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Joanna Helen Teale (MA Honours)

Cognitive and Affective Predictors of Participation in Rehabilitation after Acquired Brain Injury

Major Research Project

&

Clinical Research Portfolio

Volume I

(Volume II bound separately)

*Submitted in partial fulfilment of the requirement of the
Degree of Doctorate in Clinical Psychology.*

August 2014

INSTITUTE OF HEALTH AND WELLBEING



University
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SYSTEMATIC REVIEW

Frequency of Anxiety Disorders after Traumatic Brain Injury in Children and Adolescents: A Systematic Review of the Literature

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Prepared in accordance with the instructions to authors for the Journal of the International Neuropsychological Society (see Appendix 1.1)

ABSTRACT

Objective

A number of studies have suggested that anxiety disorders are common after Traumatic Brain Injury (TBI) in children and adolescents. This systematic review summarises and synthesises the findings from these studies with the aim of establishing the frequency of, and risk factors for, anxiety after paediatric brain injury.

Method

A combined electronic and manual search identified 14 studies which met inclusion and exclusion criteria. Quality criteria derived from guidelines for evaluation of prevalence studies were utilised to evaluate each article and relevant data were extracted and collated.

Results

Methodological quality of the majority of included studies was 'Moderate'. Inconsistencies in the measurement and reporting of anxiety disorders/symptoms were common and precluded exact identification of frequency rates of anxiety after paediatric TBI. In studies reporting incidence of development of novel anxiety disorders with onset within six months of brain injury, figures ranged from 11% to 35.7% in predominantly mild TBI samples and from 7% to 63.2% in children with severe brain injury. Conflicting results abound regarding the influence of demographic factors on anxiety frequency.

Conclusions

Current research suggests anxiety disorders occur frequently in children and adolescents following TBI. However, further research is needed to address methodological concerns such

as the improved use of matched control groups, larger samples sizes and more appropriate epidemiological study designs in order to help determine both rate and relevant risk factors for children with brain injuries.

Keywords: Traumatic brain injury, anxiety, anxiety disorders, children and adolescents, frequency

Word Count: 8119

INTRODUCTION

Traumatic Brain Injury (TBI) affects many children, with data showing that in the USA, children aged from zero to fourteen years account for almost half a million emergency department visits due to TBI annually (Centers for Disease Control and Prevention, 2013). Many more children are likely to pursue other routes through healthcare resulting in general practitioner visits, hospital admissions or death. Although the majority of TBIs are mild, indicating better prognosis (Cassidy et al., 2004), TBI remains a leading cause of neurological disability in children. It occurs most commonly as blunt trauma, as opposed to penetrating injury, usually as a result of falls and road accidents for children under fourteen (Kraus, 1995). Some evidence suggests brain injuries are more frequent among black populations (Langlois, Rutland-Brown & Thomas, 2005) and occur most among young males, although it has been suggested that when females are affected they may show worse outcomes (Farace & Alves, 2000).

The degree of neurological sequelae and consequent prognosis for cognitive recovery are influenced by the age at which injury occurred and the nature and severity of TBI. Measures of injury severity are typically length of Posttraumatic Amnesia (PTA) and coma duration and depth, commonly assessed by the Glasgow Coma Scale (Teasdale & Jennett, 1974) which also has a paediatric version (Simpson et al., 1991). Head injuries sustained in childhood may lead to lower mortality rates than in adulthood (Luerssen, Klauber & Marshall, 1988). However, research indicates that injuries sustained at an earlier age before the brain has fully matured are more likely to lead to increased cognitive difficulties than those occurring in adulthood (Taylor & Alden, 1997). This is in contradiction to the Kennard principle, which stated that there is a negative linear relationship between age at brain injury

and functional outcome (Johnson & Rose, 1996). ‘Sleeper’ phenomena may also arise as, while some functional difficulties may not be immediately apparent after paediatric TBI, they may develop in later years once the brain region implicated starts to develop.

Aside from the physical neurological impact of TBI in childhood, other factors are also salient in considering long term prognosis. Difficulties such as headache (Blume et al., 2011), sleep disturbance (Tham et al., 2012; Viola-Saltzman & Watson, 2012), aggression (Cole et al., 2008), behavioural dysfunction (Hawley, 2003) and personality change (Max et al., 2000) are also common consequences which persist over time and may be highlighted as social and academic demands intensify (Taylor et al., 2002).

A growing body of research is examining the development of new mental health problems after sustaining a head injury in childhood and adolescence. Since associations have been established between severity of paediatric brain insult and level of behavioural problems (e.g. Schwartz et al., 2003), cognitive impairment (Beauchamp et al., 2011; Chadwick, Rutter, Brown, Shaffer & Traub, 1981) and quality of life (Rivara et al., 2011) there has been investigation to ascertain whether this relationship is also present with regard to psychiatric disorders. The first prospective study of psychiatric disorders after childhood TBI to use standardized instruments was conducted by Brown and colleagues (1981) over a two and a quarter year follow-up. Greater mental health problems after severe TBI compared with controls was observed and associated with severity of injury, early post-injury intellectual level, child’s pre-injury behaviour and psychosocial environment. A further early prospective study of consecutively admitted children with predominantly mild TBI found that approximately 80% of children showed no posttraumatic symptoms. However, standardized

psychiatric instruments were not used, nor was there a control group (Black et al., 1969, 1981).

The last fifteen years has seen a surge in published research investigating factors associated with development of novel psychiatric disorders after paediatric TBI. This review will focus on studies that have investigated the frequency of anxiety disorders after childhood and adolescent TBI, excepting studies whose exclusive focus is on Posttraumatic Stress Disorder (PTSD) because PTSD may have a different mechanism after TBI than other anxiety disorders (Gerring et al., 2002; Max, Castillo et al., 1998) and could warrant the attention of a separate systematic review. In epidemiology frequency of a condition may be examined in terms of prevalence or incidence. Prevalence refers to an estimation of the frequency and distribution of a condition based on a sample from a larger population (Boyle, 1998). Incidence denotes the number of instances of illness commencing, or of persons becoming ill, during a given period in a specified population (Last, 2001). Literature reviews exist describing the frequency of anxiety disorders after TBI in adults (e.g. Hiott & Labbate, 2002; Moore, Terryberry-Spohr & Hope, 2006; Somers, Goldner, Waraich & Hsu, 2006) and the effective psychological treatment of these (Soo & Tate, 2007). A recent systematic review also described the psychosocial outcomes within two years of paediatric TBI amongst school-age populations (Trenchard, Rust & Bunton, 2013). However, there are no known published systematic reviews which have previously focused on the incidence and prevalence of anxiety specifically after paediatric and adolescent TBI.

This knowledge is essential in establishing the breadth of difficulties faced by children and adolescents who sustain head injuries. Anxiety disorders are likely to impact on and impair a

developing child's ability to participate effectively in multiple domains such as school and home life, and academic and social development. This, in conjunction with the neurological impairments present, could drastically impact on a child's maturation into society if unrecognised and so untreated. This review, therefore, aims to contribute to the evidence base by collating and evaluating the available studies that examine the frequency of anxiety disorders after childhood TBI, and the factors which may influence this. The quality of existing studies providing information on frequency will also be investigated and recommendations will be guided by this in considering how future research may progress.

AIMS

1. To investigate the frequency of anxiety disorders/symptoms after TBI in children and adolescents.
2. To investigate if demographic and other confounding factors are associated with the frequency of anxiety disorders/symptoms after paediatric TBI.

METHOD

Search Strategy

A systematic, electronic literature search was conducted on 07/05/2014 using the EBSCO host online interface to access PsycINFO, Medline, CINAHL, PsycARTICLES and Psychology and Behavioral Sciences Collection research databases and the Web of Science database.

Topic searches were executed using the terms: traumatic/acquired brain injury/head injury, children/paediatric/pediatric, adolescents, frequency, rate, prevalence, incidence, anxiety disorders, anxiety which were combined and searched together utilising the Boolean operators “AND” and “OR”. Keyword searches were additionally conducted.

A sensitivity search was conducted in addition to the electronic investigation after articles had been reviewed and excluded based on the content of abstracts. This entailed inspecting the reference lists of relevant papers identified by hand for further potential articles and employing the “cited by” function in electronic search systems such as Google Scholar.

Duplicate entries were removed. All treatment or intervention studies were also removed along with animal and drug studies. Also excluded were book sections, systematic reviews, literature reviews, meta-analyses, case studies, dissertations, conference abstracts, guidelines, letters, commentaries and prefaces. Only studies published in the last twenty years were included due to the wealth of recently published literature. There has also been a trend towards increasing use of standardized instruments to assess psychiatric disorders, such as anxiety, enhancing more recent research methodology and study quality.

Inclusion and Exclusion Criteria

Inclusion Criteria

- Studies accessible in English
- Studies including children aged 0 – 19 years
- Studies which include children/adolescents reported to have experienced mild, moderate and/or severe TBI
- Studies published in peer-reviewed journals
- Studies published between 1994 – 2014
- Studies reporting on frequency (e.g. prevalence/incidence) of all anxiety disorders included in DSM-IV
- Studies using a standardised measure to assess anxiety
- Studies including participants recruited prospectively or retrospectively from consecutive admissions to acute or post-acute (e.g. rehabilitation, brain injury clinic) health services
- Where more than one study reported on the same participant sample within the same follow-up timeframe, only one study was selected for inclusion

Exclusion Criteria

- Studies focusing on PTSD only
- Treatment studies
- Drug/animal studies
- Qualitative studies; case reports; book sections
- Literature reviews; meta-analyses
- Time to first follow up greater than 10 years

Quality Evaluation

The quality of the studies obtained for inclusion in the systematic review was evaluated using quality evaluation criteria derived from Boyle's (1998) guidelines for assessing prevalence studies. These were effectively adopted in two previous systematic reviews concentrating on sleep difficulties and insomnia in TBI and stroke respectively (Bloomfield, 2007; Dixon, 2012). These guidelines predominantly centre on methods of sampling and measurement analysis and were adapted to focus on anxiety disorders for a brain injured population. This involved altering quality criteria items, for example, based on TBI severity and consideration of TBI as a primary or subsequent neurological insult, from Dixon's (2012) review to assess study quality. Salient reviews and journal articles were also explored in order to capture any missing criteria to include in the quality rating scale, however, no further inclusions were believed to be necessary.

The resultant quality evaluation rating scale contained 18 items, relating to: ethical approval, sampling and recruitment, measurement of anxiety disorders/symptoms and analysis (see Appendix 1.2). Completing the rating scale could lead to a maximum score of 31. Scores were converted into percentages and overall study quality judged according to the following quality designations: Poor (less than or equal to 24%), Low (25 – 49%), Moderate (50 – 74%) and High (equal to or over 75%).

It was intended that papers would be categorized as to whether they were reporting prevalence or incidence data. However, initial reading of the papers indicated that none were formally defined by authors as either prevalence or incidence studies. Furthermore, many could not be clearly classified as either incidence or prevalence studies due to the nature of the study designs used. This methodological issue is discussed further later. To help clarify

relevant design features, for each study it was noted whether it was prospective or cross-sectional, whether participants were recruited on the basis of consecutive admission to an acute hospital or to a post-acute rehabilitation centre/brain injury clinic, whether identification of anxiety was at a point in time or anytime within the follow up period and whether only novel disorders (i.e. new since brain injury) or any disorder (i.e. existing and novel disorders) were reported.

RESULTS

Search Results

As can be seen in Figure 1 below, manual and electronic literature searches initially identified 773 papers. After excluding duplicates and irrelevant articles based on title, 63 studies were reviewed by abstract, leading to a further exclusion of 37 papers. Full text journal articles were sourced for 26 studies, leading to the elimination of 12, resulting in 14 appropriate articles identified for this systematic review that met inclusion and exclusion criteria. Of the 12 papers excluded from full article review, this was due to the use of a sample not recruited from consecutive hospital admissions in 2 papers (Max, Bowers, Baldus & Gaylor, 1998; Perron & Howard, 2008) which were thought to potentially skew results due to lack of generalisability. Another 2 articles were excluded due to the existence of a retrospective follow-up period of more than 10 years (Andruszkow et al., 2014; McKinlay, Grace, Horwood, Fergusson & MacFarlane, 2009) as it was felt that this too may present confounding variables in the intervening years from pre-school to adolescence which may impact on the development of anxiety disorders beyond what could be interpreted. Two further studies (Grados et al., 2008; Max, Schachar et al., 2013) were excluded due to their reporting on the same sample within the same time period as two other studies that were retained (Max et al., 2011; Vasa et al., 2002). Six studies were also excluded due to their sole focus on PTSD.

Quality Rating Results

All 14 articles were independently rated by two reviewers. Full agreement was achieved on the majority of papers (12 out of 14; 85.7%) and disparities were resolved upon discussion leading to 100% accord (see Appendix 1.3). Ratings of study quality for each paper are provided in Table 1.

Data Extraction

Table 1 below presents a summary of the key information from all 14 included studies, such as sample characteristics, methods of assessing TBI and anxiety, main findings of the research relating to anxiety disorder/symptom frequency and quality ratings based upon the quality evaluation rating scale previously described.

Figure 1

Flow Chart Showing Systematic Search Strategy

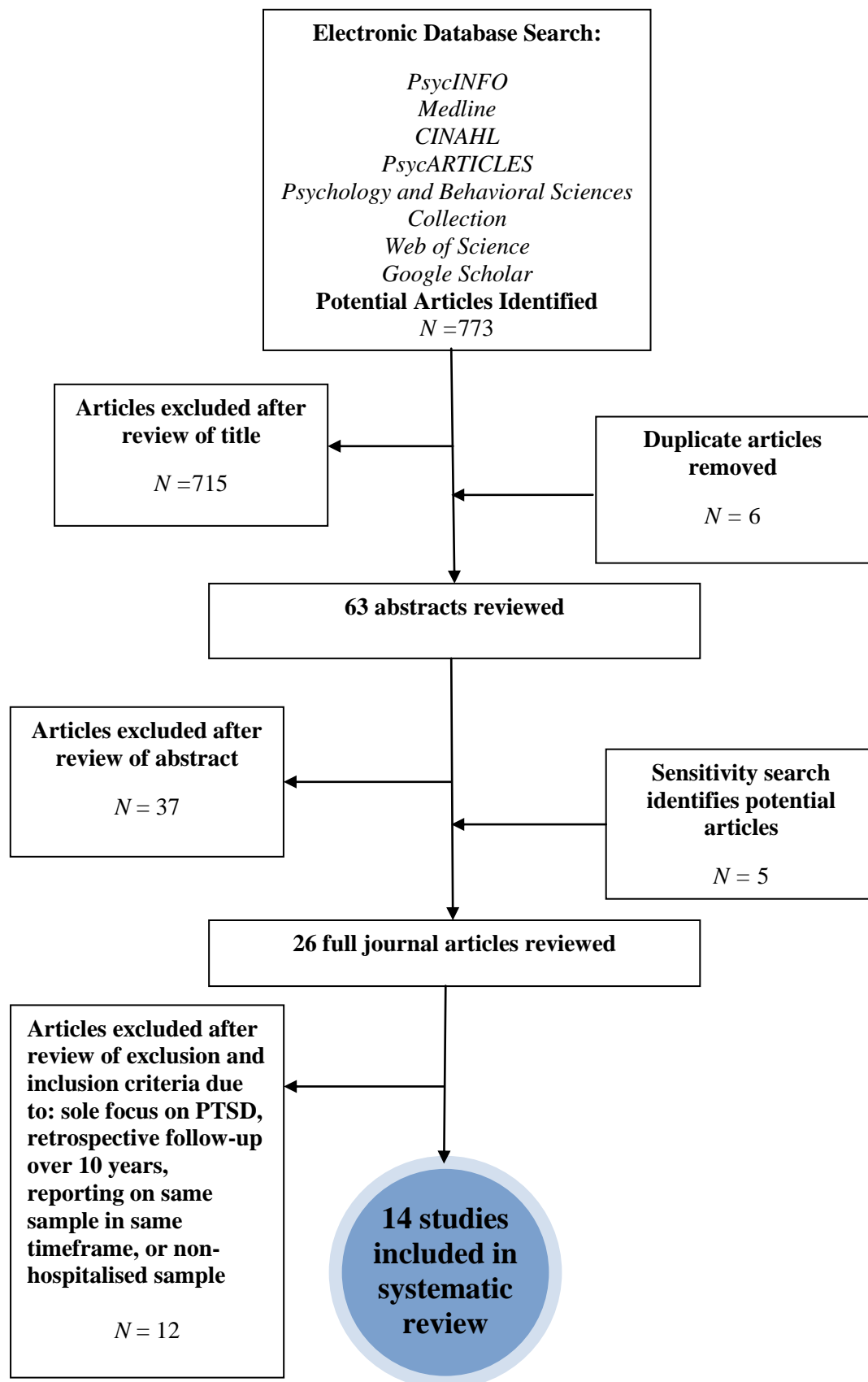


Table 1

Summation of Included Articles

Study	Sample Characteristics	Primary Assessment Methods (TBI)	Primary Assessment Methods (Anxiety)	Main Findings	Quality Rating
Max, Smith et al. (1997)	<ul style="list-style-type: none"> - Prospective study design - Consecutive admissions to one large tertiary care centre and three hospitals in North America - Identification of anxiety occurring within period up to assessment point at 3 months post-injury - Novel anxiety disorders reported - <i>N</i> = 50 (37 completed 3 month follow-up; 62.2% male, 97.3% Caucasian) - Age range = 6 – 14 years at time of injury - TBI = 52% mild; 18% moderate; 30% severe 	TBI severity categorisation based on: <ul style="list-style-type: none"> - GCS - CT scan - Traumatic Coma Bank categorisation 	Baseline assessment as soon as possible after injury. <ul style="list-style-type: none"> - K-SADS-E supplemented by the PTSD module at baseline, and supplemented also by K-SADS-E ADHD, ODD and alcohol and substance abuse sections for follow-up assessment at 3 months 	Within first 3 months following TBI novel anxiety disorders included simple phobia (2.7%); PTSD (5.4%); overanxious disorder (2.7%); separation anxiety disorder (5.4%); OCD (2.7%). Novel psychiatric disorders (not specific to anxiety) predicted by: increasing severity of injury, presence of lifetime psychiatric disorder, family psychiatric history, family dysfunction and lower SES class/pre-injury intellectual function.	- Moderate - 74%
Max, Lindgren, Robin et al. (1997)	<ul style="list-style-type: none"> - Same sample as Max, Smith et al. (1997) - Prospective study design - Consecutive admissions to one large tertiary care centre and three hospitals in North America - Identification of anxiety present within period of 3-6 months post-injury. - Novel (onset any time since brain injury) anxiety disorders reported - <i>N</i> = 50 (42 completed 6 month follow-up; 63.4% male, 98% Caucasian) - Age range = 6 – 14 years at time of injury - TBI = 48.8% mild; 22% moderate; 29.3% severe 	TBI severity categorisation based on: <ul style="list-style-type: none"> - GCS - CT scan - Traumatic Coma Bank categorisation - PTA estimate using Children's Orientation and Amnesia Test (Ewing-Cobbs et al., 1990), nursing notes and parental reports 	Baseline assessment as soon as possible after injury. <ul style="list-style-type: none"> - K-SADS-E supplemented by the PTSD module at baseline, and supplemented also by K-SADS-E ADHD, ODD and alcohol and substance abuse sections for follow-up assessment at 6 months 	In the 3-6 months following TBI novel anxiety disorders included simple phobia (2.4%); separation anxiety disorder (2.4%) and OCD (2.4%). Novel psychiatric disorder (not specific to anxiety) predicted by: severity of injury, family psychiatric history and family function.	- Moderate - 74%

Study	Sample Characteristics	Primary Assessment Methods (TBI)	Primary Assessment Methods (Anxiety)	Main Findings	Quality Rating
Max, Robin et al. (1998)	<ul style="list-style-type: none"> - Same sample as Max, Smith et al. (1997) - Prospective study design - Consecutive admissions to one large tertiary care centre and three hospitals in North America - Identification of anxiety present within period of 6-12 months post-injury) - Novel (onset any time since brain injury) anxiety disorders reported - N = 50 (43 completed 1 year follow-up; 65.1% male; 98% Caucasian) - Age range = 6 – 14 years at time of injury - TBI = 48.8% mild; 20.9% moderate; 30.2% severe 	<p>TBI severity categorisation based on:</p> <ul style="list-style-type: none"> - GCS - CT scan - Traumatic Coma Bank categorisation 	<p>Baseline assessment as soon as possible after injury.</p> <ul style="list-style-type: none"> - K-SADS-E supplemented by the PTSD module at baseline, and supplemented also by K-SADS-E ADHD, ODD and alcohol and substance abuse sections for follow-up assessment at 1 year 	<p>In period of 6-12 months following TBI, novel anxiety disorders included simple phobia (4.7%); separation anxiety disorder (4.7%), OCD (2.3%) and panic disorder (2.3%).</p> <p>Novel psychiatric disorder (not specific to anxiety) predicted by: pre-injury family function, family psychiatric history, SES/intellectual function and behaviour/adaptive function.</p>	<ul style="list-style-type: none"> - Moderate - 71%
Max, Robin et al. (1997)	<ul style="list-style-type: none"> - Same sample as Max, Smith et al. (1997) - Prospective study design - Consecutive admissions to one large tertiary care centre or three hospitals in North America - Identification of anxiety present within period of 12-24 months post-injury) - Novel (onset any time since brain injury) anxiety disorders reported - N = 50 (42 completed 2 year follow up; 61.9% male; 98% Caucasian) - Age range = 6 – 14 years - TBI = mild (47.6%), moderate (21.4%), severe (31%) 	<p>TBI severity categorisation based on:</p> <ul style="list-style-type: none"> - GCS - CT scan - Traumatic Coma Bank categorisation - PTA estimate - Assessment in acute stage of injury recorded from clinical notes 	<p>Baseline assessment as soon as possible after injury.</p> <ul style="list-style-type: none"> - K-SADS-E supplemented by the PTSD module at baseline, and supplemented also by K-SADS-E ADHD, ODD and alcohol and substance abuse sections for follow-up assessment at 2 years 	<p>In period of 6-12 months following TBI, novel anxiety disorders included simple phobia (4.8%) and separation anxiety disorder (4.8%).</p> <p>Novel psychiatric disorder (not specific to anxiety) predicted by: Severity of injury, pre-injury family function and pre-injury lifetime psychiatric history.</p>	<ul style="list-style-type: none"> - Moderate - 74%

Study	Sample Characteristics	Primary Assessment Methods (TBI)	Primary Assessment Methods (Anxiety)	Main Findings	Quality Rating
Max, Lindgren et al. (1997)	<ul style="list-style-type: none"> - Cross-sectional study design - Consecutive admissions to a post-acute paediatric brain injury clinic - Identification of anxiety not at specific time point post-injury, including onset at any time since injury - Novel and pre-existing (unresolved) anxiety disorders reported - $N = 54$ (74% male; 88% Caucasian) - Mean age (years) = 11.46 	<p>TBI severity categorisation based on:</p> <ul style="list-style-type: none"> - GCS - Criteria determined by Head Injury Interdisciplinary Special Interest Group of the American Congress of Rehabilitation Medicine (Kay et al., 1993) 	<ul style="list-style-type: none"> - K-SADS-E supplemented by the PTSD module - If child developmentally younger than 6 years, unstructured interview or play assessment - School report review and clinician observations 	<p>Figures for frequency per condition any time since TBI, including pre-existing unresolved (novel only in brackets):</p> <p>OCD total 2% (novel 2%); simple phobia total 4% (novel 2%), separation anxiety disorder 8% (novel 6%); agoraphobia 2% (novel 2%); social phobia 4% 92% novel). None had current overanxious disorder or PTSD.</p> <p>Novel psychiatric disorders (any type) occurred in 76% and were significantly correlated with family psychiatric history and family function, but not with severity of injury, pre-injury psychiatric status, intellectual/educational functioning or SES.</p>	<ul style="list-style-type: none"> - Low - 48%
Max, Koele et al. (1998)	<ul style="list-style-type: none"> - Cross-sectional study design - Consecutive admissions to 1 university hospital, 2 regional hospitals and 1 community hospital - Identification of anxiety not at specific time point post injury - Novel (onset any time since brain injury) anxiety disorders reported - $N = 72$ - 3 groups of 24: mild TBI (33.3%); severe TBI (33.3%); orthopaedic control (33.35) - Age range = 5 – 14 years 	<p>TBI severity categorisation based on:</p> <ul style="list-style-type: none"> - GCS - CT scan 	<ul style="list-style-type: none"> - K-SADS-E supplemented by the PTSD module - Psychiatric interview supplemented by TRF - CBCL - NYU-HIFI-SO 	<p>Novel anxiety disorders after severe TBI included separation anxiety disorder (8.3%), anxiety disorder NOS (4.2%), simple phobia (8.3%), agoraphobia (4.2%), OCD (4.2%). Following mild TBI, novel anxiety disorders included agoraphobia (4.2%), social phobia (4.2%).</p> <p>Severe TBI associated with significantly higher rate of current novel psychiatric disorders compared with children with mild TBI and orthopaedic injury.</p>	<ul style="list-style-type: none"> - High - 84%

Study	Sample Characteristics	Primary Assessment Methods (TBI)	Primary Assessment Methods (Anxiety)	Main Findings	Quality Rating
Bloom et al. (2001)	<ul style="list-style-type: none"> - Cross sectional study design - Identification of anxiety within period up to time of assessment, at least one year (typically 2-3 years) post injury. - Novel (onset any time since brain injury) anxiety disorders reported - $N = 46$ (63% male) - TBI = mild (32.6%); moderate (26.1%); severe (41.3%) - Age range = 6 – 15 years - Subsample of larger prospective study of neurobehavioural outcome of TBI. 	<p>TBI severity categorisation based on:</p> <ul style="list-style-type: none"> - GCS - GOS 	<ul style="list-style-type: none"> - DICA-R - PIC-R 	<p>20% of the sample showed novel anxiety disorders in 11 different diagnoses.</p> <p>58.7% of sample developed one or more novel psychiatric disorders at some point after their TBI, the two most common being ADHD and depression.</p>	<ul style="list-style-type: none"> - Low - 48%
Vasa et al. (2002)	<ul style="list-style-type: none"> - Prospective study design - Consecutive admissions to neuro-rehabilitation unit of a university affiliated tertiary centre - Identification of anxiety within the period up to assessment point at 1 year post-injury - Novel and pre-existing (unresolved) anxiety disorders reported - $N = 97$ (58% male; 55% African American; 39% Caucasian) - Severe TBI only - Age range = 4 – 19 years 	<p>TBI severity categorisation based on:</p> <ul style="list-style-type: none"> - GCS 	<p>Baseline assessment as soon as possible after injury (mean = 23 days SD= 29.1) and 1 year after TBI:</p> <ul style="list-style-type: none"> - DICA-P 	<p>Novel anxiety disorders after TBI included overanxious disorder (9.3%), simple phobia (15.5%), OCD (4.1%), separation anxiety (1%).</p> <p>Novel plus pre-existing persistent anxiety disorders included overanxious disorder (10.3%), simple phobia (24.7%), OCD (5.2%), separation anxiety (1%).</p> <p>Significant increase in total number of anxiety symptoms after injury compared with before.</p> <p>Pre-injury anxiety symptoms and younger age at injury correlated positively with post-injury anxiety symptoms and disorders.</p>	<ul style="list-style-type: none"> -Moderate - 74%

Study	Sample Characteristics	Primary Assessment Methods (TBI)	Primary Assessment Methods (Anxiety)	Main Findings	Quality Rating
Luis & Mittenberg (2002)	<ul style="list-style-type: none"> - Prospective study design - Consecutive admissions to general hospital - Identification of anxiety within the period up to assessment point at 6 months post-injury. - Novel (onset any time since brain injury) anxiety disorders reported - $N = 96$ (mild TBI group = 42, 66.7% male, 61% Caucasian; moderate/severe TBI group = 19, 68.4% male, 73.3% Caucasian; orthopaedic control group = 35, 74% male, 40% Caucasian) - Age range = 6 – 15 years 	TBI severity categorisation based on: <ul style="list-style-type: none"> - GCS - CT scan - Neurological examination - PTA 	At 6 month follow-up: <ul style="list-style-type: none"> - Module A: Anxiety Disorders of the DISC-IV - Module C: Mood Disorders of the DISC-IV 	<p>New onset anxiety disorders occurred in 35.7% of the mild TBI group and 63.2% of the moderate/severe TBI group.</p> <p>Post-injury level of stress and severity of brain injury were the most robust predictors of new onset mood and/or anxiety disorder.</p>	-Moderate - 71%
Geraldina et al. (2003)	<ul style="list-style-type: none"> - Cross-sectional study design - Consecutive admissions referred to Traumatic Brain Injury Unit - Assessment point post-injury unclear, but maximum one year. - Novel (onset any time since brain injury) anxiety disorders reported - $N = 96$ (76% male) - TBI = severe (91.7%) - Age range = 0 – 18 years 	TBI severity categorisation based on: <ul style="list-style-type: none"> - GCS - GOS - Neurological examination 	Divided into 3 age groups: <p>Group 1 (0-6 years):</p> <ul style="list-style-type: none"> - CBCL <p>Group 2 (7-13 years):</p> <ul style="list-style-type: none"> - CBCL; TAD <p>Group 3 (14-18 years):</p> <ul style="list-style-type: none"> - CBCL; TAD; CBA 	<p>Pathological anxiety present in 30% of Group 2 and 11.3% of Group 3.</p> <p>Different psychological problems were found across the 3 age groups. Younger patients showed more internalizing problems and with increasing age behaviour problems became more frequent. Predictive factors of psychological, behavioural and adjustment problems were GOS scores, degree of impairment on neurological examination and male gender.</p>	-Moderate - 65%

Study	Sample Characteristics	Primary Assessment Methods (TBI)	Primary Assessment Methods (Anxiety)	Main Findings	Quality Rating
Hawley (2003)	<ul style="list-style-type: none"> - Cross-sectional study design - Postal questionnaire sent to all 974 surviving children admitted with TBI to North Staffordshire Hospitals NHS Trust (UK) from 1992-1998. Parents then invited to participate in study and interviews. - Identification of anxiety not at specific time point post-injury (range post injury, 6 months-5 years) - Novel (onset any time since brain injury) anxiety disorders reported - $N = 97$ in main study but assessment of anxiety only in children aged over 11 ($n=67$; mild TBI $n=35$, moderate/severe $n=32$)) - Age range = 5 – 15 years at time of injury (6-20 at time of interview). 	<p>TBI severity categorisation based on:</p> <ul style="list-style-type: none"> - GCS - Duration of loss of consciousness 	<p>Children over age 11 years at time of first interview:</p> <ul style="list-style-type: none"> - HADS (score of 8-10 borderline, 11-21 definite case) 	<p>In moderate/severe TBI, 28.1% definite cases, 21.9% borderline. In mild TBI, 14.3% definite cases, 28.6% borderline.</p> <p>Children with mild and moderate/severe TBI were significantly more anxious than healthy controls ($p = 0.04$).</p>	<ul style="list-style-type: none"> - Low - 35%
Max et al. (2011)	<ul style="list-style-type: none"> - Prospective study - Participants recruited from consecutive admissions to 3 academic medical centres in North America - Identification of anxiety within the period up to assessment at 6 months post-injury - Novel (onset any time since brain injury) anxiety disorders reported - $N = 177$ (71% male) - TBI = mild (49%); moderate (15%); severe (36%) - Age range = 5 – 14 years 	<p>TBI severity categorisation based on:</p> <ul style="list-style-type: none"> - GCS - MRI 	<p>At baseline (after resolution of PTA) and 6 month follow-up:</p> <ul style="list-style-type: none"> - K-SADS-E 	<p>Novel definite anxiety disorders occurred in 8.5% of participants in the first 6 months after TBI.</p> <p>Mild TBI - 11% developed a definite anxiety disorder. Moderate TBI - 0% developed a definite anxiety disorder Severe TBI – 7 % developed a definite anxiety disorder.</p> <p>Younger age the only significant factor associated with presence of definite anxiety disorder.</p>	<ul style="list-style-type: none"> -Moderate - 65%

Study	Sample Characteristics	Primary Assessment Methods (TBI)	Primary Assessment Methods (Anxiety)	Main Findings	Quality Rating
Karver et al. (2012)	<ul style="list-style-type: none"> - Concurrent cohort/prospective design - Consecutive admissions to 3 children's hospitals and 1 general hospital - Identification of anxiety not at specific point post-injury - Follow up assessment minimum of 24 months post injury (average of 38.24 months (s.d. 10.29) post-injury) - Novel (onset any time since brain injury) anxiety disorders reported - $N = 143$ (49 mild to moderate TBI, 56.9% male, 66.2% Caucasian; 19 severe TBI, 69.6% male, 69.6% Caucasian; 75 orthopaedic control, 58% male, 75.6% Caucasian) - Age range = 3 – 7 years 	TBI severity categorisation based on: <ul style="list-style-type: none"> - GCS - MRI - CT scan 	- CBCL - Anxiety and Attention Deficits/Hyperactivity DSM IV clinical sub-scales	Anxiety occurred in 26.3% of the severe TBI group, 10.2% of mild TBI and 10.8% of orthopaedic injury. Severe TBI was associated with significantly more anxiety problems relative to the orthopaedic control group. With increasing time since injury, children who sustained a severe TBI at an earlier age had significantly higher levels of parent-reported ADHD symptoms and anxiety than children older at TBI.	-Moderate - 67%
Max, Pardo et al. (2013)	<ul style="list-style-type: none"> -Participants from same sample as Max, et al. (2011) - Prospective study design - Participants recruited from consecutive admissions to 3 academic medical centres - Identification of anxiety present within period of 6-12 months post-injury - Novel (onset any time since brain injury) anxiety disorders reported - $N = 79$ (60 at 12 month follow-up; 68.4% male; 65% Caucasian; 15% African American; 3% Asian; 3% Other) - TBI = mild only - Age range = 5 – 14 years 	TBI severity categorisation based on: <ul style="list-style-type: none"> - GCS - MRI - AIS 	At baseline (after resolution of PTA), 6 month and 12 month follow-up: <ul style="list-style-type: none"> - K-SADS-E - Survey Diagnostic Instrument (Teacher completed) when available 	Novel psychiatric disorders occurred in 28% of children in the 6 - 12 month period following mild TBI. Novel anxiety disorders after Mild TBI included social phobia (1.7%) simple phobia (3.3%), GAD (5%) PTSD (3.3%), separation anxiety (1.7%). Novel psychiatric disorders were associated with SES, psychosocial adversity, pre-injury academic functioning and cognitive deficits.	- Moderate - 65%

Note: AIS = Abbreviated Injury Scale; CBA = Cognitive-Behavioural Assessment 2.0 (Sanavio, Bertolotti & Michelin et al., 1996); CBCL = Child Behaviour Checklist (Achenbach, 1991a); CT = Computerised Tomography; DICA-P = Interview for Children and Adolescents (Herjanic & Reich 1982); DICA-R = Diagnostic Interview for Children and Adolescents-Revised (Reich, 2000); DISC-IV = Diagnostic Interview Schedule for Children - 4th Edition (Shaffer et al., 1996); DSM = Diagnostic and Statistical Manual of Mental Disorders; GAD = Generalised Anxiety Disorder; GCS = Glasgow Coma Scale; GOS = Glasgow Outcome Scale; HADS = Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983); K-SADS-E = Schedule for Affective Disorders and Schizophrenia for School-Age Children Epidemiologic version (Kaufman, Birmaher & Brent, 1997); MRI = Magnetic Resonance Imaging; NYU-HIFI-SO = Head Injury Family Interview Significant Other checklist (Kay et al., 1988); OCD = Obsessive Compulsive Disorder; PIC-R = Personality Inventory for Children-Revised (Wirt et al., 1990); PTA = Post-Traumatic Amnesia; PTSD = Posttraumatic Stress Disorder; SD = Standard Deviation; SES = Socioeconomic Status; TAD = Test of Anxiety and Depression in Childhood and Adolescence (Newcomer, Barenbaum & Bryant, 1997); TRF = Teacher's Report Form (Achenbach, 1991b)

Samples

Across the articles evaluated, sample size was generally small. With the exception of two studies (Karver et al., 2012; Max et al., 2011) all had samples sizes under one hundred participants. The challenges inherent in acquiring large samples of consecutively admitted children who are retained through prospective follow-up are clear. However, many of the authors called for replication of research using larger samples to ascertain the validity and generalisability of their findings. In addition, studies often split samples across groups in order to differentiate mild, moderate and severe TBI for analysis, further reducing sample sizes. Two studies included an orthopaedic or healthy sample control group (Karver et al., 2012; Luis & Mittenberg, 2002) and a matched control group was only included in another two articles (Hawley, 2003; Max, Koele et al., 1998). The low use of matched control groups also introduces ambiguity into the association between anxiety and paediatric TBI.

Generally, samples involved representative, community groups in the form of consecutive admissions to general hospitals or acute treatment centres. However, some studies did not, samples instead being referred post-acutely to a University affiliated hospital or specialist clinic (Grados et al., 2008; Max, Lindgren et al., 1997) or sent invitation letters to participate (Hawley, 2003), potentially inflating frequencies of disorders.

Inclusion and exclusion criteria for participants were usually defined, although no study provided an estimate of the number of excluded individuals as a proportion of the target population, while some provided details of individuals who dropped out at later stages of the research. This information, if available, could provide useful insights into the quantity of

excluded participants and characteristics of these as compared to those who met inclusion criteria and whose data frequency rates are based upon.

Measurement of TBI and Anxiety

Many of the studies included used a variety of different psychiatric interviews to assess anxiety disorders/symptoms, including the Schedule for Affective Disorders and Schizophrenia for School-Age Children Epidemiologic version (K-SADS-E; Kaufman, Birmaher & Brent, 1997); Head Injury Family Interview Significant Other checklist (NYU-HIFI-SO; Kay et al., 1988); Diagnostic Interview for Children and Adolescents-Revised (DICA-R; Reich, 2000) and Anxiety and Mood Disorders Modules of the Diagnostic Interview Schedule for Children - 4th Edition (DISC-IV; Shaffer et al., 1996). Only three articles used parent-report or participant self-report measures without additional psychiatric interview to establish diagnosis. Hawley (2003) utilised the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) with children over eleven years at the time the first interviews were conducted, while Karver and colleagues (2012) and Geraldina et al. (2003) conducted the Child Behaviour Checklist (CBCL; Achenbach, 1991a). Geraldina and colleagues (2003) supplemented this with the Test of Anxiety and Depression in Childhood and Adolescence (TAD; Newcomer, Barenbaum & Bryant, 1997) and Cognitive-Behavioural Assessment 2.0 (CBA; Sanavio et al., 1996).

Frequency of Anxiety

Differences in frequencies may reflect sample biases and differences in controlling for pre-injury behaviour and psychological problems, variations in length of time since injury to assessment periods, variations in sampling methods and lack of a non-brain injured control

group. The use of different standardized instruments to assess anxiety will also impact on this, as will variations in defining anxiety disorders.

Studies which could be considered incidence, by identifying the proportion of consecutively admitted people developing a novel anxiety disorder within a specified period of time, were those conducted by Max, Smith et al. (1997), Luis and Mittenberg (2002) and Max et al. (2011). In the latter two studies, incidence rates for the development of anxiety disorders post-TBI ranged from 11% (Max et al., 2011) to 35.7% (Luis & Mittenberg, 2002) in predominantly mild TBI samples, while this figure became 7% (Max et al., 2011) and 63.2% in moderate/severe TBI groups assessed with psychiatric interview (Luis & Mittenberg, 2002). Max, Smith et al. (1997) reported that children developed a variety of anxiety disorders, however, because the study data does not specify whether children received more than one diagnosis of a novel anxiety disorder an overall anxiety rate could not be established. This was also the case in several other studies (e.g. Max, Lindgren, Robin et al., 1997; Max, Robin et al., 1998; Max, Robin et al., 1997). However, the available data indicated that frequencies were higher in Luis and Mittenberg's (2002) sample than Max, Smith et al.'s (1997). The reasons behind the large variation in incidence rates reported by Luis and Mittenberg's (2002) and Max et al. (2011) is unclear. However, while both samples involved consecutive hospital admissions of similar ages, the assessment tools used to investigate anxiety were different, as were the locations where studies were conducted and the racial backgrounds of the samples, with Luis and Mittenberg's (2002) sample containing greater ethnic diversity.

Only two of the included frequency articles were prevalence studies reporting the frequency of anxiety at one time (Hawley, 2003; Karver et al., 2012). Both studies could be described as

point prevalence in that anxiety was measured in terms of whether it was present at a single assessment point. However, the assessment point was defined differently across studies. Hawley (2003) reported prevalence at a particular point in real time, whereas Karver et al. (2012) assessed this at a particular point in relation to the head injury. Hawley (2003) reported the prevalence rate of anxiety measured on average 2.29 years post-TBI to be 42.9% assessed with HADS alone, while Karver et al. (2012) reported anxiety disorders in 26.3% of the severe TBI group, 10.2% of mild TBI and 10.8% of an orthopaedic injury control group.

Whilst Hawley's (2003) recruitment strategy invited all children who had survived a head injury over a specified period of time, this was done via a postal survey method to participants, many of whom were several years post injury. This could have led to a selection bias whereby parents whose children were exhibiting difficulties volunteered to participate in the hope of gaining additional support, whereas caregivers of head-injured children without complications may not have, leading to an overrepresentation of the problems expressed in the sample and potentially inflated rates of disorders. Karver et al.'s (2012) point prevalence study reported the proportion of cases who showed clinically elevated anxiety without taking into account pre-injury anxiety. However, baseline scores suggest that almost all anxiety cases reported were new onset since the mean and standard deviation scores relating to baseline measures were low, implying that this research could also be viewed as an incidence study reporting novel post-injury anxiety.

The majority of included studies could not be defined as incidence or prevalence. Some studies (e.g. Bloom et al., 2001; Max, Koele et al., 1998) did not have set time points post-injury in which participants were followed-up, while other studies which conducted anxiety

assessments at specified times did not determine when participants developed disorders. For example, a series of studies published by Max and colleagues following the same sample at three months, six months, one year and two years post-injury do not provide information regarding how many children developed anxiety within each phase, apart from the initial three month period (Max, Smith et al., 1997).

Factors Associated with the Development of Anxiety Disorders

Injury Severity

Only three of the included studies (Luis & Mittenberg, 2002; Max et al., 2011; Vasa et al., 2002) explored factors associated with the development of anxiety disorders specifically, rather than psychiatric disorders in general. Among these few studies, results appear contrasting. Luis and Mittenberg's (2002) multivariate analysis showed severity of brain injury to be one of the most robust predictors of new-onset anxiety disorders. Contrary to this, Max and colleagues (2011) and Vasa et al. (2002) did not find injury severity to be a significantly associated with post-injury anxiety. However, in the study conducted by Vasa and colleagues (2002), these findings may be due to the small range of injury severity present within the sample in comparison to other studies.

Severity of the TBI has been implicated as an important factor in the development of post-injury psychiatric disorders in general in the majority of studies (Andruszkow et al., 2014; Geraldina et al., 2003; Gerring et al., 2002; Hawley, 2003; Luis & Mittenberg, 2002; Max, Castillo et al., 1998; Max, Koele et al., 1998; Max, Lindgren, Robin et al., 1997; Max, Robin et al., 1997; Max, Robin et al., 1998; Max, Smith et al., 1997). Earlier studies by Black et al. (1981) and Brown et al. (1981) also emphasised the importance of injury severity as a predictor of psychological problems. However, some frequency studies did not find a

significant correlation between injury severity and the development of new psychiatric disorders post-TBI (Max, Lindgren et al., 1997) or reported only a non-significant trend towards severity being an important predictor variable (Bloom et al., 2001).

However, in one of these studies the lack of a significant relationship between severity and psychological problems was due to an unusually high rate of disorders within the mild TBI sample which reduced statistical differences between groups (Max, Lindgren et al., 1997). Overall, it seems apparent that injury severity is an important factor in predicting increasing frequency of anxiety and psychiatric disorders after paediatric TBI.

Age at Injury

It is possible to assess and detect psychological disorders with greater accuracy and ease in older children than those below 6 years. This is because many standardized instruments are designed for use with older populations and different versions exist within the age ranges to mirror the changing presentation of anxiety symptoms as children develop. This is reflected in published studies, whose samples typically include children from 6 – 14/15 years, more unusually going up to 18 years of age. This is with the exception of Vasa et al. (2002) whose age range spanned 4 – 19 years and Geraldina and colleagues (2003) who aimed to investigate the incidence of different psychological problems presenting after TBI at varying ages in childhood so included a sample from 0 to 18 years. For this reason it is difficult to draw definitive conclusions on the influence of age at injury on increasing risk for anxiety disorders. This lack of knowledge is particularly relevant since the majority of TBIs occur in children aged 0 – 4 years (Langlois et al., 2005) and neurobehavioural function is most vulnerable to disruption in children under 5 (Levin et al., 1992).

However, Max and colleagues (2011) reported that younger age at injury was associated with post-injury anxiety disorders. In contrast, Vasa et al. (2002) found younger age at injury to be related to higher anxiety symptom ratings but not novel disorders. Karver et al. (2012) reported a relationship between increasing age and outcome, suggesting that children who acquired severe TBI at earlier ages had significantly greater levels of parent-reported anxiety than older children at injury. Luis and Mittenberg reported no association between age and post-injury anxiety.

Geraldina and colleagues (2003) noted the presence of different psychiatric disorders across the different age groups studied. Younger children exhibited more internalizing difficulties and behaviour problems increased with age. There were also differences in the frequencies of anxiety noted. Anxiety was only investigated with the use of the CBCL in children aged 0 – 6 years, with the addition of the TAD for those aged 7 – 13 years and the CBA also for adolescents (14 – 18 years). Children aged 7 – 13 showed the highest level of pathological anxiety (30%), which decreased in adolescence to 11.3%.

While evidence suggests a link between earlier age at injury and increased anxiety and general psychiatric problems, difficulties remain in effective assessment of these issues and some studies report a lack of association (Max, Robin et al., 1997; Max, Koele et al., 1998; Max, Robin et al., 1998; Max, Smith et al., 1997; Max, Lindgren, Robin et al., 1997; Max, Pardo et al., 2013; Andruszkow et al., 2014).

Race

Few of the included studies note varying associations between anxiety or psychiatric disorder frequency rates and ethnicity, except to report when no significant association was observed

(Max, Koele et al., 1998). However, it should be noted that the majority of studies were executed in North America and comprised predominantly Caucasian samples, with the exemption of Vasa et al. (2002; 55% African American sample).

Gender

Across age groups TBI occurs more frequently in males, possibly due to higher risk-taking behaviour and lower parental supervision, among other factors. This is reflected in the evidence base as the majority of studies include majority male samples. However, there is some evidence suggestive that gender may influence anxiety frequency after childhood brain injury.

Grados and colleagues noted a significant association between OCD and female gender after paediatric TBI. While females demonstrate greater life-time incidence of anxiety disorders (Kessler et al., 2005) and possible higher genetic susceptibility to OCD (Nestadt et al., 2000) this finding is still noteworthy as male children with OCD typically present with earlier onset and this finding was apparent even utilising a predominantly male sample. Female gender was also cited as a predictor variable in the development of PTSD post-TBI in childhood (Gerring et al., 2002).

In contrast, Geraldina et al. (2003) found male gender to be a predictive factor influencing psychological, behavioural and adjustment problems after childhood TBI. In particular, adolescent males were at increased risk of developing emotional lability and relational and socialisation difficulties. However, other studies did not find a significant association between gender and anxiety after childhood TBI (Luis & Mittenberg, 2002) or with gender

and psychiatric problems post-TBI (Max, Koele et al., 1998; Max, Lindgren, Robin et al., 1997; Max, Pardo et al., 2013).

Psychosocial Adversity/Family Functioning

Measures of psychosocial adversity such as family functioning, family psychiatric history, socio-economic status (SES) and social deprivation have been employed by studies to ascertain the influence of this on the development of post-injury anxiety and psychiatric disorders in general in children. With exceptions (Max, Schachar et al., 2013) the majority of studies investigating the association between psychosocial adversity and psychiatric disorders have found this to be highly significant (Brown et al., 1981, Gerring et al., 2002; Max, Pardo et al., 2013).

Relationships between family functioning and family psychiatric history have been regularly observed as important predictors of post-TBI psychiatric disorders in children (Brown et al., 1981; Max, Lindgren et al., 1997; Max, Lindgren, Robin et al., 1997; Max, Pardo et al., 2013; Max, Robin et al., 1997; Max, Robin et al., 1998; Max, Smith et al., 1997). This is in contrast to the results of some studies (Max, Koele et al., 1998; Max, Schachar et al., 2013).

Research implicates SES and other measures of social deprivation as important variables in the development of post-injury psychiatric disorders in childhood. However, overall SES was not found to be a significant predictive factor in several studies (Max, Koele et al., 1998; Max, Lindgren et al., 1997; Max, Lindgren, Robin et al., 1997; Max, Schachar et al., 2013) while in some it was significant (Hawley, 2003; Gerring et al., 2002; Max, Pardo et al., 2013; Max, Robin et al., 1998; Max, Smith et al., 1997).

Nevertheless, increased levels of social deprivation have been previously noted in head injured children (Klonoff, 1971). This was measured by Hawley (2003) using Townsend Deprivation Scores, noting that two-thirds of children with TBI lived in areas with an element of social deprivation. A recent study by Max, Pardo and colleagues (2013) noted that novel post-TBI psychological disorders were significantly associated with SES, psychosocial adversity, pre-injury family psychiatric history and family functioning.

There have been fewer studies which have investigated the relationship between psychosocial adversity and anxiety specifically. Luis and Mittenberg (2002) assessed children's post-injury environmental stress and found this to be the most significant predictor in a multivariate analysis. An orthopaedic-injured control group also reported significantly less environmental stress than TBI groups across injury severity. A literature review concluded that the level of stress experienced by families with head-injured children even 10 – 15 years after injury was sufficient to warrant professional intervention (Verhaeghe, Defloor & Grypdonck, 2005) and families with limited support are most at risk. The review also suggested that better family coping skills led to increased recovery in children.

In contrast, Vasa and colleagues reported no association between psychosocial adversity or SES and anxiety. However, this may have been due to the small scope of psychosocial adversity scores in the study, sample characteristics, memory biases, or lack of sensitivity of the Modified Psychosocial Adversity Scale adopted to measure this variable. Furthermore, the latter study did not assess family history of anxiety disorders. In addition, although Max et al. (2011) found no association between psychosocial adversity and new psychiatric problems 6 months after TBI, a later study utilising the same sample examined at 12 months did find such a relationship (Max, Pardo et al., 2013). This could reflect the importance of

psychosocial variables which may become more apparent with increasing time since injury as physical brain damage improves and children move from a hospital to home environment. Overall, these findings appear to be in common with research in the general population which suggests that negative aspects of family functioning and elevated parental anxiety are associated with increased development of anxiety disorders in children (Bögels & Brechman-Toussaint, 2006).

Pre-Injury Anxiety Disorders/Symptoms

As well as pre-injury family psychiatric history, existence of psychiatric problems or anxiety disorders in children pre-TBI has been measured by some studies. Vasa et al. (2002) reported a positive association between anxiety symptoms before TBI and anxiety symptoms and disorders post-injury. Similarly, a study assessing clinical predictors of PTSD after childhood brain injury also reported pre-injury anxiety symptoms to be predictive of post-injury PTSD (Gerring et al., 2002). The reverse was found by Max et al. (2011). However, the authors suggest this may have been due to the wide range of TBI severity in the sample used and loss of statistical power due to the treatment of anxiety disorders as categorical, rather than interval variables in the analyses. Indeed, the same study reported that pre-TBI anxiety was approximately twice as prevalent in children who subsequently developed anxiety problems post-TBI.

More generally, measures of pre-injury psychiatric status have also been shown to be predictive of the development of new psychological problems post-TBI in children (Brown et al., 1981; Max, Robin et al., 1997; Max, Smith et al., 1997). However, this has not been the case in other studies (Black et al., 1969; Luis & Mittenberg, 2002; Max, Koele et al., 1998; Max, Lindgren et al., 1997; Max, Lindgren, Robin et al., 1997; Max, Pardo et al., 2013; Max,

Schachar et al., 2013). Considering these findings in more detail, this shows that in one prospective study of the development of novel psychiatric disorders following paediatric TBI, lifetime psychiatric disorders were significantly associated with new-onset psychological problems in the first 3 months after head injury, but not in the following 3 to 6 months after injury. This may represent the process of adjustment whereby immediately after TBI children with pre-injury psychiatric difficulties are especially vulnerable to the development of psychological disorders. However, this susceptibility is overcome later once the initial disruption of the event has lessened.

These findings should be viewed with caution as measures of pre-injury anxiety and psychiatric disorders are always conducted retrospectively and thus are open to subjectivity, inaccuracy and recall bias. Although many studies aim to conduct such assessments as soon as possible after injury, post-injury assessments of pre-injury psychiatric function are sometimes not conducted until 4 years (Max, Koele et al., 1998) or more after injury (Hawley, 2003).

Cognitive, Intellectual and Adaptive Functioning

Intellectual and adaptive functioning may also be expected to be relevant factors, since intellectual ability is often seen as protective and increased adaptive skills may allow a child to feel self-sufficiency and confidence, helping limit some anxious symptoms. Although the impact of intellectual and adaptive functioning on anxiety disorders after paediatric TBI has not been directly examined, studies have investigated associations between this and psychiatric disorders in general. Max, Robin et al. (1998) found adaptive and intellectual functioning to be predictive of novel psychiatric disorder, while intellectual/academic functioning in particular was significant in more studies (Brown et al., 1981; Max, Lindgren,

Robin et al., 1997; Max, Pardo et al., 2013; Max, Schachar et al. 2013; Max, Smith et al., 1997).

Interestingly, Max, Schachar et al. (2013) reported that novel psychological problems were related to concurrent deficits in intellectual functioning, expressive language and processing speed but not executive function. A study using the same sample at 12 month follow-up found similar results with the addition of memory impairment as a factor related to new-onset psychiatric disorders (Max, Pardo et al., 2013). From these findings one may hypothesise that brain injury results in increased risk for psychological and cognitive problems (Max et al., 1999). In contrast, Max, Lindgren et al. (1997) did not find intellectual functioning to be significant in relation to psychiatric disorders after childhood TBI and Max, Schachar et al. (2013) reported no association between novel psychiatric disorders and adaptive functioning. A study evaluating the same sample at 6 – 12 months post-TBI did find a significant relationship between new onset psychiatric disorders and concurrent deficits in adaptive functioning, even when pre-injury adaptive functioning was controlled (Max, Pardo et al., 2013). These contrasting results may be suggestive of behavioural change accompanying new psychiatric disorders which become more apparent over time. However, a control group, such as an orthopaedic-injured sample would help to clarify these disparities to ascertain whether this is due to the effects of brain damage alone.

Litigation

Although often reported as a salient factor in psychological well-being in adults following TBI, litigation was not found to be associated with the development of anxiety or other psychiatric disorders after paediatric TBI (Luis & Mittenberg, 2002; Max, Lindgren, Robin et al., 1997; Max, Smith et al., 1997).

DISCUSSION

Measurement of Anxiety

All of the measures used across the reviewed studies represent standardized instruments with reasonable validity and reliability. However, self-report measures of severity such as the TAD and HADS are vulnerable to subjectivity due to participants potentially generating socially desirable responses or acquiescing. These problems may be intensified when children have recently suffered brain injury.

The assessment of psychological difficulties using only caregiver ratings is also not always reliable. It has been reported that while teachers tend to report more behavioural/externalising problems, parents are more sensitive to their child's internalizing difficulties (Max, Koele et al., 1998). This may not have led to under-reporting of anxiety disorders, although may cause a lack of recognition of commonly comorbid conditions such as ADHD (Schatz & Rostain, 2006). Nevertheless, parents may miss symptoms of anxiety which are not immediately apparent or the child self-consciously hides. Contrastingly, parents anxious about their injured child may also misinterpret normal behaviours as signs of anxiety in line with their own concerns. Both these processes could lead to an under or over-representation of anxiety within a sample. These difficulties can also be present in psychiatric interviews which rely solely on parent-reported symptoms. Although, some studies suggest that parent-reported assessments alone are sufficient to identify anxiety disorders (Jensen et al., 1999). Long-term follow-up of difficulties represents another means of establishing reliability of diagnoses over time.

DSM-IV informed psychiatric interview is generally viewed as the optimal platform for diagnosis of mood disorders. However, this too is susceptible to methodological issues.

Grados et al. (2008) note that their study focused exclusively on identified Obsessive Compulsive Disorder (OCD) and Obsessive Compulsive Symptoms (OCS). However, the psychiatric interview schedule used, the DICA-R, was limited in its assessment of OCS, for example, not examining religious obsessions, counting, touching or hoarding. This may have led to an under-estimation of OCD symptoms, lowering study power. Future research investigating specific anxiety disorders may benefit from the use of measures designed to explore that particular disorder alone to avoid this. Furthermore, the DICA-P was developed for use with ages 6 – 17 years, but was utilised by Vasa and colleagues (2002) when the age of the sample exceeded these parameters because a comparable standardized measure could not be sourced. Nevertheless, Bloom et al.'s (2001) findings also demonstrated that psychiatric interviews corresponding to DSM-IV criteria were more successful in identifying pre-injury and current mental health problems, including internalizing or sub-threshold problems, than parent-rated measures, in agreement with other research (Brown et al., 1981; Lehmkuhl & Thoma, 1990).

However, included studies rarely reported psychiatrists who assigned diagnosis being blind to variables such as severity of injury, pre-injury and post-injury psychiatric status, or family function, which may have influenced results through interviewer bias. In addition, information on pre-injury psychiatric diagnoses, although often assessed, was usually gathered retrospectively and is therefore subject to memory and other biases. Overall, half of the studies included used psychiatric interview alone to diagnose anxiety disorders/symptoms. Ideally, future research would benefit from the use of mixed methods measures such as self-report, parent-report, teacher reports, observations and psychiatric interview to gain comprehensive information across contexts.

Impact of Demographic and Other Confounding Factors

The importance of considering the impact of demographic features is clear when acknowledging that the psychological health of children who experience TBI will be influenced by multiple factors. The significance of demographic variables in understanding emotional problems after TBI has been highlighted in adult populations (Draper, Ponsford & Schönberger, 2007; Ponsford, Draper & Schönberger, 2008; Vanderploeg, Curtiss, Duchnick & Luis, 2003). Therefore, studies which include these factors in their analyses are likely to arrive at more in-depth conclusions relating to the development of anxiety disorders post-TBI and aid in the recognition of individuals most at risk for negative outcomes. The majority of research is in agreement that psychosocial variables, in particular family functioning, are crucial in predicting the development of novel psychiatric disorders and determining outcome after TBI in childhood. However, further research is required to examine this variable in relation to anxiety disorders specifically. Results from examining other relevant demographic factors were less conclusive, with studies reporting inconsistent findings relating to the influence of age at injury, race, gender and pre-injury psychiatric history. These discrepancies highlight the need for replication in larger samples utilising the same measurement tools and definitions to clarify risk factors.

The finding that pre-injury, worsening family functioning in particular, in association with increased family psychiatric history, stress and deprivation is associated with higher levels of psychiatric disorders in children after TBI is prominent. Although the influence of genetic loading is relevant to children with TBI, this is also the case in children without TBI. Brain-injured children may experience the influence of genetic predisposition in addition to phenotypic influences in the development of anxiety disorders. Furthermore, there is a bidirectional relationship between family functioning and psychological outcome and

improvement after childhood TBI. Possible reasons for this may be that more affluent families have improved access to additional resources such as privately funded medical care and they may feel more empowered to request additional information and support. These results are reflected in the literature in general, which finds that more adaptive family functioning and healthy parental psychological adjustment is associated with improved adjustment for children with chronic health conditions (Drotar, 1997). Future research may benefit from further exploration of these findings using larger samples followed over time in order to assess the impact of family functioning on anxiety disorders post-TBI as children develop and deficits become more pronounced or are improved through rehabilitation.

Although some studies used measures of adaptive functioning, a salient confounding variable barely assessed relates to the existence and impact of other injuries. Children who sustain head injuries are likely to incur other physical hurt, possibly leading to physical or sensory disabilities. The level and nature of these would be likely to impact on psychological health, including anxiety disorders, but was rarely reported. Hawley (2003) noted that in their sample, 53.1% of children with mild head injury suffered other injuries at the time of the TBI as did 31.6% of those with moderate TBI and 75.9% with severe TBI. When surveyed, these injuries were still causing difficulties for 32% of the whole TBI sample years later, potentially influencing anxiety problems. Further exploration of this in future research seems necessary in order to establish a clear understanding of mechanisms maintaining and impacting on the development of anxiety disorders after paediatric TBI.

Summary and Overall Methodological Quality of Published Research Studies

Providing a definitive statement on the frequency of anxiety disorders after childhood and adolescent TBI remains challenging. Although measurement of TBI was consistent and fairly

robust across studies, inconsistencies in the instruments used to assess anxiety as well as definitions of what constitutes anxiety disorders varied widely across research making direct comparisons between frequency rates problematic. Further issues in the literature relate to duplication of data from the same participants in different published studies and different sampling methods, for example prospective and retrospective, and consecutive hospital admissions or recruitment from post-acute services. Differences in recruitment may also impact on frequencies of reported anxiety, as it is possible that anxiety disorders could be over-represented in populations referred from specialist services.

Methodological quality of the majority of research in this area was reasonable, rated as 'Moderate' (10/14; 71.4%), with the remaining being predominantly 'Low' quality (3/14; 21.4%) as only one study received a rating of high methodological quality. Furthermore, although many studies noted that informed consent had been granted by parents and children with TBI, the majority of studies did not directly report this or note what ethical approval had been achieved for the research (71.4%).

The highest quality study (Max, Koele et al., 2008) discovered a variety of anxiety disorders in children with mild brain injury, while none of the orthopaedic-injured control group exhibited any anxiety disorders. The latter research utilised a control group, based diagnosis of TBI robustly on GSC and CT scans and measured anxiety and other psychiatric disorders through psychiatric interview supplemented by parent and teacher reported measures.

However, this study was not devoid of methodological issues. The cross-sectional nature of the study precludes any statements on causation and prohibits knowledge of how anxiety disorders change when followed over time. Furthermore, the study relied on gathering data

retrospectively from participants at one point in time, sometimes when injuries had transpired up to 4 years previously, leading to recall bias and inaccuracies in data, as well as sample dissimilarities due to variations in injury-to-assessment time intervals which were not explored in analysis. A small sample size was used, reducing statistical power and interviewers were not blind to injury severity of participants. Nevertheless, inter-rater reliability was assessed with another child psychiatrist blind to severity and was found to be good. The use of assessment at one time point as opposed to multiple assessments through prospective follow-up is also a clear limitation. Therefore, these frequency rates cannot be directly compared with rates derived from large population-based incidence or prevalence studies due to these methodological issues.

Distinguishing between incidence and prevalence studies, and comparing these, is problematic. The majority of included articles could not be categorised as incidence or prevalence studies. No study investigated anxiety at specified time points, most examining this at any point within a defined period of follow-up meaning that accurate person-time incidence rates could not be provided. None of the studies followed and monitored anxiety symptoms/disorders at regular intervals across follow-up periods, instead performing baseline assessments typically as soon as possible after head injury or study enrolment, then one further assessment between three months (Max, Smith et al., 1997) to over four years post-injury (Max, Koele et al., 1998) without intermittent follow-up between these periods. Since anxiety often exhibits a remitting and relapsing course, this design could lead to diagnoses being missed and not represented if, for example, an individual became anxious but this resolved between assessment points. This design also limits the identification of relevant risk factors associated with post-TBI anxiety and so reduces the clinical utility of the research. Indeed, Max et al.'s series of published follow-up studies of post-TBI psychiatric disorders

demonstrates the fluctuating pattern of anxiety, which reportedly varied in children at three months (Max, Smith et al., 1997), six months (Max, Lindgren, Robin, et al., 1997), one year (Max, Robin et al., 1998) and two years post-injury (Max, Robin et al., 1997). However, it should be noted that these findings simply relate to the proportion of a small sample who had an anxiety disorder within that time period. Many of these participants may have developed anxiety during the first three months post-injury, some of whom could have developed a condition initially which then resolved, whilst others developed disorders only during the particular period under review. Aside from results from the original 3 month study, the data provided therefore cannot be used to determine incidence.

Study aims conflated typical prevalence and incidence goals, and subsequently employed mixed study designs, planning to investigate both the frequency of anxiety disorders and risk factors associated with the development of these. Equally, two of the fourteen included articles excluded individuals with pre-injury psychological problems (Bloom et al., 2001; Geraldina et al., 2003) while the other studies did not, causing further difficulties with synthesising study findings as these cannot be directly comparable. These dissimilarities in assessment, inclusion/exclusion criteria, approach, aims and study design meant that it was not possible to combine results across studies. Future research should aim to address this by setting out clear research aims supported by appropriate epidemiological study designs suitable for an incidence or prevalence study. This would give greater clinical usefulness to findings by allowing for effective mental health service planning following on from prevalence studies, or elucidation of relevant risk factors and appropriate screening of these in well-designed incidence studies conducting regular, prospective assessments at appropriate intervals.

Conclusions

Overall, the available evidence indicates that anxiety disorders after TBI in childhood and adolescence occur frequently, and those sustaining more severe injuries appear at increased risk. Results highlighting the importance of family functioning in the development and maintenance of psychiatric disorders in general following childhood brain injury are suggestive that further investigation into family functioning and anxiety is warranted.

More research is needed of a high quality, employing larger samples, clear methodology and following participants at regular intervals over time. The use of the same standardised instruments across studies and mixed methods to gather in-depth information is advocated to allow meaningful comparisons across studies. In considering pre and post-injury anxiety in children with TBI and their families, researchers should indicate the type, severity/degree of impairment and duration of disorders. Similarly, the same is required in measurement of demographic factors to allow elucidation of salient risk factors.

Other confounding variables, in particular the consideration of other injuries and physical disabilities, should also be examined in relation to anxiety disorders after childhood TBI. Future studies would benefit from the use of matched control groups identified through probability sampling and followed in longitudinal research designs to increase methodological strength. This information could allow for increased planning and implementation of prevention programs.

More research is needed to explore anxiety presentation in younger children aged 0 – 6 years who are rarely investigated yet especially vulnerable to neurological insult. Future research and clinical practice may aim to address this by reviewing younger children more frequently

in order to gain an accurate diagnosis of their difficulties. The development of standardised instruments to assess this is also crucial to allow successful diagnosis of these problems.

A systematic review exploring psychological treatment for anxiety disorders after TBI in adults suggests the use of Cognitive Behaviour Therapy (CBT) and CBT combined with neuro-rehabilitation (Soo & Tate, 2007). There are no known randomised controlled trials investigating the use of CBT to treat anxiety disorders in children with brain injury and future research should seek to do so.

Finally, research comparing the impact of inpatient versus outpatient treatment and community care on psychological well-being and the development of anxiety disorders is lacking. This seems overdue and may be of particular relevance in the future due to the increasing trend for children with mild TBI to be discharged home after presentation at hospital emergency facilities.

Clinical Implications

The findings implicating severity of injury and possibly other factors such as younger age at injury, gender and pre-injury anxiety as important potential risk factors may aid clinicians in identifying children most vulnerable to the development of anxiety problems post-TBI. Screening should be used regularly with those children who have additional risk factors which increase their susceptibility to anxiety disorders.

Since many studies conclude family functioning to be central to post-injury psychiatric disorders in children, this would implicate the potential usefulness of family-based therapies in the treatment of psychological difficulties in children following TBI. Additional support

should be routinely offered to families to reduce stress levels and promote rehabilitation and reintroduction into society.

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MAJOR RESEARCH PROJECT

Cognitive and Affective Predictors of Participation in Rehabilitation after Acquired Brain Injury

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*Prepared in accordance with the instructions to authors for Neuropsychological
Rehabilitation (see Appendix 2.1)*

LAY SUMMARY

Background

Cognitive impairment and emotional problems are both very common after individuals suffer an Acquired Brain Injury (ABI) such as a stroke or Traumatic Brain Injury (TBI). This study investigated whether the way in which the brain is able to process information and mood difficulties such as depression impact on a person's ability to engage and participate in rehabilitation after suffering a brain injury. In relation to processing information, the study investigated the effect of difficulties with executive functioning, which refers to the cognitive abilities that support planning, problem solving, task management and the regulation of our behaviour.

Questions to be addressed by the study

1. Is impairment of executive functioning associated with poorer engagement in rehabilitation?
2. Is depression associated with poorer engagement in rehabilitation?
3. Is general cognitive impairment associated with poorer participation in rehabilitation?

Methods

Participants were 29 patients with ABI receiving rehabilitation in NHS Highland from physiotherapists and/or occupational therapists. Participants completed a questionnaire about their mood and assessments of executive functioning, while physiotherapists and/or

occupational therapists already involved in their care noted how well patients participated in each rehabilitation session.

Results and Conclusions

Analysis of the data showed that patients who had more impaired executive functioning and lower mood showed significantly poorer participation in their rehabilitation. This finding has important implications since research has previously shown that the majority of progress made in treatment is in the early stages of rehabilitation after brain injury. It is, therefore, crucial that people with depression and difficulties with executive functioning are identified early on through screening. This would allow identified individuals to receive extra support to help them engage in their rehabilitation in order for them to maximise their potential and get the most out of their rehabilitation.

ABSTRACT

Objective

The present study aimed to investigate the factors relating to mood and cognition which influence a person's ability to participate in rehabilitation after Acquired Brain Injury (ABI). It was hypothesised that impairment in cognition, including specific impairment in executive functioning and depression would be associated with poorer engagement in rehabilitation.

Method

Twenty-nine patients undergoing rehabilitation following stroke (89.7%) or TBI (10.3%) participated. Individuals recruited completed the Hospital Anxiety and Depression Scale as a measure of mood and an executive functioning test battery. Data collection occurred over a two week period as concurrent ratings of participation were gathered from physiotherapists and occupational therapists using the Pittsburgh Rehabilitation Participation Scale.

Results

In support of the hypotheses, correlation analysis showed a significant positive correlation between participation in rehabilitation with executive functioning ($p < .05$) and a significant negative correlation between participation in rehabilitation and low mood ($p < .05$). No association was found between general cognitive ability, functional disability, time since injury, age, gender and participation.

Conclusions

Low mood and executive functioning may influence the ability of patients with ABI to engage in rehabilitation. The clinical implications of this are discussed along with suggestions for future research.

Keywords: Acquired Brain Injury, rehabilitation, executive functioning, depression

Word Count: 5875

INTRODUCTION

Acquired Brain Injury (ABI) is defined as “damage to the brain that was sudden in onset and occurred after birth and the neonatal period” (Scottish Needs Assessment Programme Report, 2000). There are various causes of ABI including stroke, tumours or Traumatic Brain Injury (TBI) due to, for example, falls or road accidents. ABI is a significant cause of mortality and morbidity in Scotland. A recent 13 year study following head injury patients in Glasgow found that the death rate for individuals with ABI was over double that for the general Scottish population (McMillan, Teasdale, Weir, Stewart, 2011). Furthermore, stroke is the leading cause of complex disability (Adamson, Beswick & Ebrahim, 2004) and third most common cause of death in the UK (Wolfe, 2000). ABI does not only affect the individual who obtains the injury, but their family, social life, work and the entire system surrounding them.

ABI can result in physical, behavioural, hormonal, emotional, cognitive and executive functioning difficulties (Headway, 2013). Physical problems after brain injury can include weakness, paralysis and spasticity. Rehabilitation after ABI involves a multidisciplinary approach. Decades of research shows that the majority of recovery occurs during the initial months of rehabilitation after stroke and ABI (Dikmen, 1990; Skilbreck, Wade, Hewer & Wood, 1983). The UK National Clinical Guideline for Stroke (2012) recommends that for every person who has a stroke: “rehabilitation services should be commissioned to reduce impairment, promote recovery and increase ability to participate and improve quality of life using adaptive rehabilitation strategies” (p. 17).

Cognitive impairment is common following ABI. It exists in approximately 70% to 78% of stroke patients in the acute stages of recovery in at least one cognitive domain (Lesniack, Bak, Czepiel, Seniow & Człankowska, 2008; Nys et al., 2005) and is a strong predictor of dementia and functional dependence long-term (Nys et al., 2007). Among those with TBI, the cognitive domains of executive function, memory and processing speed are frequently affected (Kinnunen et al., 2010) and these deficits can be long-lasting (Draper & Ponsford, 2008). Impairments in executive functioning following TBI are related to functional outcome (Wang, Chan & Shum, 2014). Problems with executive functioning are also the most common cognitive impairments post-stroke (Zinn, Bosworth, Hoenig & Swartzwelder, 2007), occurring in approximately 39% of cases (Nys et al., 2007; Zinn et al., 2007), and have been shown to impact on the effectiveness of stroke treatment (McDowd, Filion, Pohl, Richards & Stiers, 2003; Mok et al., 2004).

A recent systematic review (Poulin, Korner-Bitensky, Dawson & Bherer, 2012) concluded that persons with stroke could benefit from specific executive function training interventions and by learning compensatory strategies. Similarly, another meta-analysis reported evidence for the effectiveness of attention training after TBI (Rohling, Faust, Beverly & Demakis, 2009). The Scottish Intercollegiate Guidelines Network (SIGN; 2010) recommend detailed cognitive assessment following stroke to quantify the nature and extent of deficits and abilities. SIGN Guidelines (2013) recommend that individuals with cognitive impairment following TBI should receive comprehensive multidisciplinary input to guide holistic, goal-focused rehabilitation programmes. This would have “the capacity to address cognitive, emotional and behavioural difficulties with the aim of improving functioning in meaningful everyday activities” (p. 8).

Previous research has also documented the prevalence of mental health problems such as anxiety, depression, emotionalism and PTSD after ABI (Burvill et al., 1995; Hackett, Yapa, Parag & Anderson, 2005; Hibbard, Uysal & Kepler, Bogdany & Silver, 1998). Prevalence rates of depression are similar after both TBI and stroke with approximately 20–40% affected at any time during the first year, while around 50% of people experience depression at some point (Fleminger, Oliver, Williams & Evans, 2003). A large cohort study including 559 participants found that 53.1% of people with TBI met criteria for depression at some point during the year following injury, nearly eight times greater than the general population (Bombardier et al., 2010). However, these studies are complicated by the difficulties in recognising, assessing and diagnosing an underlying mood disorder in the presence of symptom overlap and co-occurring cognitive and language impairments, or behavioural syndromes, caused by acute brain insults such as stroke and TBI (Hackett, Anderson, House & Halteh, 2008; McMillan, 2001).

There has been very little investigation of how cognitive and mood factors directly contribute to participation in rehabilitation. For example, Skidmore et al. (2010) examined an older adult population who had experienced stroke using the Digit Span Test from the Wechsler Adult Intelligence Scale III (WAIS-III; Wechsler, 1997), Hopkins Verbal Learning Test (Shapiro, Benedict, Schretlen & Brandt, 1999), Executive Interview (Royall, Mahurin & Gray, 1992), Hamilton Rating Scale for Depression (Hamilton, 1960) and Apathy Evaluation Scale (Marin, Biedrzycki & Firinciogullari, 1991). They found that both executive functioning and depressive symptoms were correlated with participation in rehabilitation but that executive functioning and baseline disability were the only significant predictors of engagement in rehabilitation in a multiple regression analysis. Further research is required to validate these findings and extend them to a wider ABI population. The importance of establishing whether

there is a relationship between executive functioning, depression and a person's ability to participate in rehabilitation has clear implications for the need to assess and treat these difficulties in the rehabilitation environment in order to maximise gains. It would also be of interest to examine whether screening measures commonly used in rehabilitation settings can identify those with difficulties engaging in rehabilitation.

Aims and Hypotheses

Aims

To investigate whether general cognition, executive functioning and depression affect participation in rehabilitation after ABI.

Hypotheses

1. The primary hypothesis is that more severe impairment of executive functioning as measured by the Hayling and Brixton Tests (Burgess & Shallice, 1997), Colour Word Interference Test (Delis, Kaplan & Kramer, 2001) and Addenbrooke's Cognitive Examination III fluency subscale (ACE-III; Hodges, 2012) will be associated with poorer engagement in rehabilitation (as assessed by the Pittsburgh Rehabilitation Participation Scale; PRPS; Lenze et al., 2004).
2. The secondary hypothesis is that higher ratings of depression measured on the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) will be associated with poorer engagement in rehabilitation.
3. More severe cognitive impairment measured by the ACE-III will be associated with poorer engagement in rehabilitation.

METHODS

The present study represents a cross-sectional, correlational research design.

Ethical Approval

Ethical approval was granted by the North of Scotland Research Ethics Committee (see Appendix 2.2). Site approval was awarded by NHS Highland Research and Development Department (see Appendix 2.3 for further details).

Participants

Participants were a sample of 29 adult patients with an ABI receiving rehabilitation from physiotherapists and/or occupational therapists in NHS Highland. Thirty-three participants were approached for recruitment into the study. Consecutive admissions to inpatient rehabilitation wards were invited to participate, resulting in recruitment of 28 participants. An additional 3 consecutively admitted patients undergoing community rehabilitation were also included. However, two participants declined to participate and another two participants were excluded from analysis: one due to incomplete data and another because at the time of inclusion in the study they were believed to have suffered a TBI from a fall but later investigations proved head injury had not been sustained on falling and neurological difficulties were due to a neurological degenerative condition.

Inclusion Criteria

Participants had suffered an acquired brain injury and were undergoing rehabilitation in physiotherapy and/or occupational therapy. Participants were medically stable, fully

conscious and had the capacity to give informed consent as determined by a medical rehabilitation consultant.

Exclusion Criteria

All patients fitting inclusion criteria and willing to participate in this study were deemed suitable unless they had severe aphasia, current substance misuse, previous diagnosis of dementia, learning disability or were under 16 years old.

Justification of sample size

A power calculation using G*Power (Faul, Erdfelder, Buchner & Lang, 2009) was based on effect sizes taken from a similar study (Skidmore et al., 2010) which found a correlation between participation in rehabilitation and executive functioning of $r = .55$ and with depression of $r = .39$. The present study employed a comprehensive battery of executive function tests and a measure of depression designed for a hospital population (HADS) and it was therefore expected that a large effect would be found for both these relationships. Using an effect size estimate of $r = .5$, a power of .8 and alpha of .05 (two-tailed) provided a sample size estimate of 29 for the main hypotheses.

Procedure

Participants were recruited from a 22 bed stroke ward and an 8 bed neurological rehabilitation ward in Raigmore Hospital, Inverness, and from local community rehabilitation services. Potential participants were approached, invited to participate in the study and

provided with written information about the research (see Appendices 2.4 & 2.5) which could be read aloud and explained to them. After being given time to consider their decision to participate written informed consent was sought prior to taking part (see Appendix 2.6).

Over a maximum two week time period the HADS, ACE-III and executive battery was administered by the researcher and the PRPS completed by rehabilitation therapists after each session. Rehabilitation therapists received standardized instruction on the completion of the PRPS. Occupational therapists and physiotherapists also completed the Functional Independence Measure (FIM; Turner-Stokes, Nyein, Turner-Stokes & Gatehouse, 1999) as part of routine practice to assess disability. Demographic information and information on the type and location of brain injury was also gathered for each person when available. The Wechsler Test of Adult Reading (WTAR; Wechsler, 2001) was conducted to measure premorbid intellectual functioning.

The tests and monitoring of participation by rehabilitation staff was therefore completed concurrently, allowing the results of the assessments to be shared with rehabilitation staff after the two week period of data collection had elapsed to inform and aid future rehabilitation planning.

Participants were assessed in private rooms under test conditions in Raigmore Hospital (Inverness), County Community Hospital (Invergordon), Nairn Town and County Hospital and Ian Charles Community Hospital (Grantown-On-Spey). Quiet rooms were selected and distractions removed. Assessment sessions typically lasted one hour but were split into more

than one session for participants who were unable to maintain concentration for this length of time. Tests were administered in order: ACE-III, Hayling Test, Brixton Test, WTAR, Colour Word Interference, HADS.

Measures

PRPS

The PRPS is a criterion-referenced measure in which rehabilitation therapists rate the degree a patient actively participated in each rehabilitation session (Lenze et al., 2004). Each session is scored 1 (no participation/refusal) to 6 (excellent participation). The PRPS has been shown to have good predictive validity (the ability of the PRPS to predict patients' rehabilitation outcome) and high interrater reliability with intraclass correlation coefficient (ICC) .91 for Occupational Therapy and .96 for Physiotherapy (Lenze et al., 2004). See Appendix 2.7 for full PRPS.

HADS

The 14-item self-report HADS is a screening measure of anxiety and depression specifically designed to consider issues relevant for use in somatic medical settings. HADS-A consists of seven items rating anxiety and HADS-D of seven items rating depression. Each item is scored from 0 to 3, and the HADS-A and HADS-D scores are the sum of the relevant item scores. Good reliability and validity of the HADS has been demonstrated internationally (Herrmann, 1997) and in stroke (Turner et al., 2012) and ABI populations (Dawkins, Cloherty, Gracey & Evans, 2006).

ACE-III

The Addenbrooke's Cognitive Examination III is an updated version of the Addenbrooke's Cognitive Examination-Revised (Mioshi, Dawson, Mitchell, Arnold & Hodges, 2006). The ACE-R is a well validated and reliable measure designed to detect patients with dementia in community samples which has since been validated across a range of populations, including detecting impairment in visuospatial, attention and executive cognitive domains in a stroke population (Morris, Hacker & Lincoln, 2012). A recent study suggests that the ACE-III has similar psychometric properties to the ACE-R. The authors also note that the fluency subscale is the "only component which relies heavily upon executive function" and as such was used as an additional executive functioning measure in the present study (Hsieh, Schubert, Hoon, Mioshi & Hodges, 2013).

Hayling and Brixton Tests

These two tests aim to assess behavioural regulation and were developed to be sensitive to symptoms of executive disturbance. The Hayling Test evaluates initiation speed as well as response suppression, while the Brixton Spatial Anticipation Test is a rule attainment task. The reliability and validity of the Hayling and Brixton Test has been shown to be adequate (Burvill et al., 1995) in older adult and stroke populations also (Bielak, Mansueti, Strauss & Dixon, 2006; Van Den Berg et al., 2009) and both tests correlate with other measures of executive function (Clark, Prior & Kinsella, 2000; Marczewski, Van der Linden & Laroi, 2001) with evidence of ecological validity (Stokes & Bajo, 2003).

Colour Word Interference Test (Delis–Kaplan Executive Function System subtest)

A modified version of the Stroop's (1935) procedure testing inhibition of an over-learned response and flexibility. Reliability and validity of the D-KEFS and Colour Word Interference Test specifically is good, with adequate internal consistency and test-retest reliability (Delis, Kramer, Kaplan & Holdnack, 2004).

Wechsler Test of Adult Reading (WTAR)

Is a well validated and reliable test of premorbid (pre-injury) intellectual functioning in which patients are asked to read aloud 50 words with atypical grapheme to phoneme translations (Wechsler, 2001). The WTAR has been validated for use with TBI populations (Green et al., 2008).

Functional Independence Measure (FIM)

The FIM is a widely used measure of global disability that incorporates aspects of functional performance such as grooming, eating, mobility and dressing. Assessment is through ratings on a 7-point ordinal scale ranging from total independence to complete assistance required, with higher scores indicating greater functional ability. The FIM is a valid and reliable measure, the effectiveness of which has been demonstrated in those undergoing neuro-rehabilitation (Kidd et al., 1995) and individuals aged 80 years and above (Pollak, Rheault & Stoecker, 1996). In this study, the FIM was completed by occupational therapists and physiotherapists as part of standard ward practice on patient admission and discharge.

Statistical Analysis

Data were analysed using SPSS statistics (version 19). Sample characteristics were explored using descriptive statistics and distributions of data were examined for normality. Scores on executive functioning measures were converted to z-scores using published test norms and summed to provide a composite executive functioning score for each participant. Spearman's rho correlations were performed to explore the associations between measures of depression, executive functioning, cognition and participation in rehabilitation.

RESULTS

Sample Characteristics

Data from 29 participants were included and analysed in the present study. Descriptive statistics were computed by calculating the means and standard deviations of variables to examine demographic information. Participants ranged in age from 52 to 93 years ($M = 70.3$, $SD = 11.6$), with 16 males (55.2%) and 13 females (44.8%). Most of the participants were white (96.6%; 3.4% black). Only one participant (3.4%) received education beyond High School level. Participants were assessed for the study on average 95.9 days after suffering ABI ($SD = 100.9$).

The majority of the sample had experienced stroke (89.7%) with 10.3% of participants having suffered TBI. Injury occurred predominantly in the right hemisphere in 48.3% of participants; left hemisphere in 31.0%; both hemispheres in 3.4% and the location of damage was unknown in 17.2% of participants. ABI insult was largely due to ischemic stroke (51.7%) or some form of haemorrhage (41.4%) and was unknown in 6.9% of cases.

One previous ABI such as a stroke or head injury had occurred in 7 participants (24.1%), more than one prior ABI occurred in 2 participants (6.9%) and the majority had experienced no previous ABIs (20; 69.0%).

ACE-III

Descriptive statistics of the ACE-III are reported in Table 1 for this ABI population alongside those attained by Hsieh and colleagues (2013) in their control group (M age = 64.4, $SD = 5.7$) for the ACE-III total score and attention, language and visuospatial domains. The latter study

does not report information regarding fluency and memory domains and so these are compared with those obtained using the ACE-R by Mioshi et al. (2006) in their control group (M age = 66.0, SD = 6.3). The memory and fluency scales within the ACE-III were not changed from the ACE-R and although it would have been helpful to have been provided with data for these subscales, it seems likely that they are reasonably comparable. In addition, Hsieh et al. reported that the correlation between the two assessment tools is very high ($r = .99$). Mean scores from the present sample were lower than Hsieh et al.'s (2013) and Mioshi et al.'s (2006) control groups and typically above those reported for dementia groups. However, mean scores in the visuospatial domain were slightly lower than those attained by the dementia groups in the same studies (Hsieh et al., 2013; Mioshi et al., 2006).

Table 1

Descriptive statistics from present sample and control group from Mioshi and colleagues (2006) and Hsieh and colleagues (2013) of the total ACE-III scores and domains

	<i>N</i> = 29			
	Mean	SD	Mean	SD
ACE-III Total Score	74.9	16.6	* 95.4	3.3
100 Point Maximum				
Attention Domain	14.4	3.4	* 17.4	1.2
18 Point Maximum				
Memory Domain	18.4	6.7	# 23.4	2.7
26 Point Maximum				
Fluency Domain	7.8	3.1	# 11.9	1.7
14 Point Maximum				
Language Domain	22.3	3.6	* 25.6	.6
26 Point Maximum				
Visuospatial Domain	11.4	2.3	* 15.6	.6
16 Point Maximum				

* Control Group *N* = 25 (Hsieh et al., 2013)

Control Group *N* = 63 (Mioshi et al., 2006)

Table 2 below presents the mean, standard deviation and median for each of the other measures taken including WTAR, FIM, HADS, Hayling, Brixton and Colour Word Interference Tests. Overall performance scores were used for each participant on the Hayling and Brixton Tests. For the Colour Word Interference task, the score relating to switching attention and inhibition was selected as this was believed to be the aspect of executive functioning most likely to impact on a person's ability to engage well in rehabilitation. Each

of these selected scores, together with the ACE-III verbal fluency scores were then converted to z-scores. Hayling and Brixton and Colour Word Interference scores were converted using the standard score (Sten score and Weschler score) that each person achieved and transforming this to a z-score using the equation for converting a standard score with one metric (e.g. Sten score) into a standard score with another metric (e.g. z-score). Z-scores were calculated for each participant on the fluency subscale of the ACE-III using published mean and SD information for the fluency subscale. Because different executive function tests may capture different aspects of executive functioning, but each could potentially impact on participation, to try to better capture this z-scores from individual executive functioning tests were summed to produce a composite score. The mean of the composite executive functioning score was -6.8 (SD = 3.6) and the median was -5.8.

Table 2

Descriptive statistics from the present sample for the WTAR, FIM, HADS Domains, Hayling Test z-score, Brixton Test z-score and Colour Word Interference Test inhibition/switching z-score

	<i>N</i> = 29		
	Mean	SD	Median
WTAR (estimated pre-morbid IQ)	97.3	9.2	96.5
FIM	68.6	26.9	75.0
HADS Depression	5.4	4.9	4.0
HADS Anxiety	4.9	3.3	4.0
Hayling Test (z-score)	-1.3	1.1	-1.8
Brixton Test (z-score)	-1.8	.8	-2.3
Colour Word Interference Test (z-score)	-1.4	1.2	-1.7

Correlations

The level of correlation between ratings of engagement in rehabilitation sessions and measures of mood, executive functioning and general cognition were examined. Given the ordinal nature of the PRPS and several of the cognitive measures being non-normally distributed, non-parametric Spearman's rho correlations were conducted to explore the associations between measures of depression, executive functioning, cognition, and participation in rehabilitation.

Rehabilitation sessions for 23 participants were obtained from 15 occupational therapists, while 16 participants received PRPS ratings from 12 physiotherapists. Ten participants (34.5%) were undergoing rehabilitation from both occupational therapists and physiotherapists and so received PRPS ratings from both. Participation was generally rated as 'Very Good' by both occupational therapists (Median = 5, IQR = 4 – 5) and physiotherapists (Median = 5, IQR = 4 – 5). A Wilcoxon Signed-Rank Test was conducted to investigate whether systematic difference was present between PRPS ratings provided by occupational therapists and physiotherapists. This was non-significant ($T = -.82, p = .41$) and so all rehabilitation sessions carried out by both professions were analysed together.

Participants received between 3 and 24 rehabilitation sessions over the two week assessment period. For each participant a median PRPS rating was calculated. The overall median participation rating for the whole sample was 5 (IQR = 4 – 5.5). Data collection was complete for all participants on all measures except for missing FIM data for two participants.

Given that the analysis involved multiple correlations, the question arose of whether a correction for multiple comparisons should be applied, such as Bonferroni correction. However, because very specific apriori hypotheses were established and given the modest sample size, it was decided to use a conventional p-value of .05 in order to balance the possibility of type 1 and type 2 errors.

Table 3 presents the correlation data examining the associations between PRPS ratings and the measures of cognition, mood and other demographic variables. In line with the primary

hypothesis that more severe impairment of executive functioning would be associated with poorer engagement in rehabilitation, participation scores were significantly positively correlated with executive functioning ($p < .05$) and attention ($p < .05$). In support of the secondary hypothesis that higher ratings of depression would be associated with poorer engagement in rehabilitation, participants who showed poorer participation in their physiotherapy and occupational therapy rehabilitation exhibited significantly lower mood ($p < .05$). However, the final hypothesis that more severe cognitive impairment measured by the ACE-III would be associated with poorer engagement in rehabilitation was not supported ($\rho = .27, p > .05$).

Age, time since injury, pre-morbid IQ (WTAR) and functional disability level (FIM) were not significantly related to participation. A Mann-Whitney U Test showed there to be no effect of gender on participation ($U = 80.0, z = -1.1, p = .31$).

Table 3

Bivariate Spearman's rho correlations between participation and depression, executive functioning, overall cognition (ACE-III Total score), ACE-III subscales, FIM score, WTAR, time since injury and age

N = 29		
	Overall Participation	<i>p</i>
Depression	-.42*	.02
Executive Functioning	.44*	.02
Overall Cognition	.27	.16
Attention	.50**	.01
Memory	.19	.32
Fluency	.35	.07
Language	.31	.10
Visuospatial	.06	.76
Functional Independence Measure	.27	.17
WTAR	.18	.37
Time Since Injury	-.00	.99
Age	-.07	.73

* $p < .05$; ** $p < .01$

DISCUSSION

The present study aimed to investigate factors relating to cognition and mood which might influence the ability of individuals with acquired brain injury to engage successfully in their rehabilitation. Consecutively admitted patients representative of a typical ABI clinical population were recruited and measures in common clinical use were utilised to increase the generalisability of the findings. It was hypothesised that increasing levels of impairment of executive functioning and depression would be associated with poorer engagement in rehabilitation. It was also hypothesised that more severe cognitive impairment in general would be associated with worse participation in rehabilitation.

Consistent with the hypotheses and Skidmore et al.'s (2010) study, participants with executive functioning deficits and low mood showed poorer participation in their physiotherapy and occupational therapy rehabilitation. Participants with poorer participation also showed impairment in the domain of attention. Similar findings were also reported in a study investigating participation in rehabilitation in elderly patients with hip-fracture, which found that depression and cognitive impairment predicted poorer participation which in turn predicted worse functional outcomes upon discharge (Lenze et al., 2004).

Research has previously linked post-stroke executive dysfunction (Zinn et al., 2007) and post-stroke depression (Gillen, Tennen, McKee, Gernert-Dott, & Affleck, 2001; Paolucci et al., 1999) with negative impacts on the effectiveness of rehabilitation and functional outcome. Both difficulties are common post-ABI (Fleminger et al., 2003; Zinn et al., 2007) and there is frequent overlap between depression and impairment in executive functioning in

stroke and TBI populations (Jorge et al., 2004; Vataja, 2005) and older adults in general (Alexopoulos, Kiosses, Klimstra, Kalayam, & Bruce, 2002).

In contrast to previous research (Inouye, Hashimoto, Mio & Sumino, 2001; Skidmore et al., 2010; Ween, Alexander, D'Esposito & Roberts, 1996) no association was found between functional disability measured by the FIM and participation in rehabilitation. Age, time since injury, gender and estimated pre-morbid IQ also did not appear to be major factors in determining engagement in rehabilitation. Contrary to our hypothesis, overall cognitive ability as measured by the ACE-III was not associated with participation, the correlation effect size being only small-medium suggesting a lack of any substantial effect.

Furthermore, anxiety scores in general were low in the present sample ($M = 4.9$, $SD = 3.3$) in contrast with previous findings that anxiety is prevalent post-stroke (Barker-Collo, 2007) and following TBI (Moore, Terryberry-Spohr & Hope, 2006). Again, this may be related to the generally high prevalence of executive dysfunction within the sample which led to a lack of insight regarding impairments, another dysexecutive symptom which may help to negate any anxious feelings concerning performance abilities or the future.

Clinical Implications

Despite receiving intensive rehabilitation, many people will continue to show reduced outcomes and disability (Paolucci, 2000). The effects of executive dysfunction and depression are also likely to increase the burden for those caring for patients with ABI when they are discharged home. This is complicated further as carers of individuals with ABI are also shown to have higher rates of depression than the general population (Turner et al.,

2010). Poor participation in rehabilitation therapy is associated with decreased functional outcomes, disability and longer hospital stays (Lenze, 2004), which in turn has been related to increased levels of depression in stroke and other conditions (Pollack & Alovís, 1991; Schubert, Burns, Paras & Sioson, 1992). This could be contributing to a vicious cycle in which dysexecutive symptoms and low mood lead to poorer participation in rehabilitation causing worse functional outcomes and longer hospital stays which decrease motivation to engage in therapy further. This is understandable, as depression causes a loss of motivation and difficulties in initiation, deficits also apparent in executive dysfunction. Furthermore, many rehabilitation tasks such as upper-body dressing and bed-to-chair transfers require attention, perception, intention and multi-tasking for the complex integration of physical and sensory information while also following instructions, remembering them and attempting to forge a trusting therapeutic relationship with sometimes multiple therapists present at once.

Deficits which impair the accomplishment of rehabilitation tasks such as grooming and increasing mobility can also impact on long-term dependence. Routine screening to identify common executive functioning deficits and difficulties with low mood are necessary to tailor and structure rehabilitation in the crucial early stages of recovery to maximise potential benefits and prevent further decline. This is particularly necessary since depression and executive dysfunction are both conditions without obvious physical signs which may easily be missed by clinicians and not addressed in treatment. This is especially true in acute inpatient settings where symptoms may be less obvious due to ward routine and an absence of demands on patients.

Furthermore, poor rehabilitation participation is likely to impact on therapy staff morale and the effective planning and utilisation of service resources, with subsequent cost implications. Patients who take longer to engage in the rehabilitation process are likely to require a greater number of sessions and may also refuse appointments which therapists have scheduled and planned for. A qualitative study investigating staff's experiences of a British NHS stroke service found that one of the main themes highlighted was of staff morale, noting that this could be improved with better consideration of patients' individual needs, especially those such as cognitive difficulties (Morris, Payne & Lambert, 2007).

The present study identified dysexecutive difficulties with inhibition, attention and rule attainment and mood problems in the form of depression. When such impairments are recognised, compensatory strategies and other approaches such as Cognitive Behaviour Therapy (CBT), motivational interviewing, self-instruction programmes and making environmental adaptations could be used to improve mood and executive functioning, hence potentially aiding participation in rehabilitation and functional outcome. Planning and maintaining changes to lifestyle to promote healthiness on discharge such as remembering and adhering to new medication regimes and dietary requirements are also liable to be affected by problems with executive functioning (Zinn et al., 2007). Thus, environmental supports are required. A systematic review concluded that cognitive rehabilitation can facilitate improvements in executive functioning following stroke (Poulin et al., 2012), further emphasising the need to identify dysexecutive symptoms through effective screening so benefits can be achieved for patients. The importance of identifying and treating mood disorders in this population is nonetheless recognised and SIGN guidelines (2010) recommend that routine screening for mood disorders should be in place for stroke patients to

identify those who may benefit from pharmacological and/or psychological intervention as part of their rehabilitation. Additionally, TBI sufferers should be considered for Cognitive Behavioural Therapy for acute stress disorder or anxiety following TBI (SIGN, 2013).

These requirements are mirrored in research and policy, as NICE guidelines (2008) suggest that comprehensive evaluations of executive functioning are necessary to assist in consideration of the influence of such deficits on engagement in rehabilitation. Furthermore, HersHKovitz and Brill (2007) point out that such investigations can aid multidisciplinary teams in creating and evaluating effective, individualised rehabilitation programs and helping to plan resource allocation. Dysexecutive syndrome can impact on other cognitive domains as, for example, impairments in memory may be mediated by executive difficulties with initiation, working memory, retrieval strategies and confabulation. This increases the necessity to identify cognitive difficulties through screening which can then be explored and differentiated with comprehensive assessment in order to target deficits and plan rehabilitation strategies. There are also financial and societal benefits to this. Estimated costs of stroke in the UK are approximately £8.9 billion annually (Saka, McGuire & Wolfe, 2009). As well as this financial burden, return to work after ABI is an important achievement for patients which improves life satisfaction, but is negatively influenced by cognitive impairment (Treger, Shames & Giaquinto, 2007).

Limitations

Results from the present study and the conclusions drawn from these should be interpreted with caution due to the execution of multiple correlations without correction, increasing the risk of type 1 errors. The decision to use conventional p-values was taken due to there being

specific apriori directional hypotheses and a small sample size, reducing the likelihood of type 2 errors at this relatively early stage of research addressing the issue of predictors of rehabilitation engagement. Correlation coefficients also provide a direct measure of effect size, with most of the significant results reported being medium-large. A further limitation was that physiotherapist and occupational therapist raters of the participation in rehabilitation measure were not blind to hypotheses and this could have influenced ratings.

It is also possible that potentially confounding variables could explain the significant relationships found. The significant associations observed between depression and participation and attention and participation could themselves be related, as depression regularly leads to difficulties with concentration and attention (Hartlage, Alloy, Vázquez & Dykman, 1993). Future research utilising a much larger sample size would allow the use of multivariate analysis methods such as regression that could explore in more detail the relative contribution of different variables and move closer to determining causal factors.

The retrospective nature of the HADS could lead to inaccuracy of some responses, particularly in a sample with cognitive impairments which may be affecting memory. The self-report method of the HADS may bias results with the possibility of participants producing socially desirable responses, although this may have been less among participants with dysexecutive symptoms relating to social behaviour. Moreover, comprehensive assessment of depression would require integrating information from multiple sources such as self-report and clinical interview. However, the ability of the HADS to accurately assess depression and anxiety in ABI populations has been demonstrated (Turner et al., 2012; Dawkins et al., 2006).

Furthermore, one of the objectives of the present study was to establish whether commonly used screening measures could be effective in identifying mood and cognitive difficulties, hence the use of these measures. In the present study, the ACE-III was not a good predictor of participation compared to more detailed assessments of executive functioning, suggesting that brief cognitive measures may not be as useful in identifying deficits relating to rehabilitation participation in an ABI sample. This is an important consideration in future patient care when advocating the use of routine screening since studies suggest that the main barrier in the use of screening measures in health-care practice is lack of time (Mitchell, Kaar, Coggan & Herdman, 2008).

Informed consent was sought from all participants before enrolment. While this was necessary for ethical reasons, it may have led to possible self-selection biases as individuals who were more motivated to participate in their rehabilitation may also have been more likely to engage in optional, additional assessment through the research study. This process could help to account for the generally good ratings of participation reported.

Whilst the correlation analysis provides evidence of association it does not provide clear evidence of a causal relationship. Furthermore, many of the participants had pre-existing health problems which could have influenced the findings. However, the sample was representative of a typical neurological rehabilitation service suggesting the findings may have more ecological validity and clinical utility than if people with comorbid health problems had been excluded.

Executive functioning has only relatively recently become the focus of widespread research in neuropsychology. Thus, test selection when investigating this construct remains a controversial and problematic area due to the many skills and abilities encapsulated within the concept of executive functioning such as abstract thought, planning, problem solving and social and emotional skills. There is no gold standard, agreed upon battery approach for assessing executive function and so the present investigation aimed to use assessments in frequent clinical use which targeted aspects of executive functioning hypothesized to impact on real-life tasks such as those faced when engaging with professionals in rehabilitation. Therefore, measures assessing inhibition, initiation, cognitive flexibility, switching attention and rule attainment were prioritized in the belief that these would correspond to social awareness in effective engagement and the ability to learn new skills in the face of competing attentional demands.

The discovery of a significant relationship between the elements of executive functioning measures and objective ratings of participation in real-world rehabilitation would seem to suggest the instruments selected had good ecological validity in this sample. The decision to not include further tests of executive functioning was also taken to reduce burden on predominantly acute ABI patients suffering with fatigue.

Suggestions for Future Research

Future research should consider the advantage of using a large, longitudinal research design examining the long-term impact of depression and executive functioning impairments and

other factors such as social support and personality on participation in rehabilitation and functional outcome.

Other factors such as sensory and motor deficits and hemianopia have also been shown to impact on functional outcome post-stroke and may influence motivation or ability to participate in rehabilitation (Patel, Duncan, Lai & Studenski, 2000). Future research could investigate the impact of additional impairments and health problems on ability and motivation to engage in rehabilitation.

Aphasic patients were excluded from the present study due to the selection of tests with heavy reliance on language ability. However, a similar study using alternative assessment tools could include this group. This would represent an interesting and important addition to the literature, as research indicates that people with aphasia participate in fewer activities in general and report worse quality of life than non-aphasic stroke victims (Hilari, 2011).

An exhaustive battery investigating the various aspects of executive function and their associated impact on participation was not used in the present study and represents an interesting investigation for future research which could help differentiate the specific domains of executive functioning which impact most on participation.

Finally, the process of rehabilitation represents a dynamic interaction between patients and the multiple therapists involved in their treatment. Numerous influences are likely to impact on this complex interaction. Further research investigating patients' views on their

rehabilitation participation and progress would be beneficial. Equally, studies could take into account therapist perspectives relating to perceived reasons for difficulties with engagement and explore the methods they use to adapt to and overcome these barriers. This would add depth to the understanding of this multifaceted process.

Conclusion

In several important ways, the findings of the present study are consistent with those of previous research. Executive dysfunction and low mood following ABI were shown to be negatively associated with engagement in rehabilitation, and research has demonstrated that this could have implications for recovery, level of independence, return to work and involvement in social activities (Angeleri, Angeleri, Foschi, Giaquinto & Nolfi, 1993; Poulin et al., 2012). Therefore, further research is necessary to explore this process further. One potential implication is that mood and executive function screening tools should be employed by all staff working therapeutically with patients with acquired brain injuries in order to identify deficits and incorporate knowledge of these into treatment early in the rehabilitation process.

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A Reflection on the Changing Roles of the Clinical Psychologist in the Context of Government Targets

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ABSTRACT

In this reflective account, I explore the changing roles and models of working being adopted by Clinical Psychologists in the context of government targets and agendas. Having now entered 2014, the deadline set by the access HEAT target stating that services must be “delivering 18 week referral to treatment for psychological therapies from December 2014” is looming large. I consider the impact of this on services and expectations within Clinical Psychology. My reflective process is guided by Gibb’s (1988) model of reflection as my thoughts on this topic are illustrated through discussion at a Peer Support Meeting I attended with other Trainee Clinical Psychologists based in NHS Highland. I consider how my thoughts on this topic have changed over the course of my training in relation to the role of a Clinical Psychologist as I viewed it as an Assistant Psychologist, and now.

A Reflection on the Role of Consultation in Clinical Psychology

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ABSTRACT

This reflective account is derived from my experiences working in an acute inpatient stroke and neurological rehabilitation setting in my final year of the Doctorate in Clinical Psychology. Spending a year involved in work in this setting allowed me to gain many valuable experiences. This was most apparent in developing competency in areas of advanced practice such as offering consultation, teaching and training to other professionals and staff groups. In addition, I conducted my research primarily on the acute inpatient stroke and neurological rehabilitation wards. This placement allowed me to acquire further useful experiences and I reflect on some of these in this account. In particular, I reflect on my first attendance at a multidisciplinary team (MDT) stroke ward meeting.

APPENDICES

Appendix 1.1 *Journal of the International Neuropsychological Society* Author Guidelines

JOURNAL OF THE INTERNATIONAL NEUROPSYCHOLOGICAL SOCIETY

Instructions for Contributors

Aims and Scope The *Journal of the International Neuropsychological Society* is the official journal of the International Neuropsychological Society, an organization of over 4,500 international members from a variety of disciplines. The *Journal of the International Neuropsychological Society* welcomes original, creative, high quality research papers covering all areas of neuropsychology. The focus of articles may be primarily experimental, applied, or clinical. Contributions will broadly reflect the interest of all areas of neuropsychology, including but not limited to: development of cognitive processes, brain-behavior relationships, adult and pediatric neuropsychology, neurobehavioral syndromes (such as aphasia or apraxia), and the interfaces of neuropsychology with related areas such as behavioral neurology, neuropsychiatry, genetics, and cognitive neuroscience. Papers that utilize behavioral, neuroimaging, and electrophysiological measures are appropriate.

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Manuscript Length In order to increase the number of manuscripts that can be published in the Journal of the International Neuropsychological Society, please adhere to the following length requirements. Please provide a word count on the title page for the abstract and manuscript (not including abstract, tables, figures, or references). Manuscripts will be returned if they exceed length requirements.

Regular Research Article: Maximum of 5,000 words (not including abstract, tables, figures, or references) and a 250 word abstract. Regular Research Articles are original, creative, high quality papers covering all areas of neuropsychology; focus may be experimental, applied or clinical.

Brief and Rapid Communications: Maximum of 2,500 words (not including abstract, tables, figures, or references) and a 200 word abstract, with a maximum of two tables or two figures, or one table and one figure, and 20 references. Brief and Rapid Communications are shorter research articles.

Neurobehavioral Grand Rounds: Maximum of 3,500 words with an informative literature review (not including abstract, tables, figures, or references) and a 200 word abstract. Neurobehavioral Grand Rounds are unique case studies that make a significant theoretical contribution.

Critical Review: Maximum of 7,000 words (not including abstract, tables, figures, or references) and a 250 word abstract. Critical Reviews will be considered on any important topic in neuropsychology. Quantitative meta-analyses are encouraged. Critical Reviews must be preapproved by the Editor-in-Chief. For consideration, please e-mail your abstract to jins@cambridge.org.

Short Review: Maximum of 2,500 words (not including abstract, tables, figures, or references) and a 150 word abstract. Short Reviews are conceptually- oriented snapshots of the current state of a research area by experts in that area. Short Reviews must be pre-approved by the Editor-in-Chief. For consideration, please e-mail your abstract to jins@cambridge.org.

Dialogues: Maximum of 2,000 words for each segment (not including abstract, tables, figures, or references) and a 150 word abstract, with a maximum of two tables or two figures, or one table and one figure and 20 references. Dialogues provide a forum for two distinct positions on controversial issues in a point- counterpoint form. Dialogues must be preapproved by the Editor-in-Chief. For consideration, please e-mail your abstract to jins@cambridge.org.

Symposia: Maximum of 5,000 words (not including abstract, tables, figures, or references) and a 250 word abstract for each article (same as Regular Research Articles). Symposia consist of several thematically linked research articles which present empirical data. Symposia must be pre-approved by the Editor-in- Chief. For consideration, e-mail your proposal to jins@cambridge.org to receive prior approval.

Letters to the Editor: Maximum of 500 words (not including table, figure, or references) with up to five references and one table or one figure. Letters to the Editor respond to recent articles in *Journal of the International Neuropsychological Society*.

Book Reviews: Maximum of 1000 words in length. Include name and affiliations, a title for the review, the author(s)/editor(s), title, publisher, date of publication, number of pages and price. For consideration, e-mail jins@cambridge.org.

Manuscript Preparation and Style The entire manuscript should be typed double-spaced throughout using a word processing program. Unless otherwise specified, the guideline for preparation of manuscripts is the *Publication Manual of the American Psychological Association* (6th edition) except for references with 3 or more authors (see References section). This manual may be ordered from: APA Order Dept., 750 1st St. NE, Washington, DC 20002-4242, USA.

Pages should be numbered sequentially beginning with the Title Page. The Title Page should contain the full title of the manuscript, the full names and institutional affiliations of all authors; mailing address, telephone and fax numbers, and e-mail address for the corresponding author; and the word count for the abstract and manuscript text (excluding title page, abstract, references, tables, and figures). At the top right provide a short title of up to 45 characters preceded by the lead author's last name. Example: Smith-Memory in Parkinson's Disease. This running head should be repeated at the top right of every following page.

Page 2 should include an Abstract and a list of at least six keywords or mesh terms. Note: structured abstracts must be included with papers submitted after January 1, 2014. A structured abstract must include four header labels: *Objective*, *Method*, *Results*, and *Conclusions*. A total of six mesh terms (<http://www.nlm.nih.gov/mesh/>) or keywords should be provided and should not duplicate words in the title.

The full text of the manuscript should begin on *page 3*. For scientific articles, including *Regular Research Articles*, *Brief Communications*, *Rapid Communications*, and *Symposia*, the format should include a structured Abstract, Introduction, Method, Results, and Discussion. This should be followed by Acknowledgments, References, Tables, Figure Legends, Figures, and optional Appendices and Supplemental Material.

The use of abbreviations, except those that are widely used, is strongly discouraged. They should be used only if they contribute to better comprehension of the manuscript. Acronyms should be spelled out at first mention. Metric system (SI) units should be used.

Appendices and Supplemental Materials may be submitted. Appendices include material intended for print and should be included with the manuscript file. Supplementary material will appear only online and should be submitted as a separate file.

The Acknowledgements Section should include a disclosure of conflicts of interest (see above) and all sources of financial support for the paper. In documenting financial support, please provide details of the sources of financial support for all authors, including grant

numbers. For example, “This work was supported by the National Institutes of Health (grant number XXXXXXXX)”. Multiple grant numbers should be separated by a comma and space and where research was funded by more than one agency, the different agencies should be separated by a semi- colon with “and” before the final funding agency.

Grants held by different authors should be identified using the authors’ initials. For example, “This work was supported by the Wellcome Trust (A.B., grant numbers XXXX, YYYY), (C.D., grant number ZZZZ); the Natural Environment Research Council (E.F., grant number FFFF); and the National Institutes of Health (A.B., grant number GGGG), (E.F., grant number HHHH).”

Tables and Figures should be numbered in Arabic numerals. Figures should be numbered consecutively as they appear in the text. Figures should be twice their intended final size and authors should do their best to construct figures with notation and data points of sufficient size to permit legible photo reduction to one column of a two-column format.

Please upload figure(s) in either a .doc or .pdf format. There is no additional cost for publishing color figures. When uploading figures (color or black and white) they need only be a high enough resolution for the reviewers and editors to identify the information you are trying to convey.

The approximate position of each table and figure should be provided in the manuscript: [INSERT TABLE 1 HERE]. Tables and figures should be on separate pages. Tables should have short titles and all figure legends should be on separate pages.

References should be consistent with the Publication Manual of the American Psychological Association (6th Edition). In-text references should be cited as follows: “y Given the critical role of the prefrontal cortex (PFC) in working memory (Cohen et al., 1997; Goldman-Rakic, 1987; Perlstein et al., 2003a, 2003b)y” with multiple references in alphabetical order. Another example: “Cohen et al. (1994, 1997), Braver et al. (1997), and Jonides and Smith (1997) demonstrated” References cited in the text with two authors should list both names. References cited in the text with three, four, or five authors, list all authors at first mention; with subsequent citations, include only the first author’s last name followed by et al. References cited in the text with six or more authors should list the first author et al. throughout. In the reference section, for works with up to seven authors, list all authors. For eight authors or more, list the first six, then ellipses followed by the last author’s name. Examples of the APA reference style are as follows:

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The processes will depend on your source of funding, permissions to use material owned by an outside source, etc.

Appendix 1.2 *Quality Evaluation Criteria Rating Scale*

Ethical approval

1. Ethical approval obtained?

0 = No/not reported

1 = Yes

Sampling/recruitment

2. Is the sample community (general population) based?

0 = No/not reported

1 = Yes (e.g. consecutive hospitalised patients)

3. Was probability sampling used to identify potential respondents?

0 = No/not reported

1 = Simple (i.e. predetermined number of individuals selected from the sampling frame with equal chance of being chosen)

2 = Complex (e.g. stratified, cluster, multistage, or multiphase)

4. Are the inclusion and exclusion criteria clearly defined?

0 = No/not reported

1 = Inclusion *or* exclusion criteria reported

2 = Inclusion and exclusion criteria reported

3 = Inclusion and exclusion criteria reported; *and* number of excluded individuals estimated as a proportion of the target population

5. Adequate description of TBI severity experienced by sample?

0 = No/not reported

1 = Severity is based on subjective outcome measure and/or subjective report (e.g. mild/moderate/severe)

2 = Severity is based on objective measure (e.g. Neuro-imaging, Glasgow Coma Scale; Post-Traumatic Amnesia)

6. Control group included?

0 = No/not reported

1 = Yes – not matched/no detail

2 = Yes – matched

Measurement

7. Adequate definition of anxiety provided?

0 = No (e.g. parent reported anxiety symptoms; participant self-reported anxiety problems) *or* not reported

1 = Definition partially maps onto classification system (i.e. reference is made to problem(s) with restlessness, difficulty concentrating, muscle tension, sleep disturbance, anxiety and worry)

2 = Definition of anxiety disorder maps onto classification system (i.e. reference is made to Diagnostic and Statistical Manual of Mental Disorders – IV or International Classification of Diseases – 10)

8. Are the data collection methods standardised across all participants?

0 = No/not reported

1 = Use of standardised methods is reported for eliciting information from respondents

2 = Use of standardised methods is reported for eliciting information from respondents *and* interviewer training, supervision, enlistment of respondents, processing data

9. Type of instrument(s) used to assess anxiety disorder/anxiety symptoms?

0 = Non-standardised (e.g. rating scales, participant self-report, parent self-report, questionnaire)

1 = Standardised (e.g. clinical interview; anxiety questionnaire such as Beck Anxiety Inventory or Hospital Anxiety and Depression Scale)

10. Reliability reported for instrument(s) used to assess anxiety/anxiety symptoms?

0 = No/not reported

1 = Reliability of instrument(s) reported

11. Validity reported for instrument(s) to assess anxiety/anxiety symptoms?

0 = Not reported

1 = Validity of instrument(s) reported

Analysis

12. Consideration of demographic factors?

0 = Not reported

1 = Reported (e.g. age, gender, language, ethnicity, employment status, residency)

2 = Reported *and* included in statistical analyses to assess impact upon anxiety

13. Consideration of anxiety disorders preceding TBI?

0 = Not reported

1 = Anxiety problems preceding TBI reported

2 = Anxiety problems preceding TBI reported *and* either homogenous group, or included in statistical analyses to assess impact upon anxiety

14. Consideration of TBI as a first or subsequent neurological insult?

0 = No/not reported

1 = TBI as first/subsequent neurological event reported

2 = TBI as first/subsequent neurological event reported *and* either homogenous group, or included in statistical analyses to assess impact upon anxiety

15. Consideration of impact of TBI severity?

0 = Not reported

1 = TBI type reported (i.e. mild, moderate, severe)

2 = TBI type reported *and* either homogenous group, or included in statistical analyses to assess impact upon anxiety

16. Consideration of time elapsed since TBI?

0 = Not reported

1 = Time elapsed reported

2 = Time elapsed reported *and* either homogenous group, or included in statistical analyses to assess impact upon anxiety

17. Consideration of other potential confounding factors which might impact upon anxiety post-TBI (e.g. other current/premorbid psychological, psychiatric or physical health problems; environment; medications)?

0 = Not reported

1 = Potentially confounding factors reported

2 = Potentially confounding factors reported *and* either excluded, or included in statistical analyses to assess impact upon anxiety

18. Satisfactory confidence intervals?

0 = $\leq 90\%$ / not reported

1 = $\geq 90\%$

Total Score: _____ / 31

Score (%): _____ %

$\leq 24\%$ = poor

25 – 49% = low

50 – 74% = moderate

$\geq 75\%$ = high

Quality Rating of Study: _____

Appendix 1.3 *Agreed Quality Ratings for all Included Articles*

								Article*						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Ethical approval	1	0	0	0	0	0	0	0	0	0	0	1	1	1
2. Community sample	1	1	1	1	1	1	0	1	1	1	0	1	1	1
3. Probability sampling	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4. Inclusion/exclusion	2	0	2	2	2	2	2	1	1	2	0	1	2	1
5. Description of TBI severity	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6. Control group	0	0	0	0	2	0	0	0	1	0	2	1	0	0
7. Definition – anxiety	2	2	2	2	2	2	2	2	2	2	0	2	2	2
8. Data collection	2	0	2	2	2	1	1	1	1	1	1	0	1	2
9. Anxiety measures	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10. Reliability	1	0	1	1	1	1	0	1	1	1	0	1	0	0

11. Validity	0	0	0	0	0	0	0	1	0	1	0	1	0	0
12. Demographic factors	2	2	2	2	2	2	1	2	2	1	1	1	2	2
13. Anxiety preceding TBI	2	2	2	2	2	2	1	2	2	2	0	2	2	2
14. First/recurrent neurological insult	2	0	2	2	2	2	2	2	2	2	0	2	0	0
15. TBI severity	2	2	2	2	2	2	1	2	2	2	2	2	2	2
16. Time elapsed	2	1	2	2	2	2	1	1	2	2	1	2	2	2
17. Other confounds	2	2	2	2	2	2	1	2	2	0	1	1	2	2
18. Confidence intervals	0	0	0	0	1	0	0	1	0	0	0	0	0	0
Total Score	23	15	23	23	26	22	15	23	22	20	11	21	20	20
Score (%)	74	48	74	74	84	71	48	74	71	65	35	67	65	65
Quality Rating	M	L	M	M	H	M	L	M	M	M	L	M	M	M

***Key to Article Identification:** 1 = Max, Robin et al. (1997); 2 = Max, Lindgren et al. (1997); 3 = Max, Smith et al. (1997); 4 = Max, Lindgren, Robin et al. (1997); 5 = Max, Koele et al. (1998); 6 = Max, Robin et al. (1998); 7 = Bloom et al. (2001); 8 = Vasa et al. (2002); 9 = Luis & Mittenberg (2002); 10 = Geraldina et al. (2003); 11 = Hawley (2003); 12 = Karver et al. (2012); 13 = Max, Schachar et al. (2013); 14 = Max, Pardo et al. (2013)

Key to Quality Rating: P = Poor, L = Low, M = Moderate, H = High

Appendix 2.1 Neuropsychological Rehabilitation Author Guidelines

Neuropsychological Rehabilitation: An International Journal

Print ISSN: 0960-2011

Online ISSN: 1464-0694

Publication Frequency: 6 issues per year

Instructions for Authors

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Manuscript preparation

1. Journal-specific guidelines

- This journal accepts original (regular) articles, scholarly reviews, and book reviews.
- The style and format of the typescripts should conform to the specifications given in the Publication Manual of the American Psychological Association (6th ed.).
- There is no word limit for manuscripts submitted to this journal. Authors should include a word count with their manuscript.

2. General guidelines

- Manuscripts are accepted in English. Oxford English Dictionary spelling and punctuation are preferred. Please use double quotation marks, except where “a quotation is ‘within’ a quotation”. Long quotations of words or more should be indented without quotation marks.
- Manuscripts should be compiled in the following order: title page; abstract; keywords; main text; acknowledgements; references; appendices (as appropriate); table(s) with caption(s) (on individual pages); figure caption(s) (as a list).
- Abstracts of 150-200 words are required for all manuscripts submitted.
- Each manuscript should have up to 5 keywords.
- Search engine optimization (SEO) is a means of making your article more visible to anyone who might be looking for it. Please consult our guidance [here](#).
- Section headings should be concise.
- All authors of a manuscript should include their full names, affiliations, postal addresses, telephone numbers and email addresses on the cover page of the manuscript. One author should be identified as the corresponding author. Please give the affiliation where the research was conducted. If any of the named co-authors moves affiliation during the peer review process, the new affiliation can be given as a footnote. Please note that no changes to affiliation can be made after the manuscript is accepted. Please note that the email address of the corresponding author will normally be displayed in the article PDF (depending on the journal style) and the online article.
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- Please supply all details required by any funding and grant-awarding bodies as an Acknowledgement on the title page of the manuscript, in a separate paragraph, as follows:
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 - *For multiple agency grants:* "This work was supported by the [Funding Agency 1] under Grant [number xxxx]; [Funding Agency 2] under Grant [number xxxx]; and [Funding Agency 3] under Grant [number xxxx]."
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- When using a word which is or is asserted to be a proprietary term or trade mark, authors must use the symbol ® or TM.

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- Description of the Journal's reference style.
- Guide to using mathematical scripts and equations.
- Word templates are available for this journal. If you are not able to use the template via the links or if you have any other template queries, please contact authortemplate@tandf.co.uk.
- Authors must not embed equations or image files within their manuscript

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- Figures must be saved separate to text. Please do not embed figures in the manuscript file.
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- All figures must be numbered in the order in which they appear in the manuscript (e.g. Figure 1, Figure 2). In multi-part figures, each part should be labelled (e.g. Figure 1(a), Figure 1(b)).
- Figure captions must be saved separately, as part of the file containing the complete text of the manuscript, and numbered correspondingly.
- The filename for a graphic should be descriptive of the graphic, e.g. Figure1, Figure2a.

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Last updated 11/03/2014



Appendix 2.2 *Letter granting ethical approval by the North of Scotland Research Ethics Committee*

NRES Committees - North of Scotland

Summerfield House
2 Eday Road
Aberdeen

AB15 6RE

Telephone: 01224 558458

Facsimile: 01224 558609
Email: nosres@nhs.net

21 January 2014

Miss Joanna Teale
Drumossie Unit
New Craigs Hospital
Leachkin Road
INVERNESS
IV3 8NP



Dear Miss Teale

Study title: Cognitive and Affective Predictors of Participation in Rehabilitation after Acquired Brain Injury
REC reference: 14/NS/0001
IRAS project ID: 136747

Thank you for your letter of 14 January 2014. I can confirm the REC has received the documents listed below and that these comply with the approval conditions detailed in our letter dated 13 January 2014.

Documents received

The documents received were as follows:

Document	Version	Date
Covering Letter		14 January 2014
Letter of invitation to participant	3	14 January 2014
Email from Jonathan Evans re GCP Training		20 January 2014
Reply Slip	1	14 January 2014
Participant Information Sheet	2	14 January 2014

Approved documents

The final list of approved documentation for the study is therefore as follows:

<i>Document</i>	<i>Version</i>	<i>Date</i>
Covering Letter		29 November
Covering Letter		10 December
Covering Letter		14 January 2014


<i>Document</i>	<i>Version</i>	<i>Date</i>
Investigator CV: Joanna Teale		11 October 2013
Letter of invitation to participant	3	14 January 2014
Professor Jonathan Evan - CV		30 September 2013
Dr Jim Law - CV		11 October 2013
Participant Demographic Information Sheet	2	27 August 2013
Colour Word Test		12 December 2013*
The Hayling & Brixton Test		12 December 2013*
Wechsler Test of Adult Reading		12 December 2013*
Email from Jonathan Evans re GCP Training		20 January 2014
Reply Slip	1	14 January 2014
Participant Consent Form	1	27 August 2013
Participant Information Sheet	2	14 January 2014
Protocol	5	30 May 2013
Questionnaire: Hospital Anxiety and Depression Scale (HADS)		4 December 2013*
Questionnaire: Addenbrooke's Cognitive Examination - ACE III		4 December 2013*
Questionnaire: Pittsburgh Rehabilitation Participation Scale		4 December 2013*
REC application	136747/534 138/1/20	29 November 2013
Referees or other scientific critique report		12 July 2013

* date received

You should ensure that the sponsor has a copy of the final documentation for the study. It is the sponsor's responsibility to ensure that the documentation is made available to R&D offices at all participating sites.

14/NS/0001	Please quote this number on all correspondence
-------------------	---

Yours sincerely



Mrs Carol Irvine

Ethics Co-ordinator

Copy to: Ms Frances Hines, NHS Highland

Appendix 2.3 Letter granting site and management approval by the NHS Highland Research and Development Department

RECEIVED

Professor Angus Watson
Research & Development Director
NHS Highland Research & Development Office
Room S101
Centre for Health Science
Old Perth Road
Inverness
IV2 3JH

Tel: 01463 255822
Fax: 01463 255838
E-mail: angus.watson@nhs.net

NHS Highland

21 January 2014

NHS Highland R&D ID: 980
NRSPCC ID: NA

Dr Jim Law
Consultant Clinical Psychologist
Department of Psychological Services
New Craigs Hospital
Leachkin Road
Inverness
IV3 8NP

Dear Dr Law,

Management Approval for Non-Commercial Research

I am pleased to tell you that you now have Management Approval for the research project entitled: **'Cognitive and Affective Predictors of Participation in Rehabilitation After Acquired Brain Injury'**. [Protocol V5 30/05/13]. I acknowledge that:


- The project is sponsored by NHS Highland.
- The project does not require external funding.
- Research Ethics approval for the project has been obtained from the North of Scotland Research Ethics Committee, (Reference Number: 14/NS/0001).
- The project is Site-Specific Assessment exempt.

The following conditions apply:

- The responsibility for monitoring and auditing this project lies with NHS Highland.
- This study will be subject to ongoing monitoring for Research Governance purposes and may be audited to ensure compliance with the Research Governance

Headquarters:
NHS Highland, Assynt House, Beechwood Park, Inverness, IV2 3HG

Chairman: Mr Garry Coutts
Chief Executive: Elaine Mead
Highland NHS Board is the common name of Highland Health Board

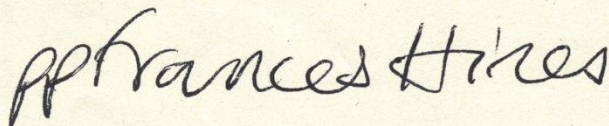


Framework for Health and Community Care in Scotland (2006, 2nd Edition), however prior written notice of audit will be given.

- All amendments (minor or substantial) to the protocol or to the REC application should be copied to the NHS Highland Research and Development Office together with a copy of the corresponding approval letter.
- The paperwork concerning all incidents, adverse events and serious adverse events, thought to be attributable to participant's involvement in this project should be copied to the NHS Highland R&D Office.
- Monthly recruitment rates should be notified to the NHS Highland Research and Development Office, detailing date of recruitment and the participant trial ID number. This should be done by e-mail on the first week of the following month.

Please report the information detailed above, or any other changes in resources used, or staff involved in the project, to the NHS Highland Research and Development Manager, Frances Hines (01463 255822, frances.hines@nhs.net).

Yours sincerely,



Professor Angus Watson
NHS Highland Research and Development Director

cc Frances Hines, R&D Manager, NHS Highland Research & Development Office,
Room S101, The Centre for Health Science, Old Perth Road, Inverness, IV2 3JH

Joanna Teale, Trainee Clinical Psychologist, Drumossie Unit, New Craigs Hospital,
Leachkin Road, Inverness, IV3 8NP

Appendix 2.4 Participant invitation letter



University
of Glasgow



Date _____

LETTER OF INVITATION

Rehabilitation after a Brain Injury

Would you be interested in helping stroke and brain injury research in the Highlands?

Researchers from NHS Highland (stroke and brain injury services) and the University of Glasgow are carrying out research into rehabilitation after stroke or brain injury. This research is sponsored by NHS Highland.

Summary of study

After stroke or other forms of injury to the brain people may have a period of rehabilitation. We are interested in how to ensure that people get the maximum benefit from their rehabilitation. The purpose of this study is to investigate whether the way in which people process information after brain injury as well as their mood and emotions affect

their ability to engage with, and participate in, rehabilitation. By taking part in this research you will be providing useful information regarding the factors which influence a person's ability to get the most out of their rehabilitation. If we understand more about how mental abilities and emotions affect participation in rehabilitation activities, this may help us to be better at tailoring rehabilitation programmes to meet each person's needs.

Why have I been invited?

You have been invited to take part in this study as you have recently had a brain injury (such as a stroke, head injury or other neurological condition leading to injury to the brain) and are undergoing rehabilitation.

Yes I am interested – what do I do next?

Please let any member of the clinical team know that you are interested in helping with this study and they will inform the researchers who will then contact you to give you more information about the study. There is also some more information in the Patient Information Sheet which is attached to this letter.

Thank you for reading this information.

Yours sincerely,

On behalf of the NHS Highland Psychology Service



**Department of Clinical Psychology
Drumossie Unit
New Craigs Hospital
Inverness
IV3 8NP**

Rehabilitation after a Brain Injury

Information Sheet

We would like to invite you to take part in a research study. Before you decide you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Talk to others about the study if you wish. Ask us if there is anything that is not clear or if you would like more information.

Who is conducting the research?

The research is being carried out by **Joanna Teale** and **Dr Jim Law** from the Department of **Clinical Psychology at New Craigs Hospital, Inverness**, and **Professor Jonathan Evans** from the **University of Glasgow**.

What is the purpose of the study?

The purpose of the study is to investigate whether the way in which people process information after brain injury as well as their mood and emotions impact on their ability to engage with, and participate in, rehabilitation after brain injury

Why have I been invited?

You have been invited to take part in this study as you have recently had a brain injury (such as a stroke, head injury or other neurological condition leading to injury to the brain) and are undergoing rehabilitation.

Do I have to take part?

No, it is up to you to decide. We will describe the study and go through this information sheet, which we will then give to you. You will be asked to sign a consent form to show you have agreed to take part. You are free to withdraw at any time, without giving reason. This would not affect the standard of care you receive or your future treatment.

What does taking part involve?

You will be asked to complete a short questionnaire about the way you have been feeling lately, followed by 4 short questionnaires and tasks which will ask you to do different things like complete spoken sentences, read single words, and name pictures of animals and objects. All together these tasks should take no more than an hour to complete and will be done at times convenient for you. They don't have to be done all at once if that is not convenient.

What happens to the information?

Your identity and personal information will be completely confidential and known only to the researcher. The information obtained will remain confidential and stored securely. The data are held in accordance with the Data Protection Act, which means that we keep it safely and cannot reveal it to other people, without your permission.

What are the possible benefits of taking part?

Our aim is to help people get the most benefit possible from rehabilitation. By taking part in this research you will be providing valuable information regarding the factors which influence a person's ability to get the most out of their rehabilitation. Also, with your permission, the results of the tests you do can be fed back to your medical team to help tailor and plan your future rehabilitation to you.

Who has reviewed the study?

This study has been reviewed by the NRES Committees: North of Scotland 2.

If you have any further questions?

We will give you a copy of the information sheet and signed consent form to keep. If you would like more information about the study and wish to speak to someone **not** closely linked to the study, please contact Prof Tom McMillan (details below).

Contacts:

Joanna Teale – Main Researcher

Trainee Clinical Psychologist
Drumossie Unit
New Craigs Hospital
Inverness
IV3 8NP
01463 253697

Dr Jim Law – Clinical Supervisor

Head of Clinical Psychology Services for Older People
Drumossie Unit
New Craigs Hospital
Inverness
IV3 8NP
01463 253697

Professor Jonathan Evans – Academic Supervisor

Professor of Applied Neuropsychology
Institute of Mental Health and Wellbeing
College of Medical, Veterinary and Life Sciences
University of Glasgow
First Floor of Admin Building
Gartnavel Royal Hospital
1055 Great Western Road
G12 0XH
0141 2113978

Professor Tom McMillan – Independent Contact

Professor of Clinical Neuropsychology
Institute of Mental Health and Wellbeing
College of Medical, Veterinary and Life Sciences
University of Glasgow
First Floor of Admin Building
Gartnavel Royal Hospital
1055 Great Western Road
G12 0XH
0141 2110354

If you have a complaint about any aspect of the study?

If you are unhappy about any aspect of the study and wish to make a complaint, please contact the researcher in the first instance but the normal NHS complaint mechanisms is also available to you.

Thank you for your time and co-operation.

Appendix 2.6 Participant consent form



Department of Clinical Psychology
Drumossie Unit
New Craigs Hospital
Inverness
IV3 8NP

Subject number:

Cognitive and Affective Predictors of Participation in Rehabilitation after Brain Injury

Consent Form

Please initial the BOX

I confirm that I have read and understand the information sheet dated 14/01/14 (version 3) for the above study and have had the opportunity to ask questions.

☐

I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.

☐

I understand that sections of my medical notes may be looked at by the researcher where it is relevant to my taking part in the research. I give my permission for the researcher to have access to my records.

☐

I understand that the results of the tests I do may be shared with my rehabilitation team to aid in the future planning and delivery of my rehabilitation. I give my permission for the researcher to share this information with the medical staff already involved in my care.

☐

I understand that my data (including personal information) may be accessed by authorised representatives of NHS Highland (the Sponsor) for the purposes of audit only.

☐

I agree to take part in the above study

Name of Participant

Date

Signature

Name of Researcher

Date

Signature

1 copy to the patient, 1 copy to the researcher, 1 original for the patients' notes

Appendix 2.7 *Pittsburgh Rehabilitation Participation Scale (PRPS; Lenze et al., 2004)*

PITTSBURGH REHABILITATION PARTICIPATION SCALE

Patient name: _____

Admission date: _____

Instructions to therapist: for each therapy session, please circle one of each of the following to assess the patient's participation (effort and motivation as perceived by you) in the therapy session. Please rate as follows: None: patient refused entire session, or did not participate in any exercises in session (see Note below).

Poor: patient refused or did not participate in at least half of session.

Fair: patient participated in most or all of exercises/activities *, but did not show maximal effort or finish most exercises*, or required much encouragement to finish exercises*.

Good: patient participated in all exercises/activities * with good effort and finished most but not all exercises* and passively followed directions (rather than actively taking interest in exercises* and future therapy).

Very good: patient participated in all exercises/activities * with maximal effort and finished all exercises, but passively followed directions (rather than actively taking interest in exercises* and future therapy).

Excellent: patient participated in all exercises/activities * with maximal effort, finished all exercises/activities *, and actively took interest in exercises/activities* and/or future therapy sessions.

Note: if patient was unable to attend therapy because of medical test, bed rest order, illness, or scheduling conflict, do not mark any score.

Note: in cases of doubt, choose the lower rating, eg, "good" rather than "very good."

PARTICIPATION:

Session Number	Date	Therapist Initials		None	Poor	Fair	Good	Very good	Excellent
1				1	2	3	4	5	6
2				1	2	3	4	5	6
3				1	2	3	4	5	6
4				1	2	3	4	5	6
5				1	2	3	4	5	6
6				1	2	3	4	5	6
7				1	2	3	4	5	6
8				1	2	3	4	5	6
9				1	2	3	4	5	6
10				1	2	3	4	5	6

NOTE. Available as an electronic file from the corresponding author by request.

*This version is specifically for PT. For the OT form, "exercises" should be replaced by "activities."

Appendix 2.8 Major Research Project Proposal

Abstract

The present study aims to investigate whether executive functioning and depression affect participation in rehabilitation after Acquired Brain Injury (ABI), hypothesising that more severe problems in executive functioning and higher ratings of depression and cognitive impairment will be associated with poorer participation in rehabilitation. Participants will be an opportunistic sample of 29 patients receiving rehabilitation in clinical settings in NHS Highland. Rehabilitation participation will be assessed by staff over a two week period after which the results of the cognitive and mood assessments will be fed back to aid in future rehabilitation planning. Data analysis will be correlational.

Introduction

Acquired Brain Injury (ABI) is defined as “damage to the brain that was sudden in onset and occurred after birth and the neonatal period. It is thus differentiated from birth injuries, congenital abnormalities and progressive or degenerative diseases affecting the central nervous system” (Scottish Needs Assessment Programme report, 2000). There are various causes of ABI including stroke, tumours or Traumatic Brain Injury (TBI) due to, for example, falling or road accidents. ABI is a significant cause of mortality and morbidity in Scotland, with a recent 13 year study following head injury patients in Glasgow finding that the death rate for individuals with ABI was over double that for the general Scottish population (McMillan, Teasdale, Weir, Stewart, 2011). Furthermore, stroke, contained within the ABI group, is the leading cause of disability and third most common cause of death in the UK and worldwide. ABI does not only affect the individual who obtains the injury, but their family, social life, work and the entire system surrounding them.

ABI can result in physical, behavioural, emotional, cognitive, hormonal and executive functioning difficulties (Headway, 2013). Physical problems after brain injury can include weakness, paralysis, spasticity, walking difficulties and changes in sensations. Rehabilitation after ABI involves a multidisciplinary approach. Input from physiotherapists aims to help patients regain movement and manage physical difficulties using appropriate exercises. Additionally, occupational therapy enables individuals to carry out daily activities and maintain their independence, sometimes through providing specialist equipment for the home (Stroke Association, 2012). Decades of research shows that the majority of recovery occurs during the initial months of rehabilitation after stroke and ABI (Dikmen, 1990; Skilbreck, Wade, Hewer & Wood, 1983). The UK National Clinical Guideline for Stroke (2012) recommends that for every person who has a stroke: “rehabilitation services should be commissioned to reduce impairment, promote recovery and increase ability to participate and improve quality of life using adaptive rehabilitation strategies”.

Cognitive impairment is common following ABI. It exists in approximately 70% of stroke patients in the acute stages of recovery (Nys et al., 2005) and is a strong predictor of dementia and functional dependence long-term (Nys et al., 2007). The extent and nature of cognitive impairment is dependent on the location of the brain insult, but difficulties may occur with language, perception, attention, executive functioning or memory (Nys et al., 2005; Nys et al., 2007). Neurological problems as well as physical impairments post-stroke or TBI greatly affect an individual’s daily living. Problems with executive functioning are the most common cognitive impairments post-stroke (Zinn, Bosworth, Hoenig & Swartzwelder, 2007), occurring in approximately 39% of cases (Nys et al., 2007; Zinn et al., 2007), and have been shown to impact on the effectiveness of stroke treatment (McDowd, Filion, Pohl, Richards, & Stiers, 2003; Mok et al., 2004). A recent systematic review (Poulin, Korner-Bitensky, Dawson, & Bherer, 2012) concluded that persons with stroke could benefit from

specific executive function training interventions and by learning compensatory strategies. There are no specific guidelines regarding screening for cognitive impairment following stroke. Furthermore, SIGN guidelines (2013) suggest that “referral for cognitive (psychometric) assessment is not routinely recommended after Mild TBI”. However, since cognitive difficulties are common cognitive screening that is sensitive to executive function could be valuable in identifying individuals that would benefit from neuropsychological intervention as part of their rehabilitation.

Previous research has also documented the prevalence of mental health problems such as anxiety, depression, emotionalism and PTSD after ABI (Burvill et al., 1995; Hackett, Yapa, Parag & Anderson, 2005; Hibbard

et al., 1998). Prevalence rates of depression are similar after both TBI and stroke with approximately 20–40% affected at any time during the first year, while around 50% of people experience depression at some point (Fleminger, Oliver, Williams & Evans, 2003).

However, these studies are complicated by the difficulties in assessing, recognising and diagnosing an underlying mood disorder in the presence of symptom overlap and co-occurring cognitive and language impairments, or behavioural syndromes, caused by acute stroke and TBI (Hackett, Anderson, House & Halteh, 2008; McMillan, 2001). The importance of identifying and treating mood disorders in this population is nonetheless recognised and SIGN guidelines (2010) recommend that routine screening for mood disorders should be in place for stroke patients to identify those who may benefit from pharmacological and/or psychological intervention as part of their rehabilitation, while TBI sufferers should be considered for Cognitive Behavioural Therapy for acute stress disorder or anxiety following TBI (SIGN, 2013).

Only one other study has considered how cognitive and mood factors directly contribute to participation in rehabilitation (Skidmore, Whyte, Holm, Becker, Butters, Dew, Munin & Lenze, 2010). This study examined an older adult population who had experienced stroke using the Digit Span Test from the WAIS, Hopkins Verbal Learning Test, Executive Interview, Hamilton Rating Scale for Depression and Apathy Evaluation Scale. They found that both executive functioning and depressive symptoms were correlated with participation in rehabilitation but that executive functioning and baseline disability were the only significant predictors of engagement in rehabilitation in a multiple regression analysis.

Further research is required to validate these findings and extend them to a wider ABI population. The importance of establishing whether there is a relationship between executive functioning, depression and a person's ability to participate in rehabilitation has clear implications for the need to assess and treat these difficulties in the rehabilitation environment in order to maximise gains. It would also be of interest to examine whether screening measures commonly used in rehabilitation settings can identify those with difficulties engaging in rehabilitation.

Aims and Hypotheses

Aims

To investigate whether executive functioning and depression affect participation in rehabilitation after ABI.

To investigate the cognitive and mood factors that affect participation in rehabilitation.

Hypotheses

1. The primary hypothesis is that more severe impairment of executive functioning as measured by the Addenbrooke's Cognitive Examination III (ACE-III; Hodges, 2012),

Hayling and Brixton Tests (Burgess & Shallice, 1997) and Colour Word Interference Test (Delis, Kaplan & Kramer, 2001) will be associated with poorer engagement in rehabilitation (as assessed by the Pittsburgh Rehabilitation Participation Scale; PRPS; Lenze, Munin, Quear, Dew, Rogers, Begley & Reynolds, 2004).

2. The secondary hypothesis is that higher ratings of depression measured on the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) will be associated with poorer engagement in rehabilitation.
3. More severe cognitive impairment measured by the ACE-III (Hodges, 2012) will be associated with poorer engagement in rehabilitation.

Plan of Investigation

Participants

Participants will be an opportunistic sample of 29 patients receiving rehabilitation on the stroke and TBI wards at Raigmore Hospital Inverness, or other clinical settings in NHS Highland, who meet inclusion criteria.

Inclusion Criteria

Participants will have suffered a brain injury and be undergoing rehabilitation from physiotherapy and/or occupational therapy. Participants will be medically stable, fully conscious and have the capacity to give informed consent.

Exclusion Criteria

All patients fitting inclusion criteria and willing to participate in this study will be deemed suitable unless they have severe aphasia, current substance misuse, diagnosis of dementia, lack of capacity to consent to research, previous diagnosis of learning disability or are under 16 years old.

Sample Size

The study aims to recruit 29 participants over a six-month period. In consultation with ward staff it is estimated that about 10 individuals from the 30 bedded unit would be eligible for inclusion at any one time with the average length of stay on the ward being 6 – 8 weeks.

Recruitment Procedures

There is a 30 bed stroke and TBI ward in Raigmore Hospital in NHS Highland. Individuals who suffer a stroke within Highland receive rehabilitation there for approximately 6-8 weeks, or less if community rehabilitation is offered. Individuals who experience another form of ABI may stay on the ward for longer.

Participants will be approached when considered by the rehabilitation therapists as meeting inclusion/exclusion criteria and are undergoing or considered ready to commence rehabilitation. Patients suitable for inclusion in the study will be identified through weekly ward meetings.

Potential participants will be approached by ward staff not directly connected with the research to invite them into the study and an information sheet provided which could also be

read aloud and explained to them. They will then be given at least 24 hours to consider whether they would like to participate or not before consent is taken.

Over a two week time period the HADS, ACE-III and executive battery will be administered by the researcher and the PRPS will be completed by occupational therapists and physiotherapists after each rehabilitation session. Demographic information and information on the type and location of brain injury will also be gathered for each person. The Wechsler Test of Adult Reading (WTAR; Wechsler, 2001) will also be conducted to measure premorbid intellectual functioning. This period of assessment could occur at any time during the participant's stay on the ward. The tests and the monitoring of participation by rehabilitation staff will therefore be completed concurrently, allowing the results of the assessments to be shared with ward staff after this two week period of data collection has elapsed.

Measures

HADS

The 14-item self-report HADS is a screening measure of anxiety and depression specifically designed to consider issues relevant for use in somatic medical settings. HADS-A consists of seven items rating anxiety and HADS-D of seven items rating depression. Each item is scored from 0 to 3, and the HADS-A and HADS-D scores are the sum of the relevant item scores. Good reliability and validity of the HADS has been demonstrated internationally (Herrmann, 1997) and in stroke (Turner, Hambridge, White, Carter, Clover, Nelson & Hackett, 2012) and ABI populations (Dawkins, Cloherty, Gracey & Evans, 2006).

ACE-III

The Addenbrooke's Cognitive Examination III is an updated version of the Addenbrooke's Cognitive Examination-Revised (Mioshi, Dawson, Mitchell, Arnold & Hodges, 2006). The ACE-R is a well validated and reliable measure designed to detect patients with dementia in community samples which has since been validated across a range of populations, including detecting impairment in visuospatial, attention and executive cognitive domains in a stroke population (Morris, Hacker & Lincoln, 2012). A recent study suggests that the ACE-III has similar psychometric properties to the ACE-R (Hsieh, Schubert, Hoon, Mioshi & Hodges, in press).

PRPS

The PRPS is a valid and reliable criterion-referenced measure in which rehabilitation therapists rate the degree a patient actively participated in each rehabilitation session (Lenze et al., 2004). Each session is scored 1 (no participation, refusal) to 6 (excellent participation).

Hayling and Brixton Tests

These two tests aim to assess behavioural regulation and were developed to be sensitive to symptoms of executive disturbance. The Hayling Test evaluates initiation speed as well as response suppression, while the Brixton Spatial Anticipation Test is a rule attainment task. The reliability and validity of the Hayling and Brixton Test has been shown to be adequate (Burvill, Johnson, Lamrozik, Anderson, Stewart-Wynne & Chakera, 1995), and both tests correlate with other measures of executive function (Clark, Prior & Kinsella, 2000;

Marczewski, Van der Linden, & Laroi, 2001) with evidence of ecological validity (Chan, 2001).

Colour Word Interference Test (DKEFS subtest)

A modified version of the Stroop's (1935) procedure testing inhibition of an over-learned response and flexibility. Reliability and validity of the DKEFS and Colour Word Interference Test specifically is good, with adequate internal consistency and test-retest reliability (Delis, Kramer, Kaplan & Holdnack, 2004).

Wechsler Test of Adult Reading (WTAR)

Is a well validated and reliable test of premorbid intellectual functioning (Wechsler, 2001).

Design

The present study represents a cross-sectional, correlational design.

Research Procedures

Once patients have provided informed consent to take part in the study they will be asked to provide demographic information and complete the WTAR, ACE-III, HADS, Hayling and Brixton Tests and Colour Word Interference Test, which would be administered by the researcher and take approximately 1 hour to complete. Physiotherapists and occupational therapists providing rehabilitation for these individuals will be asked to complete the short

PRPS after each rehabilitation session for a two week period for each participant. Staff will keep the PRPS at the front of participant's rehabilitation clinical notes to allow ease of access and as a memory aid for completion. Rehabilitation therapists will receive standardized instruction on the completion of the PRPS. Each participant's scores across all occupational and physiotherapy sessions over the two-week assessment period of rehabilitation will be combined to ascertain a mean rehabilitation participation score.

After this period, test results would be shared with the ABI rehabilitation team in the hope this may inform and aid future rehabilitation planning.

Data Analysis

Correlations will be carried out to examine the relationships between executive functioning, mood and cognitive functioning with participation in rehabilitation.

Justification of sample size

A power calculation using G*Power (Faul, Erdfelder, Buchner & Lang, 2009) was based on effect sizes taken from a similar study (Skidmore et al., 2010) which found a correlation between participation in rehabilitation and executive functioning of $r = .55$ and with depression of $r = .39$. The present study will employ a more comprehensive battery of executive function tests and a measure of depression designed for a hospital population (HADS) and it is therefore expected that a large effect will be found for both these relationships. Using an effect size estimate of $r = .5$, a power of .8 and alpha of .05 (two-tailed) provided a sample size estimate of 29 for the main hypotheses. Given that the usual turnover

of patients in the 30-bedded ward occurs every 6-8 weeks, a sample size of 29 participants should also be a realistic goal for recruitment within the time period.

Health and Safety Issues

Researcher Safety Issues

The nature of the research group means that some patients may have neuropsychological or mood disturbances which could cause them to behave in an unpredictable manner. Therefore, testing could take place on the ward or clinical settings where other staff are present and able to respond if needed.

Participant Safety Issues

Participants may become upset due to HADS items provoking an emotional reaction, or due to frustration if they find items on the cognitive assessments confusing or tiring. This could reduce participants' self-esteem or confidence. Therefore, if participants do become distressed there will be a break from testing and patients will be reminded that they have the opportunity to end testing at any time. The results of the assessments will be fed back to rehabilitation staff at the end of the testing period and any significant concerns about mood or cognition highlighted.

Ethical Issues

The decision to not include patients without the capacity to give informed consent to participate in this study is ethically important as it is possible that participants may become

upset completing the assessment measures and they should be fully aware of what they are being tested on so when feeding back results to patients these do not cause distress or confusion.

Data will be stored in accordance with the Data Protection Act (1998) in a secure facility and analysed on a University laptop encrypted to NHS standards with no patient identifiable information.

Ethical approval will be sought through the Integrated Research Application System.

Financial Issues

Equipment

Research will be conducted using the ACE-III, HADS and PRPS for which no costs will be incurred. The department of clinical psychology within the University of Glasgow has a license for a version of the HADS which can be photocopied for student research. The cost for the scoring sheets for the Hayling and Brixton Tests, Colour Word Interference Test and WTAR is £263.40. There will be associated photocopying costs.

Timetable

Ethical approval will be sought following the proposal being finalised and approved, with the aim to begin recruitment and data collection in November 2013. Data collection will go on until April/May 2014, and data analysis and write up will then take place before the final submission of the MRP at the end of July 2014.

Practical Applications

The findings from this study would provide a useful addition to the presently limited research on cognitive and mood predictors of patients' ability to participate in rehabilitation after ABI. If the study found a significant negative association between any mood or cognitive factors and ability to engage in rehabilitation, this could be used to strengthen arguments for improving screening for difficulties in these areas so that these patients could then be recognised and supported in their rehabilitation.

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