question compared their life before and after their ABI. Thirdly, a limitation of the current study is the sample size of the ABI group. Although the sample was large in comparison to other studies, as regression analyses require larger samples, this most likely result in only one significant model (Field, 2013). Whereas, a larger sample may have produced multiple regression models that significantly predicted functional outcomes.

Fourthly, a potential weakness of the current study includes the SPRS. Kuipers, Kendall, Fleming and Tate (2004) performed multi-dimensional scaling on the SPRS and Community Integration Questionnaire. The multi-dimensional scaling indicated that the scale should contain two dimensions, productivity/personal life and

independent/dependent (Kuipers et al., 2004), as opposed to three subscales. On the productivity/personal life domain, items related to work outcomes were at the positive end, while questions about family and personal life were at the negative end. On the independent/dependent dimension, the positive end included items relating to transport and accommodation, while spouse and family relationships clustered near the negative end of the pole. Despite the evidence of the multidimensional scaling, the scale has theoretical foundations and all other psychometric properties are sound. Therefore, if the current study ran regression with the two dimensions, different results may have been produced. However, the current study also used a total score of the SPRS, which would not have changed.

Lastly, a limitation of the present study includes the ABI participants' capacity to understand the wording of the questions and effort exerted on tasks. During test administration of the TASIT-S, some participants commented on the vignettes, which showed they understood sarcastic exchanges and what was occurring in the video. However, when asked the questions at the end of the video, they answered incorrectly. Potential reasons why participants answered incorrectly includes their effort and understanding of the question. The TASIT-S was administered last and it is possible that the ABI participants began to fatigue, potentially resulting in less effort (LaChapelle & Finlayson, 1998). Furthermore, poor performance on the TASIT-S could be due to deficits in working memory and information processing, where they cannot retain the information long enough to answer the questions (McDonald, 2012).

4.4 Future Research

Future research should investigate whether there is an underlying factor that moderates the relationship between social cognition and relationship outcomes. As previously stated, the current study recruited through a community organisation that provided support services to individuals and their families after an ABI. Future research should focus on whether social cognition predicts relationship outcomes in individuals with an ABI, who have had no contact with such services. As it is plausible that family and carer education, and access to community support services potentially moderate the relationship between social cognition and relationship outcomes. Furthermore, if this is the case, the use of such measures may be implemented to identify those more at risk of relationship difficulties, and target intervention to prevent poorer outcomes.

4.5 Conclusions

Consistent with the results of previous research, the present study found that severe ABI was associated with social cognitive impairments. The current study replicated the work of Ubukata et al. (2014) by examining the predictive utility of social cognition in determining variance in functional sequelae after brain injury. The present study found one significant regression model, where social cognition predicted functional outcomes on the living skills subscale of the SPRS. While the other regression models were non-significant, they indicated a trend whereby a large amount of variance was accounted for by the social cognition measures. This is an important finding as ABI is associated with poorer psychosocial outcomes, and if this

variance is associated with social cognitive ability, strategies to improve social cognition may also improve functional outcomes.

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Appendices

Appendix A

Ethics Approval

Social Science Ethics Officer
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Katherine.Shaw@utas.edu.au

HUMAN RESEARCH ETHICS COMMITTEE (TASMANIA) NETWORK

2 May 2016

Ms Christine Padgett
Division of Psychology
University of Tasmania

Student Researcher: Madelaine Lodge

Sent via email

Dear Ms Padgett

Re: FULL ETHICS APPLICATION APPROVAL
Ethics Ref: **H0015660 - Social Cognition as a Predictor of Functional Outcomes After Acquired Brain Injury**

We are pleased to advise that the Tasmania Social Sciences Human Research Ethics Committee approved the above project on 29 April 2016.

This approval constitutes ethical clearance by the Tasmania Social Sciences Human Research Ethics Committee. The decision and authority to commence the associated research may be dependent on factors beyond the remit of the ethics review process. For example, your research may need ethics clearance from other organisations or review by your research governance coordinator or Head of Department. It is your responsibility to find out if the approval of other bodies or authorities is required. It is recommended that the proposed research should not commence until you have satisfied these requirements.

Please note that this approval is for four years and is conditional upon receipt of an annual Progress Report. Ethics approval for this project will lapse if a Progress Report is not submitted.

The following conditions apply to this approval. Failure to abide by these conditions may result in suspension or discontinuation of approval.

1. It is the responsibility of the Chief Investigator to ensure that all investigators are aware of the terms of approval, to ensure the project is conducted as approved by the Ethics Committee, and to notify the Committee if any investigators are added to, or cease involvement with, the project.

2. Complaints: If any complaints are received or ethical issues arise during the course of the project, investigators should advise the Executive Officer of the Ethics Committee on 03 6226 7479 or human.ethics@utas.edu.au.

3. Incidents or adverse effects: Investigators should notify the Ethics Committee immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.

4. Amendments to Project: Modifications to the project must not proceed until approval is obtained from the Ethics Committee. Please submit an Amendment Form (available on our website) to notify the Ethics Committee of the proposed modifications.

5. Annual Report: Continued approval for this project is dependent on the submission of a Progress Report by the anniversary date of your approval. You will be sent a courtesy reminder closer to this date. **Failure to submit a Progress Report will mean that ethics approval for this project will lapse.**

6. Final Report: A Final Report and a copy of any published material arising from the project, either in full or abstract, must be provided at the end of the project.

Yours sincerely

Katherine Shaw
Executive Officer
Tasmania Social Sciences HREC

Appendix B

ABI Participant Documentation

University of Tasmania

Participant Information Sheet (ABI Version V1) 27/4/2016

UNIVERSITY of TASMANIA

Social Functioning and Acquired Brain Injury

Information sheet for participants

1. Invitation

We would like to invite you to participate in a study examining social functioning and acquired brain injury. The study is a partial fulfillment of an honours degree for Madelaine Lodge under the supervision of Christine Padgett, from the School of Psychology at the University of Tasmania.

2. What is the purpose of this study?

The aim of this study is to investigate how well someone with a brain injury can understand the way other people think and feel. We would like to see how important this is for the person to be able to go back to doing the same things as they did before the injury.

3. Why have you been invited to participate?

For this experiment, we are looking for people aged over 18 years old with an acquired brain injury. You have been invited to participate because you are involved with the Tasmanian Acquired Brain Injury Services (TABIS).

4. What will you be asked to do?

You will be asked some questions about your injury, and you will also be given a short word-reading test. We will also ask you to complete some questionnaires about how well you understand what other people might be feeling or thinking. You'll also be asked some questions to see what (if any) changes have occurred in your daily activities since you had your brain injury. This should take around forty-five minutes to complete.

5. Are there any possible benefits from participation in this study?

The study does not provide you with any direct benefits. The results of this study may benefit the wider community with a better understanding of everyday functioning after a brain injury.

6. Are there any possible risks from participation in this study?

If you choose to participate, we will ask you questions about your brain injury. We do not expect this to be upsetting, but if this causes you any distress, you are free to withdraw at any time. There are no other risks associated with this study.

Although we do not expect this study to be upsetting, if you do feel upset after this study you may wish to talk to a counseling service, Beyond Blue can be contacted on 1300 22 4636, and Lifeline on 13 11 14.

7. What if you change your mind during or after the study?

You are free to withdraw from this study at any time. You do not need to provide an explanation, and there are no consequences if you choose to withdraw. If at any stage you feel uncomfortable, you may withdraw from the study, there are no consequences if you choose to withdraw. If you feel fatigued while participating, you may take a break at any time.

If you choose to withdraw from the study and do not want your results to be used, it will be removed. You may also choose to withdraw (without finishing) and let your results be used.

8. What will happen to the information when this study is over?

The study's results will be kept for seven years by the University of Tasmania in password protected computer files, and the paper copies will be kept in a locked cabinet in the office of Christine Padgett. Only Christine Padgett (chief investigator) and Madelaine Lodge (student investigator) will have access to your information. After the seven (7) years, all information will be destroyed.

The information collected in this study may be used in future research if you give permission to do so. This option is on the consent form.

The data will be stored anonymously. All responses will be anonymous and no identifying information will be published.

9. How will the results of the study be published?

Once the study is complete, the thesis will be printed and kept with other psychology honours theses at the University of Tasmania. The results of this study may potentially be published in an academic journal. Results of the study after November 2016 can be accessed on the University of Tasmania's website:

http://www.utas.edu.au/psychology/research/research-project-reports

No individual participants will be identifiable in the publication of the results.

10. What if you have questions about this study?

If you have any questions regarding the study, please feel free to contact Christine Padgett on Christine.Padgett@utas.edu.au or phone (03) 6430 4946.

This study has been approved by the Tasmanian Social Sciences Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study, please contact the Executive Officer of the HREC (Tasmania) Network on +61 3 6226 6254 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number H15660.

This information sheet is for you to keep. If you would like to participate in this study, please ask the researcher for a Consent Form to complete.

Thank you for your attention - your time is appreciated.

Social Functioning and Acquired Brain Injury

For participants and guardians (if applicable)

1. I agree to take part in the research study named above.
2. I have read and understood the Information Sheet for this study.
3. The nature and possible effects of the study have been explained to me.
4. I understand that the study involves a variety of questionnaires and scales, where I have to think about my day to day functioning and social interaction. I understand that these tasks will take around forty-five minutes to complete.
5. I understand that a family member or someone who I know well will also be asked to complete some questionnaires relating to my day to day functioning and social interaction.
6. I understand that my participation in this study involves discussing detail about my acquired brain injury. If this causes me any distress I am able to contact a free counselling service if I wish to use them. I also understand that there are no other foreseeable risks associated with my participation.
7. I understand that all research data will be securely stored by the University of Tasmania for seven years after the publication of the study's results. All data will then be destroyed
8. Any questions that I have asked have been answered to my satisfaction.
9. I understand that the researcher(s) will maintain confidentiality and that any information I supply to the researcher(s) will be used only for the purposes of the research.
10. I understand that the results of the study will be published in a manner where I cannot be identified as a participant.
11. I understand that my participation is voluntary and that I may withdraw at any time without any consequences, and I may request that any data I have supplied be withdrawn from the research until September 2016.

Please tick the appropriate box for each question below. Please note that you do not need to agree to either of the below in order to participate in this study:

1. I give permission for my test results to be used in future research.

   Yes ☐ No ☐

2. I give permission to be contacted for opportunities to participate in future research.

   Yes ☐ No ☐

University of Tasmania

Participant Consent Form (ABI Version), 31/3/2016

Participant's name: _____

Participant's signature: _____

Date: _____

Guardian Consent (if applicable)

Guardian's name: _____

Relationship: _____

Guardian's signature: _____

Date: _____

Statement by Investigator

☐ I have explained the project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation.

If the Investigator has not had an opportunity to talk to participants prior to them participating, the following must be ticked.

☐ The participant has received the Information Sheet where my details have been provided so participants have had the opportunity to contact me prior to consenting to participate in this project.

Investigator's name: _____

Investigator's signature: _____

Date: _____

School of Medicine (Psychology)
Locked Bag 1342
Launceston Tas 7250
University of Tasmania

Release Form

Social Functioning and Acquired Brain Injury Study

PERMISSION TO RELEASE MEDICAL RECORDS FORM

Please read the following statement and if you are satisfied that you both agree with and understand it, enter your details in the spaces provided.

I, _____ (Name)

of _____ (Address)

and _____ (Phone number)

hereby agree to have the following details from my general practitioner _____ (name) of _____ (Dr. surgery/ health hub) and relevant hospital records, made available to Christine Padgett, School of Medicine (Psychology), University of Tasmania.

Participant

Name: _____

Signature: _____

Date: _____

Guardian (if applicable)

Name: _____

Relationship: _____

Signature: _____

Date: _____

University of Tasmania
Version 1-R, 27/4/2016

UNIVERSITY *of* TASMANIA

Demographic Questionnaire

Participant ID: _____ Date tested: ___/___/_____

Year of Birth: _____ Sex: Male / Female

Highest level of education completed: _____

Do you have a legal guardian: Yes / No

Date of accident: ___/___/_____

Cause of accident: _____

Any loss of consciousness, if yes, for how long: _____

Any post traumatic amnesia, if yes, for how long: _____

Any past or present medical conditions: _____

Any past or present mental illness: _____

Any diagnosed neurological conditions: _____

Did you have any treatment or rehabilitation from your injury, if yes what type?

_____

How long did you access this treatment? _____

What medications are you currently prescribed or taking?

Medication	Dose	Reason

PTO for estimation of PTA…

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Version 1-R, 27/4/2016

If specific injury:

What is the first event you can remember *after* the injury?_____

Can you describe in detail (how long was this after injury, time, companions)

_____

_____

_____

What is the first event you can remember ***before*** the injury?_____

Can you describe in detail (how long was this after injury, time, companions)

_____

_____

_____

Control Participant Documentation

University of Tasmania

Participant Information Sheet (Control Version) 31/3/2016

UNIVERSITY of TASMANIA

Social Cognition and Acquired Brain Injury

Information sheet for participants

Invitation

We would like to invite you to participate in a study examining social functioning and acquired brain injury. The study is a partial fulfillment of an honours degree for Madelaine Lodge under the supervision of Christine Padgett, from the School of Psychology at the University of Tasmania.

What is the purpose of this study?

The experiment is examining social functioning in individuals with acquired brain injuries. These results will be compared to a sample of participants without an acquired brain injury to determine the social implications associated with acquired brain injuries. For example, it will address functioning in daily life, such as social interaction patterns and changes in activities due to their injury.

Why have you been invited to participate?

For this experiment, we are looking for people aged over 18 years old without history of an acquired brain injury, so we can compare test results of participants with acquired brain injuries to a healthy population.

We are looking for participants without a diagnosed psychiatric condition, such as schizophrenia and bipolar disorder.

What will you be asked to do?

We will also ask you to complete some questionnaires about how well you understand what other people might be feeling or thinking, and you will also be given a short word-reading test. These will help us compare differences on these measures between people who have not had a brain injury and those who have experienced a brain injury.

The activities should take around forty-five minutes to complete.

Are there any possible benefits from participation in this study?

The study does not provide any benefits directly to you, however the results will contribute knowledge to the area of social functioning and acquired brain injury, which may provide better understanding on the daily lives of those living with an acquired brain injury.

Are there any possible risks from participation in this study?

There are no identifiable risks in this study.

What if you change your mind during or after the study?

You are free to withdraw from this study at any time. You do not need to provide an explanation, and there are no consequences if you choose to withdraw. If at any stage you feel uncomfortable, you may withdraw from the study, there are no consequences if you choose to withdraw. If you feel fatigued while participating, you may take a break at any time.

If you choose to withdraw from the study and do not want your results to be used, it will be removed. You may also choose to withdraw (without finishing) and let your results be used.

What will happen to the information when this study is over?

The study's results will be kept for seven years by the University of Tasmania in password protected computer files, and the paper copies will be kept in a locked cabinet in the office of Christine Padgett. Only Christine Padgett (chief investigator) and Madelaine Lodge (student investigator) will have access to your information. After the seven (7) years, all information will be destroyed.

The information collected in this study may be used in future research if you give permission to do so. This option is on the consent form.

The data will be stored anonymously. All responses will be anonymous and no identifying information will be published.

How will the results of the study be published?

Once the study is complete, the thesis will be printed and kept with other psychology honours theses at the University of Tasmania. The results of this study may potentially be published in an academic journal. Results of the study after November 2016 can be accessed on the University of Tasmania's website:

http://www.utas.edu.au/psychology/research/research-project-reports

No individual participants will be identifiable in the publication of the results.

What if you have questions about this study?

If you have any questions regarding the study, please feel free to contact Christine Padgett on Christine.Padgett@utas.edu.au or phone (03) 6430 4946

This study has been approved by the Tasmanian Social Sciences Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study, please contact the Executive Officer of the HREC (Tasmania) Network on +61 3 6226 6254 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number

This information sheet is for you to keep. If you would like to participate in this study, please ask the researcher for a Consent Form to complete.

Thank you for your attention - your time is appreciated.

UNIVERSITY of TASMANIA

Social Functioning and Acquired Brain Injury

For participants

1. I agree to take part in the research study named above.
2. I have read and understood the Information Sheet for this study.
3. The nature and possible effects of the study have been explained to me.
4. I understand that the study involves a variety of questionnaires and scales, where I have to think about my day to day functioning and social interaction. I understand that these tasks will take around forty-five minutes to complete.
5. I understand that a family member or someone who I know well will also be asked to complete some questionnaires relating to my day to day functioning and social interaction.
6. I understand that there are no foreseeable risks associated with my participation.
7. I understand that all research data will be securely stored by the University of Tasmania for seven years after the publication of the study's results. All data will then be destroyed after the seven years.
8. Any questions that I have asked have been answered to my satisfaction.
9. I understand that the researcher(s) will maintain confidentiality and that any information I supply to the researcher(s) will be used only for the purposes of the research.
10. I understand that the results of the study will be published in a manner where I cannot be identified as a participant.
11. I understand that my participation is voluntary and that I may withdraw at any time without any consequences, and I may request that any data I have supplied be withdrawn from the research until September 2016.

Please tick the appropriate box for each question below. Please note that you do not need to agree to either of the below in order to participate in this study:

1. I give permission for my test results to be used in future research.

   Yes ☐ No ☐

2. I give permission to be contacted for opportunities to participate in future research.

   Yes ☐ No ☐

   If yes, I understand that my contact details will be kept on a confidential password protected file.

University of Tasmania

Participant Consent Form, (control version), 31/3/2016

Participant's name: _____

Participant's signature: _____

Date: _____

Statement by Investigator

☐ I have explained the project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation.

If the Investigator has not had an opportunity to talk to participants prior to them participating, the following must be ticked.

☐ The participant has received the Information Sheet where my details have been provided so participants have had the opportunity to contact me prior to consenting to participate in this project.

Investigator's name: _____

Investigator's signature: _____

Date: _____

University of Tasmania
Version 1-R, 27/4/2016

UNIVERSITY of TASMANIA

Demographic Questionnaire - Control

Participant ID: _____ Date tested: ___/___/_____

Year of birth_____ Sex: Male / Female

Highest level of education completed: _____

Any loss of consciousness, if yes, for how long: _____

Any physical or mental illness that could impact testing: Yes / No

Appendix C

SPSS Analysis Outputs

Chi-squares for males and females in both conditions

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
CONDITION * SEX	60	100.0%	0	0.0%	60	100.0%

CONDITION * SEX Crosstabulation

			SEX		Total
			Male	Female	
CONDITION	ABI	Count	18	12	30
		% within SEX	48.6%	52.2%	50.0%
	CON	Count	19	11	30
		% within SEX	51.4%	47.8%	50.0%
Total		Count	37	23	60
		% within SEX	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.071[a]	1	.791		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.071	1	.791		
Fisher's Exact Test				1.000	.500
N of Valid Cases	60				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.50.

b. Computed only for a 2x2 table

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	-.034	.791
	Cramer's V	.034	.791
N of Valid Cases		60	

Chi-squares for comparing education level

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
CONDITION * EDU	60	100.0%	0	0.0%	60	100.0%

CONDITION * EDU Crosstabulation

			EDU				
			<yr10	yr10-12	tafe	uni	Total
CONDITION	ABI	Count	4	13	6	7	30
		% within CONDITION	13.3%	43.3%	20.0%	23.3%	100.0%
	CON	Count	2	12	12	4	30
		% within CONDITION	6.7%	40.0%	40.0%	13.3%	100.0%
Total		Count	6	25	18	11	60
		% within CONDITION	10.0%	41.7%	30.0%	18.3%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.525[a]	3	.318
Likelihood Ratio	3.587	3	.310
N of Valid Cases	60		

a. 2 cells (25.0%) have expected count less than 5. The minimum expected count is 3.00.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.242	.318
	Cramer's V	.242	.318
N of Valid Cases		60	

Independent samples *t*-tests comparing age

Group Statistics

	CONDITION	N	Mean	Std. Deviation	Std. Error Mean
AGE	ABI	30	47.00	14.278	2.607
	CON	30	46.10	12.061	2.202

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
AGE	Equal variances assumed	1.564	.216	.264	58	.793	.900	3.412	-5.931	7.731
	Equal variances not assumed			.264	56.424	.793	.900	3.412	-5.935	7.735

Independent samples *t*-tests comparing premorbid IQ

Group Statistics

	CONDITION	N	Mean	Std. Deviation	Std. Error Mean
TOPF	ABI	30	92.5333	16.51694	3.01557
	CON	30	104.1333	12.48650	2.27971

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
TOPF	Equal variances assumed	5.310	.025	-3.069	58	.003	-11.60000	3.78031	-19.16711	-4.03289
	Equal variances not assumed			-3.069	53.986	.003	-11.60000	3.78031	-19.17910	-4.02090

Independent samples *t*-tests comparing anxiety

T-Test

[DataSet1] F:\Thesis\Data\SPSS Output\BIG DATA FILE.sav

Group Statistics

	CONDITION	N	Mean	Std. Deviation	Std. Error Mean
HADS_A	ABI	30	6.9000	4.81628	.87933
	CON	30	7.4000	4.35969	.79597

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
HADS_A	Equal variances assumed	1.327	.254	-.422	58	.675	-.50000	1.18608	-2.87419	1.87419
	Equal variances not assumed			-.422	57.434	.675	-.50000	1.18608	-2.87469	1.87469

Independent samples *t*-tests comparing depression

Group Statistics

	CONDITION	N	Mean	Std. Deviation	Std. Error Mean
HADS_D	ABI	30	4.7667	3.73874	.68260
	CON	30	3.6667	3.11097	.56798

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
HADS_D	Equal variances assumed	1.947	.168	1.239	58	.220	1.10000	.88800	-.67753	2.87753
	Equal variances not assumed			1.239	56.145	.221	1.10000	.88800	-.67878	2.87878

Injury Severity

Crosstab

			Severity				Total
			NO_ABI	Mild	Moderate	Severe	
CONDITION	ABI	Count	0	2	4	24	30
		% within CONDITION	0.0%	6.7%	13.3%	80.0%	100.0%
	CON	Count	30	0	0	0	30
		% within CONDITION	100.0%	0.0%	0.0%	0.0%	100.0%
Total		Count	30	2	4	24	60
		% within CONDITION	50.0%	3.3%	6.7%	40.0%	100.0%

Aetiology of ABI

Crosstab

			Injury_type							
			No_ABI	Motor_Accident	Assault	Tumour	Stroke_Aneurysm	Other	Multiple_ABIs	Total
CONDITION	ABI	Count	0	12	2	3	7	4	2	30
		% within CONDITION	0.0%	40.0%	6.7%	10.0%	23.3%	13.3%	6.7%	100.0%
	CON	Count	30	0	0	0	0	0	0	30
		% within CONDITION	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Total		Count	30	12	2	3	7	4	2	60
		% within CONDITION	50.0%	20.0%	3.3%	5.0%	11.7%	6.7%	3.3%	100.0%

Means and standard deviations for all tests

Group Statistics

	CONDITION	N	Mean	Std. Deviation	Std. Error Mean
SEQ_PAR	ABI	30	88.4667	6.92688	1.26467
	CON	30	87.7333	10.63155	1.94105
SEQ_INF	ABI	30	81.1333	10.91577	1.99294
	CON	30	89.7667	8.23652	1.50378
IRI_EMPATHY	ABI	30	45.7667	11.55402	2.10947
	CON	30	48.3667	8.57616	1.56579
EET_TASIT	ABI	30	4.6667	2.03983	.37242
	CON	30	7.0667	1.08066	.19730
SIM_TASIT	ABI	30	24.2000	4.47522	.81706
	CON	30	30.2333	4.63631	.84647
SIE_TAIST	ABI	28	24.0357	3.88236	.73370
	CON	30	28.7667	3.21294	.58660
PAR_SPRS	ABI	30	46.3667	11.51755	2.10281
	CON	30	69.2333	5.23703	.95615
INF_SPRS	ABI	30	31.3333	11.25973	2.05574
	CON	30	69.7667	4.78275	.87321
WORK_PAR	ABI	30	12.6333	4.87416	.88990
	CON	0[a]	.	.	.
REL_PAR	ABI	30	14.5667	5.39913	.98574
	CON	0[a]	.	.	.
LIVING_PAR	ABI	30	19.1667	3.61113	.65930
	CON	0[a]	.	.	.
WORK_INF	ABI	30	6.6333	3.25347	.59400
	CON	0[a]	.	.	.
REL_INF	ABI	30	10.4000	5.00069	.91300
	CON	0[a]	.	.	.
LIV_INF	ABI	30	14.3000	5.00448	.91369
	CON	0[a]	.	.	.

a. t cannot be computed because at least one of the groups is empty.

Independent samples *t*-tests

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SEQ_PAR	Equal variances assumed	4.052	.049	.317	58	.753	.73333	2.31669	-3.90402	5.37069
	Equal variances not assumed			.317	49.862	.753	.73333	2.31669	-3.92019	5.38686
SEQ_INF	Equal variances assumed	2.279	.137	-3.458	58	.001	-8.63333	2.49663	-13.63087	-3.63579
	Equal variances not assumed			-3.458	53.938	.001	-8.63333	2.49663	-13.63890	-3.62777
IRI_EMPATHY	Equal variances assumed	1.628	.207	-.990	58	.326	-2.60000	2.62708	-7.85867	2.65867
	Equal variances not assumed			-.990	53.514	.327	-2.60000	2.62708	-7.86807	2.66807
EET_TASIT	Equal variances assumed	10.326	.002	-5.695	58	.000	-2.40000	.42146	-3.24363	-1.55637
	Equal variances not assumed			-5.695	44.090	.000	-2.40000	.42146	-3.24934	-1.55066
SIM_TASIT	Equal variances assumed	.003	.957	-5.128	58	.000	-6.03333	1.17648	-8.38831	-3.67836
	Equal variances not assumed			-5.128	57.928	.000	-6.03333	1.17648	-8.38837	-3.67829
SIE_TAIST	Equal variances assumed	1.618	.209	-5.069	56	.000	-4.73095	.93322	-6.60042	-2.86149
	Equal variances not assumed			-5.036	52.556	.000	-4.73095	.93937	-6.61546	-2.84645
PAR_SPRS	Equal variances assumed	21.431	.000	-9.899	58	.000	-22.86667	2.30998	-27.49060	-18.24274
	Equal variances not assumed			-9.899	40.500	.000	-22.86667	2.30998	-27.53352	-18.19981
INF_SPRS	Equal variances assumed	19.357	.000	-17.208	58	.000	-38.43333	2.23350	-42.90418	-33.96249
	Equal variances not assumed			-17.208	39.135	.000	-38.43333	2.23350	-42.95053	-33.91614

Paired samples *t*-tests

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PAR_SPRS - INF_SPRS	15.03333	14.58503	2.66285	9.58720	20.47947	5.646	29	.000
Pair 2	WORK_PAR - WORK_INF	6.00000	5.66903	1.03502	3.88315	8.11685	5.797	29	.000
Pair 3	REL_PAR - REL_INF	4.16667	5.92530	1.08181	1.95412	6.37921	3.852	29	.001
Pair 4	LIVING_PAR - LIV_INF	4.86667	5.34811	.97643	2.86965	6.86368	4.984	29	.000

a. CONDITION = ABI

Regression output for participant total on the SPRS

Model Summary[d]

CONDITION	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
						R Square Change	F Change	df1	df2	Sig. F Change	
ABI	1	.335[a]	.112	.002	11.50869	.112	1.014	3	24	.404	
	2	.552[b]	.304	.146	10.64251	.192	3.033	2	22	.069	
	3	.559[c]	.313	.116	10.82675	.008	.258	1	21	.617	1.723
CON	1	.280[e]	.078	-.028	5.31007	.078	.736	3	26	.540	
	2	.296[f]	.088	-.102	5.49871	.009	.123	2	24	.885	
	3	.327[g]	.107	-.126	5.55743	.019	.495	1	23	.489	2.010

a. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT

b. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY

c. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

d. Dependent Variable: PAR_SPRS

e. Predictors: (Constant), SIE_TAIST, EET_TASIT, SIM_TASIT

f. Predictors: (Constant), SIE_TAIST, EET_TASIT, SIM_TASIT, SEQ_PAR, IRI_EMPATHY

g. Predictors: (Constant), SIE_TAIST, EET_TASIT, SIM_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

ANOVA[a]

CONDITION	Model		Sum of Squares	df	Mean Square	F	Sig.
ABI	1	Regression	402.857	3	134.286	1.014	.404[b]
		Residual	3178.801	24	132.450		
		Total	3581.659	27			
	2	Regression	1089.872	5	217.974	1.924	.131[c]
		Residual	2491.786	22	113.263		
		Total	3581.659	27			
	3	Regression	1120.071	6	186.679	1.593	.199[d]
		Residual	2461.587	21	117.218		
		Total	3581.659	27			
CON	1	Regression	62.250	3	20.750	.736	.540[e]
		Residual	733.117	26	28.197		
		Total	795.367	29			
	2	Regression	69.707	5	13.941	.461	.801[f]
		Residual	725.660	24	30.236		
		Total	795.367	29			
	3	Regression	85.011	6	14.168	.459	.831[g]
		Residual	710.356	23	30.885		
		Total	795.367	29			

a. Dependent Variable: PAR_SPRS

b. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT

c. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY

d. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

e. Predictors: (Constant), SIE_TAIST, EET_TASIT, SIM_TASIT

f. Predictors: (Constant), SIE_TAIST, EET_TASIT, SIM_TASIT, SEQ_PAR, IRI_EMPATHY

g. Predictors: (Constant), SIE_TAIST, EET_TASIT, SIM_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

Regression output for the informant total on the SPRS

Model Summary[d]

CONDITION	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
						R Square Change	F Change	df1	df2	Sig. F Change	
ABI	1	.418[a]	.174	.071	10.85152	.174	1.690	3	24	.196	
	2	.479[b]	.229	.054	10.95012	.055	.785	2	22	.469	
	3	.534[c]	.285	.080	10.79787	.055	1.625	1	21	.216	2.266
CON	1	.382[e]	.146	.047	4.66903	.146	1.477	3	26	.244	
	2	.404[f]	.163	-.011	4.80926	.018	.253	2	24	.779	
	3	.466[g]	.217	.013	4.75131	.054	1.589	1	23	.220	2.058

a. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT

b. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY

c. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

d. Dependent Variable: INF_SPRS

e. Predictors: (Constant), SIE_TAIST, EET_TASIT, SIM_TASIT

f. Predictors: (Constant), SIE_TAIST, EET_TASIT, SIM_TASIT, SEQ_PAR, IRI_EMPATHY

g. Predictors: (Constant), SIE_TAIST, EET_TASIT, SIM_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

ANOVA[a]

CONDITION	Model		Sum of Squares	df	Mean Square	F	Sig.
ABI	1	Regression	596.973	3	198.991	1.690	.196[b]
		Residual	2826.131	24	117.755		
		Total	3423.103	27			
	2	Regression	785.193	5	157.039	1.310	.296[c]
		Residual	2637.911	22	119.905		
		Total	3423.103	27			
	3	Regression	974.628	6	162.438	1.393	.263[d]
		Residual	2448.475	21	116.594		
		Total	3423.103	27			
CON	1	Regression	96.571	3	32.190	1.477	.244[e]
		Residual	566.796	26	21.800		
		Total	663.367	29			
	2	Regression	108.270	5	21.654	.936	.475[f]
		Residual	555.097	24	23.129		
		Total	663.367	29			
	3	Regression	144.143	6	24.024	1.064	.412[g]
		Residual	519.224	23	22.575		
		Total	663.367	29			

a. Dependent Variable: INF_SPRS

b. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT

c. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY

d. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

e. Predictors: (Constant), SIE_TAIST, EET_TASIT, SIM_TASIT

f. Predictors: (Constant), SIE_TAIST, EET_TASIT, SIM_TASIT, SEQ_PAR, IRI_EMPATHY

g. Predictors: (Constant), SIE_TAIST, EET_TASIT, SIM_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

Regression output for the work subscale (participant version)

Model Summary[d]

CONDITION	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
						R Square Change	F Change	df1	df2	Sig. F Change	
ABI	1	.248[a]	.061	-.056	5.00848	.061	.524	3	24	.670	
	2	.574[b]	.330	.178	4.42016	.268	4.407	2	22	.025	
	3	.575[c]	.331	.140	4.51984	.001	.040	1	21	.843	2.111

a. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT

b. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY

c. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

d. Dependent Variable: WORK_PAR

ANOVA[a]

CONDITION	Model		Sum of Squares	df	Mean Square	F	Sig.
ABI	1	Regression	39.416	3	13.139	.524	.670[b]
		Residual	602.036	24	25.085		
		Total	641.452	27			
	2	Regression	211.619	5	42.324	2.166	.095[c]
		Residual	429.833	22	19.538		
		Total	641.452	27			
	3	Regression	212.443	6	35.407	1.733	.163[d]
		Residual	429.009	21	20.429		
		Total	641.452	27			

a. Dependent Variable: WORK_PAR

b. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT

c. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY

d. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

Regression output for the relationship subscale (participant version)

Model Summary[d]

CONDITION	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
						R Square Change	F Change	df1	df2	Sig. F Change	
ABI	1	.330[a]	.109	-.002	5.40574	.109	.978	3	24	.420	
	2	.406[b]	.165	-.025	5.46630	.056	.736	2	22	.491	
	3	.424[c]	.180	-.055	5.54459	.015	.383	1	21	.543	1.456

a. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT

b. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY

c. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

d. Dependent Variable: REL_PAR

ANOVA[a]

CONDITION	Model		Sum of Squares	df	Mean Square	F	Sig.
ABI	1	Regression	85.738	3	28.579	.978	.420[b]
		Residual	701.327	24	29.222		
		Total	787.066	27			
	2	Regression	129.696	5	25.939	.868	.518[c]
		Residual	657.370	22	29.880		
		Total	787.066	27			
	3	Regression	141.474	6	23.579	.767	.604[d]
		Residual	645.591	21	30.742		
		Total	787.066	27			

a. Dependent Variable: REL_PAR

b. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT

c. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY

d. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

Regression output for the living skills subscale (participant version)

Model Summary[d]

CONDITION	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
						R Square Change	F Change	df1	df2	Sig. F Change	
ABI	1	.332[a]	.110	-.001	3.61356	.110	.988	3	24	.415	
	2	.641[b]	.411	.277	3.07122	.301	5.612	2	22	.011	
	3	.659[c]	.435	.273	3.07849	.024	.896	1	21	.355	2.174

a. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT

b. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY

c. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

d. Dependent Variable: LIVING_PAR

ANOVA[a]

CONDITION	Model		Sum of Squares	df	Mean Square	F	Sig.
ABI	1	Regression	38.699	3	12.900	.988	.415[b]
		Residual	313.388	24	13.058		
		Total	352.086	27			
	2	Regression	144.574	5	28.915	3.065	.030[c]
		Residual	207.512	22	9.432		
		Total	352.086	27			
	3	Regression	153.068	6	25.511	2.692	.043[d]
		Residual	199.019	21	9.477		
		Total	352.086	27			

a. Dependent Variable: LIVING_PAR

b. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT

c. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY

d. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

Regression output for the work subscale (informant version)

Model Summary[d]

CONDITION	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
						R Square Change	F Change	df1	df2	Sig. F Change	
ABI	1	.413[a]	.171	.067	3.14200	.171	1.650	3	24	.204	
	2	.568[b]	.323	.169	2.96600	.152	2.466	2	22	.108	
	3	.569[c]	.324	.131	3.03349	.001	.032	1	21	.860	2.597

a. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT

b. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY

c. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

d. Dependent Variable: WORK_INF

ANOVA[a]

CONDITION	Model		Sum of Squares	df	Mean Square	F	Sig.
ABI	1	Regression	48.865	3	16.288	1.650	.204[b]
		Residual	236.931	24	9.872		
		Total	285.797	27			
	2	Regression	92.259	5	18.452	2.097	.104[c]
		Residual	193.538	22	8.797		
		Total	285.797	27			
	3	Regression	92.554	6	15.426	1.676	.176[d]
		Residual	193.243	21	9.202		
		Total	285.797	27			

a. Dependent Variable: WORK_INF

b. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT

c. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY

d. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

Regression output for the relationships subscale (informant version)

Model Summary[d]

CONDITION	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
						R Square Change	F Change	df1	df2	Sig. F Change	
ABI	1	.354[a]	.126	.016	4.95989	.126	1.149	3	24	.350	
	2	.422[b]	.178	-.009	5.02341	.052	.698	2	22	.508	
	3	.457[c]	.208	-.018	5.04477	.031	.814	1	21	.377	2.045

a. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT

b. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY

c. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

d. Dependent Variable: REL_INF

ANOVA[a]

CONDITION	Model		Sum of Squares	df	Mean Square	F	Sig.
ABI	1	Regression	84.773	3	28.258	1.149	.350[b]
		Residual	590.413	24	24.601		
		Total	675.186	27			
	2	Regression	120.023	5	24.005	.951	.468[c]
		Residual	555.163	22	25.235		
		Total	675.186	27			
	3	Regression	140.741	6	23.457	.922	.499[d]
		Residual	534.445	21	25.450		
		Total	675.186	27			

a. Dependent Variable: REL_INF

b. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT

c. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY

d. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

Regression output for the living skills subscale (informant version)

Model Summary[d]

CONDITION	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
						R Square Change	F Change	df1	df2	Sig. F Change	
ABI	1	.372[a]	.138	.031	4.92688	.138	1.286	3	24	.302	
	2	.382[b]	.146	-.048	5.12289	.008	.099	2	22	.906	
	3	.508[c]	.258	.046	4.88745	.112	3.171	1	21	.089	2.184

a. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT

b. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY

c. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

d. Dependent Variable: LIV_INF

ANOVA[a]

CONDITION	Model		Sum of Squares	df	Mean Square	F	Sig.
ABI	1	Regression	93.630	3	31.210	1.286	.302[b]
		Residual	582.581	24	24.274		
		Total	676.210	27			
	2	Regression	98.841	5	19.768	.753	.593[c]
		Residual	577.369	22	26.244		
		Total	676.210	27			
	3	Regression	174.580	6	29.097	1.218	.336[d]
		Residual	501.631	21	23.887		
		Total	676.210	27			

a. Dependent Variable: LIV_INF

b. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT

c. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY

d. Predictors: (Constant), SIE_TAIST, SIM_TASIT, EET_TASIT, SEQ_PAR, IRI_EMPATHY, SEQ_INF

Discrepancy scores for control participants

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	SEQ_INF	89.7667	30	8.23652	1.50378
	SEQ_PAR	87.7333	30	10.63155	1.94105
Pair 2	PAR_SPRS	69.2333	30	5.23703	.95615
	INF_SPRS	69.7667	30	4.78275	.87321

a. CONDITION = CON

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	SEQ_INF & SEQ_PAR	30	.117	.538
Pair 2	PAR_SPRS & INF_SPRS	30	.016	.933

a. CONDITION = CON

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SEQ_INF - SEQ_PAR	2.03333	12.66405	2.31213	-2.69550	6.76217	.879	29	.386
Pair 2	PAR_SPRS - INF_SPRS	-.53333	7.03554	1.28451	-3.16045	2.09378	-.415	29	.681

a. CONDITION = CON