

Interprofessional learning through simulation

Discharge planning: the importance of family and team collaboration



**THIS CLINICAL TRAINING INITIATIVE IS SUPPORTED BY FUNDING FROM
THE AUSTRALIAN GOVERNMENT UNDER THE INCREASED CLINICAL
TRAINING CAPACITY (ICTC) PROGRAM**

Table of Contents

Acknowledgements	3
Foreword	3
Interprofessional Ambulatory Care Program	4
ECU Health Simulation Centre	5
Interprofessional learning	5
Interprofessional learning through simulation	6
How to use this resource package	7
Scenario brief	9
Key learning competencies	10
Collaborative leadership	10
Team functioning.....	10
Client and family centred care	10
Interprofessional communication	11
Role clarification	11
Key discussion points	11
Scenario 1	11
Scenario2	12
Scenario 3	14
Literature review	15
Classification of TBI.....	16
Mild TBI	17
Moderate and severe TBI.....	17
Acute care	18
Impairments following TBI	19
Cognitive impairments.....	22
Behavioural and psychosocial impairments.....	22
Pharmacological interventions	25
An interdisciplinary rehabilitation approach.....	27
Goal setting	29
Family impacts	31
Community re-integration	34
Living situation	34

Interpersonal relationships	35
Work	35
Transportation.....	36
Psychological impact	36
Financial strain.....	36
Conclusion	37
Medical glossary and acronyms	38
Further information.....	42
References	43

Acknowledgements

This resource was developed by the Interprofessional Ambulatory Care Program (IpAC) at Edith Cowan University (ECU) in collaboration with the ECU Health Simulation Centre with funding provided by the Australian Government under the Increased Clinical Training Capacity (ICTC) Program.

Foreword

Professor Cobie J. Rudd

*Pro-Vice-Chancellor (Health Advancement), and National Teaching Fellow 2011-12,
Australian Government Office for Learning and Teaching
ECU*

Australia's health workforce is facing unprecedented challenges. Supply won't meet demand, and the safety and quality of care remain key issues. The national health workforce agency, Health Workforce Australia (HWA), an initiative of the Council of Australian Governments (COAG), has been established to address the challenges of providing a workforce that meets the needs of our community – now and in the future.

Accordingly, ECU has set a priority on meeting these challenges, with a focus on the national health workforce reform agenda set out in the 2008 National Partnership Agreement (NPA) on Hospital and Health Workforce Reform.

In June 2010, ECU was awarded \$4.6M from the Australian Government through a nationally competitive process under the ICTC Program, an initiative which aims to develop interprofessional learning and practice capabilities in the Australian health workforce.

The IpAC Program aims to complement traditional clinical placement activities with high quality interprofessional learning competency development and assessment, so that at the earliest point students gain exposure to best work practices within multidisciplinary teams that have the patient's individual needs as the focus.

Additionally, the IpAC Program has developed interprofessional learning resources and interprofessional health simulation challenges in collaboration with the ECU Health Simulation Centre. The ECU Health Simulation Centre is recognised internationally as a

specialist centre in providing human factors based sequential simulation programs using professional actors. Most simulated learning interactions revolve around a single moment, such as a patient's admission to the emergency department. What we provide at the ECU Health Simulation Centre is a sequential simulated learning event that follows the patient and carer's journey through the healthcare system, for example, from the accident site following a motor vehicle accident, to the emergency department, to a hospital ward, to their home and into the community for GP and allied health follow-up.

Human factors in health care are the non-technical factors that impact on patient care, including communication, teamwork and leadership. Awareness of and attention to the negative aspects of clinical human factors improves patient care.

ECU's involvement in national health workforce reform is all about playing a role that enables the health workforce to better respond to the evolving care needs of the Australian community in accordance with the NPA's agenda. The IpAC Program is an example of how we can work across sectors, nationally and internationally, to determine better ways of addressing the pressing issue of how best to prepare students for the workplace and thus assuring that health systems have safe, high quality health services.

Interprofessional Ambulatory Care Program

ECU's IpAC Program was established with support from the Australian Federal Government through funding from the ICTC Program. The IpAC Program aims to deliver a world-class interprofessional learning environment and community clinic that develops collaborative practice among health professionals and optimises chronic disease self-management for clients.

This is achieved through the provision of clinical placements within the multidisciplinary team at the IpAC Unit, a community clinic that develops communication and collaboration among health professionals and optimises chronic disease self-management for clients.

Additionally, a range of clinical placements are offered at existing health facilities, where trained IpAC Program clinical supervisors provide clinical support and ensure the integration of interprofessional learning into each clinical placement.

The IpAC Unit, in collaboration with the ECU Health Simulation Centre, has developed a range of interprofessional learning through simulation resources. These learning resources are packages consisting of an audiovisual resource and a facilitator's manual, and aim to facilitate interprofessional learning and to support the participants in the development of interprofessional skills.

The interprofessional learning through simulation resources developed by the IpAC Program aim to provide health students and health professionals with the opportunity to learn with, from and about one another by engaging them in interactive live simulation events. These simulations encourage students and professionals to challenge themselves and each other in a safe learning environment.

ECU Health Simulation Centre

ECU houses the only fully functioning Health Simulation Centre of its kind in Western Australia, specifically designed and equipped to address the interprofessional learning needs of the health workforce and implementation of both state and national safety and quality frameworks.

The ECU Health Simulation Centre offers health workforce training and development specialising in clinical skills, human factors, and patient safety training for multidisciplinary health teams. Using a variety of educational techniques, including a broad range of simulation mannequins, professional actors and task trainers, ECU specialises in immersive simulation and observational learning. Supporting the ECU Health Simulation Centre are nursing, medical, paramedic and psychology academic and technical staff whose aim is to cultivate the development of competent and confident health professionals centred on enhancing patient safety.

Interprofessional learning

Interprofessional education occurs when two or more professions learn with, from and about each other in order to improve collaboration and quality of care (Centre for the Advancement of Interprofessional Education, 2002).

Interprofessional learning is the learning arising from interaction between students or members of two or more professions. This may be a product of interprofessional education or happen spontaneously in the workplace or in education settings (Freeth, Hammick, Reeves, Barr, & Koppel, 2005). It has been found that interprofessional education can improve collaborative practice, enhance delivery of services and have a positive impact on patient care (Canadian Interprofessional Health Collaborative (CIHC), 2008).

The World Health Organization (WHO) has recognised the importance of interprofessional education and collaborative practice in developing a health workforce that is able to meet the complex health challenges facing the world and assist in the achievement of the health-related Millennium Development Goals (World Health Organization, 2010). In developing its framework for action, the WHO have recognised that models of interprofessional collaboration are most effective when they consider the regional issues and priority areas (including areas of unmet need) in the local population (World Health Organization, 2010). In doing so, interprofessional education and collaborative practice can best maximise local health resources, reduce service duplication, advance coordinated and integrated patient care, ensure patient safety and increase health professional's job satisfaction (World Health Organization, 2010).

The end goal of interprofessional education is to create a health workforce with improved levels of teamwork, collaboration, knowledge-sharing and problem-solving, eventually leading to better patient and client outcomes in health settings (Braithwaite et al., 2007).

Interprofessional learning through simulation

Simulation in education refers to the re-creation of an event that is as closely linked to reality as possible. Gaba (2004) defined simulation as a technique, rather than a technology, to replace or amplify real life experiences with guided experiences often immersive in nature to evoke or replicate aspects of the real world, in a fully interactive pattern. Simulation provides a safe learning environment for students to practice, where they are free to make mistakes, correct them and improve the processes of care (Kenaszchuk, MacMillan, van Soeren, & Reeves, 2011). Simulation is the bridge between classroom learning and the real life clinical experience, allowing students to put theory into practice.

Interprofessional learning through simulation combines the principles of interprofessional learning and the use of simulation as an educational methodology. Interprofessional learning through simulation provides students with the opportunity to practice working with other health professionals and allows participants to explore collaborative ways of improving communication aspects of clinical care (Kenaszchuk, et al., 2011).

Many of the interdisciplinary team core competencies, such as problem solving, respect, communication, shared knowledge and skills, patient-centred practice, and the ability to work collaboratively (Canadian Interprofessional Health Collaborative, 2010) can all be developed by interprofessional learning through simulation.

Teamwork and interprofessional practice and learning are being recognised as central to improving client care and outcomes and enhancing client safety (Sargent, 2008). Promoting patient safety through team efforts is one of the five core competencies identified by the Institute of Medicine (2003).

In today's healthcare setting, no one health professional can meet all of the client's needs and therefore a healthcare team approach is required. Interprofessional learning through simulation provides learning opportunities to prepare future healthcare professionals for the collaborative models of healthcare being developed internationally (Baker et al., 2008).

How to use this resource package

This interprofessional learning through simulation resource package is a flexible learning resource designed to support the facilitation of interprofessional learning among students and practitioners with an interest in developing their skills and knowledge of interprofessional practice.

The package consists of two components: an audiovisual resource and a supporting manual. In order to optimise the learning opportunities from this package it is recommended that participants are firstly introduced to the concepts of interprofessional learning and human factors in health care.

The audiovisual resource can be viewed in its entirety initially and/or then viewed in sections. This audiovisual resource is made up of three parts. The first part consists of seven

vignettes depicting communication and interaction between various healthcare team members and the patient's family. These vignettes give the audience an impression of the issues around the care for this patient, and allow for an initial discussion of the interprofessional learning objectives.

The second part depicts the health care team conference. During the meeting, the communication within the health care team transitions from inadequate to effective, with an increase in collaboration and client centred focus. In part three the family conference takes place, focusing on the patient's discharge and the outpatient support his family can access to help look after their son at home.

Throughout sections two, three pause points are suggested, during which discussion can take place relating to the interprofessional learning objectives.

Opportunities for further reading and exploration of the scenario are provided in the *Further Information* and *References* sections of this resource manual.

Scenario brief

Gary Mitchel is a 20-year-old man who has experienced a traumatic brain injury during a car accident nine months ago. Alcohol, speed and inattention were all contributing factors to the accident in which he ignored a stop sign and was hit by a 4WD. His friend who was in the car with him was killed in the accident and Gary sustained a severe brain injury and almost died as a result.

Following six weeks in intensive care and six weeks in a High Dependency Unit, Gary was transferred to a rehabilitation unit. Gary's physical injuries and brain damage have resulted in him having to relearn basic tasks including walking, talking and swallowing. Frontal lobe damage has resulted in significant behavioural changes: he is impulsive, aggressive and sexually uninhibited, which is challenging for the staff caring for him.

Both staff and family are unhappy with the current care environment. The clinical nurse manager arranges a team meeting to discuss Gary's behaviour and the choices that need to be made to manage his physical and psychological issues, his ongoing rehabilitation and discharge planning.

List of characters

- Clinical Nurse Manager
- Father
- Mother
- Nurse
- Occupational Therapist
- Psychiatric Registrar
- Physiotherapist
- Social Worker
- Speech Pathologist

Key learning competencies

The key learning competencies for this scenario are based on the IpAC Program learning objectives as well as the Canadian Interprofessional Health Collaborative (CIHC) Competency Framework (Canadian Interprofessional Health Collaborative, 2010). The specific competency areas for this scenario are:

- Collaborative leadership
- Team functioning
- Client and family centred care
- Interprofessional communication
- Role clarification

Collaborative leadership

Health professionals within the team support a model of shared leadership where the team leader is selected based on the context of the specific situation. In order for collaborative leadership to be effective, team members must:

- Apply the principles of collaborative decision making
- Value and respect the unique contributions of each member of the team
- Be working towards agreed client centred outcomes
- Have shared accountability

Team functioning

Professionals support a team approach by:

- Establishing and maintaining effective and healthy working relationships and team interactions
- Respect team ethics and demonstrate trust and mutual respect for members of the team
- Be an active participant in collaborative decision making
- Be an effective and engaged participant in discussions and interactions among team members demonstrating open communication and attentive listening

Client and family centred care

The interaction between team members and the client/family demonstrates:

- The sharing of information with clients/family in a respectful manner

- Communicating with client/family in a way that is clear, understandable and free of jargon
- Listening respectfully to the needs of all parties to ensure the most appropriate care
- The interaction is supportive to the client/family

Interprofessional communication

The interaction between professionals demonstrates:

- Communication that is consistently authentic and demonstrates trust
- Active listening to team members (including the client/family)
- Communication that ensures a common understanding of care decisions
- The development of trusting relationships with clients/families and other team members

Role clarification

The interaction between the health care team demonstrates:

- Clear communication of the health care professional's role, knowledge, skills, and attitudes in an appropriate manner
- Health professionals are respectful and understand the important role of others in the health care team
- Performing their own roles in a culturally respectful way

Key discussion points

Scenario 1

Pause Point 1: Following vignettes

Collaborative leadership

- Who is the leader of the team? What leadership characteristics is this person showing, and where is this person lacking?

Team functioning

- Do you think this team enjoys working together? Why?

Client and family centred care

- How do you think the family is feeling at this point? What factors have contributed to these feelings? Reflect on the impact this life-changing event has had, but also how they are supported by the health care team.

Interprofessional communication

- How would you describe the quality of communication, both within the team and with the client and his parents?
- What do you like about the communication?
- What could be improved?
- Do you think team member interactions are effective and respectful?
- Identify and discuss appropriate and inappropriate examples of interactions from the scenario

Role clarification

In preparation of the team meeting, what do you think each health professional can offer the family?

- Nurse
 - Knows the day-to-day care needed, has seen the impact of the patient's disinhibition
- Clinical Nurse Manager
 - Chair the meeting, overview of disciplines involved, keep meeting on-task
- Psychiatric Registrar
 - Why and how of the medication, impact this will have on the family, explain change of personality, offer counseling to patient, family and nurse
- Physiotherapist
 - Working on walking and driving
- Social Worker
 - What support is available to clients, mediate between clients and health professionals
- Speech Pathologist
 - Speech and communication difficulties, swallowing difficulties
- Occupational Therapist
 - Adjustments that need to be made for wheelchair access, what activities will the patient be able to perform

Scenario 2

Pause Point 2: Team conference Part 1

- Do you think the health team is functioning well? Why?
- What factors do you feel are inhibiting a team focus?

- How productive is the communication of each of the team members?
- What perceptions and beliefs may be contributing to the dynamics within the meeting?
- What can each team member do to improve client-centred communication during this meeting?
- What can each team member do to improve client-centred communication between formal meetings? Why might this not be happening? How could this be addressed?

Pause Point 3: Team conference Part 2

- What pre-existing beliefs and attitudes can impact on effectively engaging clients and their families in the rehabilitation process? How can one make sure this does not happen?
- How would you now describe the functioning of the team?
 - Discuss the roles and responsibilities of the care team in engaging the client and family in decision making.
- Do you think the health professionals respect each other's roles in Gary's care?
- How was this (positive or negative) demonstrated in the meeting?
- How would you describe the communication within the team?
 - How has it improved from the start of the meeting?
 - Is there anything else that should be improved or implemented?
- Who is the client? Are they part of the team making decisions about the choices made in the care?

Pause Point 4: Preparing for the family

- Discuss the role of the different professions in the treatment of this frontal lobe injury client (short term and long term).
- Who was designated to lead the meeting with the family?
 - Why?
 - Do you think this was appropriate?
- What are your thoughts on how the case conference finished? Was there anything unresolved?
- How do you think the family will feel walking in to the meeting? Will they feel part of the process? How can the health professionals help make the meeting less threatening for the family?

Scenario 3

Pause Point 5: Family conference

- How have the health professionals demonstrated client/family centred care? (use the characteristics as listed for client centred care)
- Would you have any more suggestions for the team?
- How would you describe the leadership in the meeting? Who was /who were the leader(s)?
- How would you describe the communication in the meeting?
- How do you think the family is feeling at the end of the meeting? Why?
- How has each of the team members contributed to the meeting?
- Do you think the family is satisfied with the outcome of the meeting? Why?

Literature review

Brain injury is a major cause of disability and death globally, with the Centers for Disease Control and Prevention in the United States (U.S.) describing it as a “silent epidemic” (Gan, Campbell, Gemeinhardt, & McFadden, 2006; Rochette, Conner, & Smith, 2009). Traumatic brain injury (TBI) is ten times more common than spinal cord injury and accounts for 1% of all adult deaths (Helmy, Vizcaychipi, & Gupta, 2007; Khan, Baguley, & Cameron, 2003). The Australian Institute of Health and Welfare estimated 22,710 cases of hospitalised TBI in Australia in 2004–05, which equates to 0.1% of the Australian population that year (Helps, Henley, & Harrison, 2008). It is estimated that someone suffers a TBI every 21 seconds in the U.S. accounting for over 1.4 million American hospitalisations annually and approximately 50,000 deaths annually (Binder, Corrigan, & Langlois, 2005). In Europe, approximately 1.6 million people are admitted annually to hospital with TBI, with 66,000 deaths annually (Ribbers, 2007).

TBI is defined as injury of the brain due to an external force (Maas, Stocchetti, & Bullock, 2008). The common causes of TBI are motor vehicle accidents (approximately 40% of serious cases), falls, sporting accidents and assaults (Reeves & Panguluri, 2011; Rochette, et al., 2009). The preventable nature of many case of TBI makes it a major public health issue (Binder, et al., 2005; Reeves & Panguluri, 2011). Interventions, particularly in the areas of car design (e.g. airbags) and road safety (e.g. enforcement of seat belt laws, random breath testing and reducing speed limits) have been found to be highly effective in reducing the death toll from TBI in motor vehicle accidents (Abelson-Mitchell, 2008; Weninger & Hertz, 2007). Despite success in reducing death rates through improved driver education and road safety, severe injuries and fatalities still occur (Weninger & Hertz, 2007).

Age is a risk factor for TBI, with the incidence highest in young adults under the age of 35 years (Clark, Brown, Bailey, & Hutchinson, 2009; Khan, et al., 2003). TBI is responsible for 15–20% of deaths in individuals aged 5–35 years (Helmy, et al., 2007). Men are also more than twice as likely to sustain a TBI than women, with some estimating the ratio at over 3:1 (Clark, et al., 2009; Shore, 2005). Much of this age and sex bias has been attributed to higher risk-taking behaviours in these cohorts (Clark, et al., 2009; Khan, et al., 2003). Alcohol use is one such risk factor for both the incidence and severity of up to half of all TBI cases (Ergh, Rapport, Coleman, & Hanks, 2002; Khan, et al., 2003). Rochette, Conner & Smith (2009) found that two-thirds of TBI cases involving alcohol and/or drug use in a US study over 3 years were in people under the age of 45 years.

Classification of TBI

TBI is defined as damage to the brain resulting from an external force causing temporary or permanent neurological dysfunction (Khan, et al., 2003). Injury to the brain can vary along a spectrum from mild (e.g. a concussion) requiring only home rest before recovering, through to severe (e.g. a deep coma) where the individual requires ongoing life-long support and assistance (Gan, et al., 2006).

Identification of the location, level and extent of an individual's brain injury can be difficult (Kumar, Macaden, & K, 2009). Fortunately the availability of neuro-imaging devices such as CAT and MRI scans has improved diagnosis and detection of brain damage. Medical professionals use two relatively simple injury severity markers to guide TBI rehabilitation planning, namely posttraumatic amnesia (PTA) and the Glasgow Coma Scale (GCS) (Khan, et al., 2003; Saatman et al., 2008).

PTA is defined as that period of time in which the brain is unable to lay down continuous day-to-day memory (Khan, et al., 2003). Symptoms of PTA include disorientation, impaired cognition, restlessness, agitation and reduced arousal (Beaulieu et al., 2008). PTA intensity can range from mild to severe. Mild PTA may only require the provision of verbal cues to allow the individual to orient themselves to the immediate environment. However, in cases of severe PTA, the individual may exhibit agitated, aggressive and combative behaviour resulting from a perceived threatening environment (Beaulieu, et al., 2008).

Confusion and delirium are reported in 15–60% of general hospital clients and in all cases of moderate to severe TBI (Beaulieu, et al., 2008). Therefore the duration of PTA is a useful indicator of cognitive and functional deficits following TBI (Khan, et al., 2003). The duration of PTA is noted to correspond closely to the degree of diffuse axonal injury, as well as functional outcomes (Khan, et al., 2003). Generally, the longer the period of PTA and coma, the worse the physical and social functioning outcomes (Abelson-Mitchell, 2008).

The Glasgow Coma Scale (GCS) is an internationally adopted classification system for assessing severity of TBI that examines an individual's level of consciousness (Saatman, et al., 2008). The GCS is a simple, quick clinical tool to assess the severity of TBI that is particularly appropriate in the acute setting (Khan, et al., 2003). Assessment of an individual's verbal, motor, and eye-opening reactions to stimuli allows the clinician to generate a score of 3–15 (Kumar, et al., 2009). A score of 13–15 is classified as mild TBI, 9–

12 as moderate and a score below 8 as severe (Kumar, et al., 2009). However, the GCS does not allow for identification of specific neurological impairments and their organic basis to inform functional outcomes; it simply provides a prognosis for survival (Khan, et al., 2003; Saatman, et al., 2008).

Mild TBI

Mild head injury is classified as only a brief period of unconsciousness and represents an estimated 70–85% of all TBI cases (Abelson-Mitchell, 2008; Khan, et al., 2003). The incidence of mild TBI has been reported as 64–131 per 100 000. However it is recognised that many people who sustain a mild TBI do not seek medical treatment and so the true incidence may be much higher (Khan, et al., 2003; Shore, 2005). Sporting accidents and falls contribute the largest proportion of mild TBI and common symptoms include headache, nausea, vomiting, slurred speech, imbalance, disorientation, neck pain, delayed verbal or motor responding, and poor concentration or attention (Khan, et al., 2003; Shore, 2005).

Despite the ‘mild’ classification, individuals often report persistent cognitive, behavioural and emotional changes. These include memory and executive functioning impairments; poor concentration; irritability; anxiety; and depression, which can negatively impact on an individual’s employment, education and interpersonal relationships (Abelson-Mitchell, 2008; Nair, Turner-Stokes, & Tyerman, 2008; Shore, 2005). Given the potential negative impact of a mild TBI, a specialist consultation and review is appropriate (Gentleman, 2001).

Moderate and severe TBI

Whilst only 10% of mild TBI results in permanent disability, this increases to 66% of moderate TBI cases and 100% of severe cases (Kumar, et al., 2009). Moderate head injury is generally classified as a loss of consciousness for between 15 minutes and six hours or a GCS of between 9–12 (Abelson-Mitchell, 2008; Kumar, et al., 2009). The incidence of moderate head injuries is 15–20 per 100 000 population (Khan, Baguley & Cameron 2003). In Australia, motor vehicle accidents account for two-thirds of moderate and severe TBI cases (Khan, et al., 2003).

Severe head injury is classified when a client has been in a coma for six hours or longer or a GCS of 8 or below (Abelson-Mitchell, 2008; Boto, Gómez, De la Cruz, & Lobato, 2009). The incidence of severe TBI is 12-14 per 100 000 (Khan, et al., 2003). The majority of severe TBI cases are male (78%) and 39% are in the 15–24 year old age group (Boto, et al., 2009). The

mortality rate for severe TBI ranges from 23 to 47% with almost half of all deaths occurring in the first 48 hours following injury (Boto, et al., 2009; Helmy, et al., 2007).

Of those who survive, approximately 60% have significant ongoing deficits in the areas of cognition, physical movement, psychology and interpersonal relationships (Helmy, et al., 2007). A study by Sandhaug and colleagues (2010) found that whilst the majority of individuals with moderate TBI were discharged to their homes, only half of individuals with severe TBI were. Approximately 30% of individuals with severe TBI were placed into nursing homes or care facilities (Sandhaug, Andelic, Vatne, Mygland, & Seiler, 2010).

Therefore the injuries sustained by individuals with moderate and severe TBI have a significant impact on the financial, social and emotional well-being of these individuals and their families (Helmy, et al., 2007). It also has significant repercussions for governments and the health care system (Abelson-Mitchell, 2008). In Europe it is estimated that the direct healthcare costs of TBI are €2.9 billion (Andlin-Sobocki, Jonsson, Wittchen, & Olesen, 2005; Ribbers, 2007). This figure does not take into account the impact on society of losses in productivity and reduced quality of life (Ribbers, 2007). The U.S. has estimated that the direct and indirect cost of TBI is \$56 billion annually (Binder, et al., 2005).

Acute care

TBI results in both immediate (primary) and secondary injuries and a loss of consciousness often occurs (Reeves & Panguluri, 2011; Turner-Stokes, Nair, DSedki, Disler, & Wade, 2005). Immediate treatment following TBI is crucial as the first hour after trauma is seen as the most important and involves attending to immediate injuries and efforts to relieve cerebral perfusion pressure and intracranial pressure (Helmy, et al., 2007; Weninger & Hertz, 2007). Urgent neurosurgical intervention can moderate the severity of secondary injuries (Khan, et al., 2003). In individuals with mild TBI full recovery is often achieved within a few days, however, given the heterogeneity of TBI, symptoms have been known to persist or even develop with time (Reeves & Panguluri, 2011).

It is difficult during the initial period of acute care to accurately forecast an individual's outcome following a moderate or severe TBI (Khan, et al., 2003). Improvements in consciousness allow for the development of a rehabilitation treatment plan (Lippert-Grüner, Wedekind, & Klug, 2002). For individuals with TBI the rehabilitation process is generally

characterised by a period of acute care in a trauma hospital followed by general inpatient rehabilitation (sub-acute care) and finally discharge into a post-acute outpatient rehabilitation program (Sandhaug, et al., 2010).

Impairments following TBI

There are a varied and complex range of potential impairments that an individual with TBI may experience following injury, with the severity of these ranging from mild to severe (Turner-Stokes, et al., 2005). These include the physical, neurological, cognitive, behavioural and psychological domains (Reeves & Panguluri, 2011). Khan, Baguley & Cameron (2003) provide a succinct outline of the potential difficulties that may be faced (Table 1).

After moderate and severe TBI, a range of physical disabilities are frequently encountered during the acute phase of care as a result of both primary and secondary injuries (Gentleman, 2001). These may include:

- Sensory impairments and a permanent or temporary loss in vision, hearing, smell (and subsequently taste) depending on the root cause (e.g. optic nerve damage, clotted blood in the ear) (Gentleman, 2001; Reeves & Panguluri, 2011).
- Permanent damage to the cerebral cortex resulting in ongoing seizures which may require long-term anti-convulsant medication (Reeves & Panguluri, 2011).
- Generalised or unilateral muscle weakness and spasticity which if not addressed can limit joint movement, affect mobility and function, and cause pain and discomfort (Gentleman, 2001).
- Pressure sores may result for bedridden individuals typically over the sacrum and gluteal regions with those who are thin, poorly nourished, or incontinent of urine or faeces at increased risk (Gentleman, 2001). Prevention is the key, with risk minimisation strategies including correct lifting and handling techniques, regular turning routines and the use of pressure mattresses (Gentleman, 2001).
- Deep venous thrombosis can occur and the use of anti-embolism stockings and passive limb mobilisation are recommended rather than the use of anti-coagulants (Gentleman, 2001).
- Inadequate nutritional intake may result from a variety reasons following TBI, including loss of consciousness or swallowing difficulties (Gentleman, 2001). Percutaneous endoscopic gastrostomy (PEG) feeding is commonly adopted to address this problem (Gentleman, 2001).

- Heterotopic ossification (growth of bone material in the soft tissues of the body) may occur up to four months after injury and can cause limb swelling, pain and further deterioration in joint movement (Gentleman, 2001).

The cognitive, behavioural and personality changes resulting from a TBI can cause significantly more distress than any residual physical impairments (Khan, et al., 2003). They can be particularly distressing as these deficits may not be apparent to the casual observer (Gentleman, 2001).

Table 1: Potential Consequences of TBI

<p>Neurological impairment (motor, sensory & autonomic)</p>	<ul style="list-style-type: none"> - Motor function impairment: coordination, balance, walking, hand function, speech - Sensory loss: taste, touch, hearing, vision, smell - Sleep disturbance: insomnia, fatigue - Medical complications: spasticity, post-traumatic epilepsy, hydrocephalus, heterotopic ossification - Sexual dysfunction
<p>Cognitive impairment</p>	<ul style="list-style-type: none"> - Memory impairment, difficulty with new learning, attention and concentration; reduced speed and flexibility of thought processing; impaired problem-solving skills - Problems in planning, organising, and making decisions - Language problems – dysphasia, problems finding words, and impaired reading and writing skills - Impaired judgement and safety awareness
<p>Personality and behavioural changes</p>	<ul style="list-style-type: none"> - Impaired social and coping skills, reduced self-esteem - Altered emotional control; poor frustration tolerance and anger management; denial, and self-centredness - Reduced insight, disinhibition, impulsivity - Psychiatric disorders – anxiety, depression, post-traumatic stress disorder, psychosis - Apathy, amotivational states
<p>Common lifestyle consequences</p>	<ul style="list-style-type: none"> - Unemployment and financial hardship - Inadequate academic achievement - Lack of transportation alternatives - Inadequate recreational opportunities - Difficulties in maintaining interpersonal relationships, marital breakdown - Loss of pre-injury roles; loss of independence

Source: (Khan, et al., 2003, p. 291)

Cognitive impairments

Cognitive impairments include a range of information processing, memory concentration and organisation deficits (Reeves & Panguluri, 2011). Individuals with TBI frequently have difficulties in attention, concentration, memory, problem solving, decision making and insight (Kumar, et al., 2009). An individual's executive functioning may also be affected, impairing the ability to plan, initiate, sequence, and monitor performance in a task which is a skill required for many activities of daily living (e.g. planning and preparing a meal) and most paid employment (Gentleman, 2001).

General improvements in cognitive functioning have been found to naturally occur within the first six months following TBI but can continue for a period of up to two years with appropriate clinical interventions. The recovery process for many of these deficits is varied and often sporadic (Gentleman, 2001).

Aphasia is a common result from damage to the cortical structures involved in speech production (Reeves & Panguluri, 2011). Aphasia is difficulty understanding and/or producing spoken or written language (Reeves & Panguluri, 2011). Two common forms of aphasia associated with TBI are: anomia which involves difficulties in word recall and circumlocution in conversational speech (i.e. being overly wordy); and Wernicke's aphasia where speech is fluent but there is poor comprehension and impaired repetition (Reeves & Panguluri, 2011). Language difficulties are important to address as they have the potential to limit an individual's ability to communicate and interact with others (Reeves & Panguluri, 2011). Assessment followed by necessary speech and language rehabilitation has been found to positively impact on not only language skills but also other health outcomes associated with rehabilitation (e.g. psychological and behavioural) (Gentleman, 2001; Reeves & Panguluri, 2011).

Behavioural and psychosocial impairments

Behavioural symptoms of TBI post injury may include agitation, impulsivity, irritability, paranoia, self-centredness, verbal and physical aggressiveness, and inappropriate sexual behaviour (Shore, 2005; Waldron-Perrine, Hanks, & Perrine, 2008). Irritability and aggression are particularly common with estimates of 35–96% of individuals with TBI reporting agitated behaviour whilst in acute care (Reeves & Panguluri, 2011). Aggression encompasses both verbal and physical aggression against self, objects and other people and may also include severe irritability, violent, hostile, or assaultive behaviour and “episodic

dyscontrol” (Fleminger, Greenwood, & Oliver, 2006). Agitation is defined as disturbed behaviour as a result of overactivity (Fleminger, et al., 2006, p. 1). Agitation and aggressiveness can continue or even intensify in the long term with studies reporting symptoms of irritation 10–15 years post-injury for many individuals with TBI (Hart, Vaccaro, Hays, & Maiuro, 2011; Waldron-Perrine, et al., 2008). Family often become anxious and upset when these behaviours are exhibited both as a result of genuine embarrassment and also concern as to the long term implications of such behaviour on rehabilitation and returning to a normal life (Gentleman, 2001).

Problem behaviours associated with agitation are often perceived as inappropriate by hospital staff and other clients (Lequerica et al., 2007). The effectiveness of rehabilitation can also be compromised along with associated cognitive deficits in concentration and attentiveness, when it interferes with the individual’s ability to fully engage in intensive rehabilitation interventions (Lequerica, et al., 2007). Indeed agitation has been found to result in increased length of stay and poorer cognitive and motor functioning at discharge (Beaulieu, et al., 2008; Lequerica, et al., 2007). Research has also identified that managing stress and controlling one’s temper are seen as major unmet needs in individuals one year post-injury (Hart, et al., 2011). Agitation has important implications for life in the community as it can negatively impact on social relationships, employment opportunities and general community integration (Cattelani, Zettin, & Zoccolotti, 2010; Hart, et al., 2011). Therefore it is important that behavioural issues are addressed to allow individuals with TBI to maximise the benefits of rehabilitation (Lequerica, et al., 2007).

Targeted treatments for agitated and aggressive behaviours include pharmaceutical therapy and/or behavioural strategies (Beaulieu, et al., 2008). Behaviour modification techniques based on operant learning principles can be successfully used to reduce antisocial behaviours such as aggression (Gentleman, 2001). The aim is to decrease undesirable behaviours by using negative reinforcement techniques such as time out, and to increase desirable behaviours by the use of positive reinforcement (e.g. token economy) (Gentleman, 2001). These approaches are labour and time intensive, complex, and require a high level of consistency (Gentleman, 2001; Hart, et al., 2011). This makes them most suitable for management in an inpatient setting rather than on an outpatient basis (Beaulieu, et al., 2008).

The pharmacological treatments for agitation are discussed in the section *Pharmacological interventions*.

Personality changes or amplification of established personality traits (e.g. suspiciousness, anxiety) can also result after injury to the frontal lobe (Reeves & Panguluri, 2011). This can lead to impaired social judgement, lewdness, loss of social graces and shallow, indifferent or apathetic demeanour (Reeves & Panguluri, 2011).

Apathy, with or without depression, is reported in 71% of individuals with TBI following injury (Waldron-Perrine, et al., 2008). It is characterised by diminished initiative, motivation, interest and activity, and a general lack of concern and emotional responsiveness (Reeves & Panguluri, 2011; Waldron-Perrine, et al., 2008). Treatment of apathy is important as it can negatively impact on rehabilitation outcomes and integration back into the community (Waldron-Perrine, et al., 2008). Both pharmacological and psychological interventions (e.g. problem solving or goal setting approaches) are commonly used (Waldron-Perrine, et al., 2008).

Mood disorders are also common with incidence rates higher than those in the general population for many mental disorders (Reeves & Panguluri, 2011). Rates of depression range from 15 to 60%, generalised anxiety ranges from 11 to 24% and clinical anxiety is diagnosed in approximately 30% of individuals following TBI (Reeves & Panguluri, 2011). Injury severity is not necessarily a predictor of depression with low mood occurring in even quite mild cases of TBI (Reeves & Panguluri, 2011). However, the diagnosis of depression can be challenging given the cognitive, emotional, and somatic symptoms that overlap with TBI (Reeves & Panguluri, 2011). Treatment generally includes either pharmacological or psychological intervention (Gentleman, 2001). Not surprisingly, carers also often suffer mood problems following their loved one's TBI and wherever possible should be referred to an appropriate health support service (Gentleman, 2001).

It is important to remember that psychosocial problems may occur following all cases of TBI, not just those of major severity, and that these problems can escalate rather than diminish with time unless appropriate interventions are provided to the individual (Gentleman, 2001; Seeley et al., 2009).

Pharmacological interventions

Pharmacological management is common for the treatment of chronic symptoms of TBI, particularly those of a moderate or severe classification, who are suffering from disorders of mood, cognition and behaviour problems, seizures, hypertension, pain, movement disorder, and/or spasticity (Waldron-Perrine, et al., 2008).

Brain dysfunction following TBI is likely to alter drug side effects and drug interactions (Waldron-Perrine, et al., 2008). Animal and human studies have shown not only significant benefits but also detrimental side effects from various pharmaceuticals on neurological recovery following TBI (Beaulieu, et al., 2008). Therefore, there can be high variability in response to therapeutic agents across individuals with TBI and individualised strategies for pharmacotherapy are recommended (Waldron-Perrine, et al., 2008).

The similarity in symptomatology between depression and apathy make determination of the primary cause of low mood difficult in individuals with TBI, however the use of antidepressants has been found to be beneficial in these cases regardless of the underlying cause (Waldron-Perrine, et al., 2008). Selective serotonin reuptake inhibitors (SSRIs) are considered the first-line treatment in individuals with low mood and/or apathy following TBI (Waldron-Perrine, et al., 2008). Tricyclic antidepressants and monoamine oxidase (MAO) inhibitors are not generally suitable in individuals with TBI as they are more likely to result in adverse side effects (Reeves & Panguluri, 2011).

In regards to agitation, aggression and similar dysfunctional behaviours, the efficacy of pharmacological interventions has not been firmly established (Fleminger, et al., 2006). Often pharmacology is used to sedate rather than treat the underlying cause of the dysfunctional behaviour (Fleminger, et al., 2006). On occasion, the administration of pharmacological interventions is necessary due to the perceived risk to other clients, staff and visitors and/or to the client themselves (Gentleman, 2001). In these cases, it is important to monitor the individual to ensure the medication is achieving its desired outcome and with minimal side effects (Fleminger, et al., 2006).

The following classes of medications are commonly used to treat agitation and aggression in the individual with TBI:

- Beta-blockers have the most robust evidence in relation to efficacy by consistently reducing temper outbursts and assaultive behaviour in individuals with TBI

(Fleminger, et al., 2006; Waldron-Perrine, et al., 2008). Careful monitoring is important however, as bronchoconstriction and decreased cardiac output have been found to occur when large doses of beta-blockers are administered (Waldron-Perrine, et al., 2008).

- Anticonvulsants (particularly carbamazepine) are clinically well-tolerated with few adverse neurological side effects, although there is little evidence to demonstrate its efficacy (Fleminger, et al., 2006).
- Antidepressant selective serotonin reuptake inhibitors (SSRI) may improve irritability and anger outbursts for some individuals with TBI following an eight week regimen, although results are inconsistent (Waldron-Perrine, et al., 2008).
- Studies of lithium have shown no clear evidence to demonstrate its effectiveness in treating aggression and agitation resulting from TBI. However it continues to be prescribed for individuals with TBI and co-morbid bipolar disorder. (Waldron-Perrine, et al., 2008). In addition, individuals with TBI who take lithium have been found to be at risk of neurotoxicity, especially if also taking antipsychotic medication (Waldron-Perrine, et al., 2008).
- Antipsychotics are commonly used to quieten aggressive and agitated individuals in the short term but are generally not considered for longer term use due to the negative impact they have on cognitive and functional recovery and thus the rehabilitation process (Fleminger, et al., 2006; Waldron-Perrine, et al., 2008).
- Amantadine has been found to be effective in reducing agitation and disinhibition in the first 12 weeks following a TBI, although this is only based on case study findings (Waldron-Perrine, et al., 2008).
- Benzodiazepines are highly addictive and so are not recommended as a first line treatment option.

A systematic review of research into the pharmacological management for agitation and aggression in people with acquired brain injury suggests that regardless of the type or severity of aggressive and agitated behaviour, improvements from medication are usually evident within six weeks (Fleminger, et al., 2006). It is therefore recommended that if an improvement is not evident after this period then the medication should be withdrawn and a substitute initiated after a suitable waiting time (Fleminger, et al., 2006). Individuals with TBI can be sensitive to medication and as a result clinicians should begin on minimal doses and consider the duration as many medications are not approved for long term use and some

can negatively impact on an effective and productive rehabilitation process (Elovic, Jasey, & Eisenberg, 2008; Waldron-Perrine, et al., 2008).

An interdisciplinary rehabilitation approach

Improvements in early and acute management of TBI including continuous advances in paramedical interventions, Advanced Trauma Life Support (ATLS) protocols in emergency departments, availability of neuro-imaging, early intervention surgery and sophisticated intensive care have resulted in improved survival rates following TBI (Seeley et al. 2009, Gentleman 2001). However, the physical, neurological, behavioural and psychological impairments following TBI remain significant and many individuals fail to regain their pre-injury level of functioning in all areas of their life (Clark, et al., 2009). Given the typically young age of individuals who sustain a TBI (mean age of 30 years) and the fact that life expectancy is not significantly altered, the implications of TBI-related impairments for the individual, families and society are considerable (Clark, et al., 2009; Gentleman, 2001). This has been an impetus for greater rehabilitation support to address impairments and improve overall quality of life (Lequerica, et al., 2007).

The concept of the interdisciplinary rehabilitation team developed in response to the increased numbers of severely injured and disabled soldiers appearing during World War 2 (Strasser, Uomoto, & Smits, 2008). It was recognised that the traditional uni-disciplinary medical model of health care was not sufficient in meeting the needs of these soldiers with complex and varied health care needs (Strasser, et al., 2008). Indeed research has found that the best outcomes for individuals who have experienced TBI depend on a range of medical, psychosocial and educational support across a range of specialities and targeted at multiple domains (Strasser, et al., 2008; Wade, 2005).

Rehabilitation following TBI aims to improve an individual's functioning, to minimise impairments and to assist with reintegration back into the community (Seeley, et al., 2009). It is based upon the underlying premise of an interdisciplinary, team-based, educational and goal-oriented approach (Lexell, 2007). Initial rehabilitation is undertaken as an inpatient in a sub-acute care setting such as a hospital ward or specialist rehabilitation unit and focuses on assisting the individual to regain functional skills. This facilitates discharge back into the community where TBI clients may receive outpatient or day treatment rehabilitation (Turner-Stokes, et al., 2005).

The rehabilitation team is interdisciplinary in nature, composed of a range of disciplines, primarily medicine, nursing, occupational therapy, speech therapy, physiotherapy, social work, psychology (neuro, behavioural and clinical), nutrition and dietetics (Cullen, 2007; Lexell, 2007). Consultations from audiology, pharmacy, urology, ophthalmology, podiatry and prosthetics and orthotists may also occur (Cullen, 2007; Neumann et al., 2010; Wertheimer et al., 2008). The individual's general practitioner should also be kept informed of progress, especially approaching discharge as the general practitioner often plays a key role in supporting individuals and their families once back in the community (Khan, et al., 2003).

The rehabilitation of an individual following TBI is complex and requires a wide range of knowledge, skills and abilities (Andrews, 2005). No single individual or discipline is likely to have the requisite skills required to optimise rehabilitation outcomes (Neumann, et al., 2010). The range and frequency of discipline input into rehabilitation also varies with each individual and at different points throughout the rehabilitation process, based on individualised rehabilitation aims and goals (Neumann, et al., 2010; Wade, 2005). Therefore the quality of rehabilitation is dependent not only on the individual contribution of each health professional but also upon effective collaboration of the health professionals who form part of the care team (Sinclair, Lingard, & Mohabeer, 2009).

Communication is a critical component of effective teams (Körner, 2010). Health professionals in an interprofessional team are required to regularly discuss and collaborate on rehabilitation goals and jointly implement treatment plans (Körner, 2008). Health professionals are peers who cooperate, value and respect each other's input and contribution to the rehabilitation goals (Koch, Gitcheh, & Higgins, 2009). Decisions are made collaboratively and all professionals participate in the decision making process (Körner, 2010). Neumann and colleagues (2010) identified the following key features of a successful working rehabilitation team:

- Agreed aims;
- Agreement and understanding on how best to achieve these aims (avoiding jargon unique to a particular profession);
- Appropriate range of knowledge and skills for the agreed task;
- Mutual trust and respect; and
- Willingness to share knowledge and expertise and speak openly.

(Neumann, et al., 2010, p. 6).

Interdisciplinary team meetings, also referred to as case conferences, are a valuable tool where the rehabilitation team can discuss assessment results, treatment updates and revise plans (Wertheimer, et al., 2008). When held frequently they allow progress towards rehabilitation goals to be monitored, ensure open channels of communication and foster a group identity within the team (Nyein, Thu, & Turner-Stokes, 2007; Sinclair, et al., 2009).

The rehabilitation team will also participate in case conferences with individuals and their family (Ferguson, Worrall, & Sherratt, 2009). The involvement of individuals and family is fundamental for rehabilitation to be effective (Gentleman, 2001). Rehabilitation is based on adult education principles and the individual with TBI must ideally steer the rehabilitation goals and priorities (Gentleman, 2001). Development of a contract between individuals with TBI and their interprofessional teams outlining the expectations and responsibilities of all parties, can be useful in identifying relevant and realistic outcomes of rehabilitation which will influence motivation and satisfaction (Pomeroy et al., 2011).

Goal setting

Traditionally the client is a passive recipient of an intervention imposed by a medical practitioner (Wade, 2009). Within an interdisciplinary rehabilitation setting the objective is to determine how best to meet the needs of individuals with TBI to allow them to maximise their level of functioning (McClain, 2005). This is best achieved by developing and implementing a personalised therapy plan based on the client's needs, strengths and interests (Shore, 2005).

Goal setting is beneficial to both the client and health care professionals as it provides a focus for therapy and allows for the measurement of progress towards health care objectives (McClain, 2005). It is important that clients be included in the development of therapy goals and that these are endorsed by the whole interdisciplinary team (Neumann, et al., 2010).

Rehabilitation will be more successful if the individual is driven and motivated to achieve the rehabilitation goals (McClain, 2005). However, there is evidence that health care professionals and clients differ in what they believe are important therapy goals (McClain, 2005). Health care professionals tend to set goals that focus on mobility issues and tend to

not consider psychological goals (McClain, 2005). Yet intrinsic goals are found to be more motivating for clients rather than extrinsic goals like money or praise (McClain, 2005). A range of positive benefits have been found to result from including the client in the goal-setting process, which include increased adherence to goals, improved levels of satisfaction, and empowerment of the individual in independent self-care and rehabilitation management (McClain, 2005). The development of these skills is also valuable for when the individual is discharged into the community (McClain, 2005).

The benefits of collaborative goal setting are not restricted to the individual with TBI. There are also positive benefits to the interprofessional team by unifying the team's focus on client-centred goals rather than separate discipline-specific activities (Sinclair, et al., 2009). Operating from a client-centred approach allows the team to more easily exchange information, track client care, and work collaboratively (Sinclair, et al., 2009). Client-focussed care meetings also allow team members to openly exchange information and understand how each therapy session contributes to the individual's overall therapy goals (Sinclair, et al., 2009).

The key of a successful interdisciplinary rehabilitation team is collaboration in identifying rehabilitation goals, developing an appropriate plan to attain these goals and the regular review of progress (Sander & Constantinidou, 2008). Establishing a rehabilitation plan involves a process of engaging the client to identify the client's concerns and goals, as well as their achievements so far in the rehabilitation process and how these were successfully attained (McClain, 2005). Each plan should contain goals and objectives that address the individual's physical, neurological, behavioural, psychological and daily living impairments (Shore, 2005).

Stroud (2009) outlined the basic process in establishing rehabilitation goals as follows:

1. Select the problem
2. Define the problem in terms of behaviour
3. Develop long term goal(s)
4. Develop short term objectives
5. Decide on interventions and sequence
6. Implementation of interventions
7. Evaluate the outcome
8. If necessary, return to Step 1 and repeat

Source: (Stroud, 2009, p. 202).

In this process the health care professional can assist the client in establishing relevant goals and breaking down these goals into smaller objectives to ensure they are realistic and attainable. Ideally goals should adhere to the SMART model in that they should be Specific (what, why, how?); Measurable; Achievable (challenging without being seen as unattainable); Realistic; and Timely (Stroud, 2009).

Goals that are perceived as irrelevant or unattainable by the client may result in a loss of motivation (Wade, 2009). Therefore it is critical that goals are objectively recorded and regularly reviewed with adjustments made as appropriate (Neumann, et al., 2010; Shore, 2005).

Family impacts

TBI has a significant impact on the family as well as the individual affected (Gan, et al., 2006). The family supports and advocates for their loved one during medical treatment and rehabilitation and are often left with the caring responsibilities for the individual long after discharge from formal rehabilitation (Gan, et al., 2006). Therefore the family should be a collaborative partner in the rehabilitation process (Clark, et al., 2009). The family being involved in the rehabilitation process from early on can also result in a better transition into the community from inpatient care (Boschen, Gargaro, Gan, Gerber, & Brandys, 2007). Understanding the family system can inform individual care plans and thus improve care (Clark, et al., 2009).

Clark and colleagues (2009) provide a list of essential elements that should be included when providing family-centred care:

- Recognising the family as a constant in the client's life, while the service systems and personnel within those systems fluctuate
- Facilitating family-professional collaboration at all levels of health care
- Honouring the racial, ethnic, cultural, and socio-economic diversity of families
- Recognising family strengths and individuality and respecting different methods of coping
- Sharing complete and unbiased information with families on a continuous basis
- Encouraging and facilitating family-to-family support and networking

- Understanding and responding to client and family needs as part of health-care practices
- Adopting policies and practices that provide emotional and financial support to meet the needs of families
- Designing health care that is flexible, culturally competent, and responsive to family-identified needs

(Clark, et al., 2009, p. 219).

For the majority of families, the care process following a TBI is entirely unfamiliar and they must quickly learn to navigate this new world (Duff, 2006). Due to the serious cognitive and neurological symptoms following TBI, the family plays an important decision making and advocacy role, especially in the initial period following injury (Strasser, et al., 2008). Families state that clear and accurate information is most valued at all stages of the process (Andrews, 2005). Key questions may include what has happened, why has it happened, what are the repercussions, what is being done and by whom and what will be done in the future (Andrews, 2005). However, there is not always a clear understanding of the respective roles of family members and professionals and this can lead to poor communication between the parties and result in feelings of dissatisfaction (Clark, et al., 2009).

Families sometimes describe platitudes being expressed to them about the importance of the family in the care process, but these are often unaccompanied by tangible support or information available in plain language (Duff, 2006). Although many members of a care team do introduce themselves and explain their role, families often find it difficult to process all the verbal information provided to them (Duff, 2006). Even the differentiation between various allied health professionals such as a speech pathologist, occupational therapist and physiotherapist can result in confusion (Duff, 2006). Therefore, clear communication and meaningful interactions are important as they can result in families expressing higher levels of satisfaction with both the care delivered and achievement towards treatment goals (Duff, 2006).

The various physical, neurological, behavioural and psychological impairments resulting from TBI directly impact on individuals' families with 60% experiencing a significant change in their family structure following TBI (Curtiss, Klemz, & Vanderploeg, 2000). The impact of TBI on families can be long lasting and significant and in some cases problems may escalate rather than diminish with time (Gan, et al., 2006). The strain on caregivers is

particularly high as care may be required for a long period of time, even indefinitely, and requires the caregiver to potentially sacrifice a previous lifestyle, including employment or educational opportunities, financial security, social opportunities and privacy due to the changes in family dynamics (Curtiss, et al., 2000). In one study it was found that almost 40% of the caregivers were dissatisfied with their quality of life and experienced high levels of strain (Wolters Gregório, Stapert, Brands, & van Heugten, 2011). Levels of clinically significant high emotional stress of between 30–50% have been identified among the family members in a number of studies at one or more years following the TBI (Ergh, et al., 2002; Gan, et al., 2006).

The impact of TBI is typically greater on partners as carers than on parents (Wood, Lioffi, & Wood, 2005). Whilst parents are familiar with the caring role for their child, a partner must cope with losing an equal peer and reciprocal relationship and may also have to deal with behaviour and personality changes (Wood, et al., 2005). They may also experience social isolation; one study found that 27% of partners of sufferers with severe TBI never socialised at home and 19% never visited friends and relatives (Wood, et al., 2005). Divorce rates at least five years post-injury range from 34–54% in the literature (Wood, et al., 2005).

It is therefore important to include the family as a component of the rehabilitation process and provide or direct support to the caregivers (Wolters Gregório, et al., 2011). Social workers and psychologists are able to provide or assist families in accessing appropriate support services (Andrews, 2005). Interventions that have a strong psycho-educational and problem-solving focus can be effective in decreasing depression, anxiety and anger and increasing overall wellbeing in caregivers (Ponsford & Schönberger, 2010). These sessions can also be helpful in increasing communication skills within the family and addressing concerns about the future (Boschen, et al., 2007).

Support groups are valuable in providing caregivers with an opportunity to share information and develop informal social networks (Boschen, et al., 2007). This is important as caregivers are at increased risk of social isolation because of the intensity of providing care, and social support is one effective method of alleviating caregiver distress (Ergh, et al., 2002).

Therefore the health care system must consider not only the individual but recognise the importance of supporting a healthy family structure to achieve positive long term outcomes (Boschen, et al., 2007). In order to achieve this the following has been suggested as

necessary: early, continuous, and comprehensive services; information and education; advocacy; empowerment; and social belonging (Boschen, et al., 2007).

Community re-integration

The recovery process can continue for at least five years after a TBI (Khan, et al., 2003). The transition from hospital to home is a critical stage in the rehabilitation process (Nalder et al., 2011). The focus for the individual with TBI once they are situated back in the community is on successfully undertaking activities of daily living, social participation and recreational and vocational activities (Nyein, et al., 2007). However, many people encounter difficulties as they struggle with having reduced independence, needing to rely more on others, navigating outpatient rehabilitation services and trying to re-integrate in both social and vocational domains (Nalder, et al., 2011). Individuals report that in the longer term the cognitive, behavioural and interpersonal impairments are much more stressful than any remaining physical impairments (Khan, et al., 2003). These can limit an individual's opportunities to engage in valued activities such as employment, leisure activities and previous social relations (Sloan, Winkler, & Anson, 2007). These everyday activities, which many healthy people take for granted, are important milestones for individuals following TBI in achieving a fulfilling and productive life (Kim & Colantonio, 2010).

Living situation

Between 87–97% of individuals are successful within two years of TBI of independently undertaking personal care tasks and most with undertaking domestic tasks in the home environment (Sloan, et al., 2007). Those who experienced more severe TBI experience greater difficulties in undertaking basic tasks for daily living. Even after 2 years or more, fewer than 30% of individuals who experience severe TBI are fully independent in activities of daily living, and of those that require assistance, 25% require support on a daily basis (Sloan, et al., 2007).

Most individuals eventually return to their previous living situation, however 30% of those who experienced severe TBI are required to change their living situation, with many returning to living with their parents (Sloan, et al., 2007). In a small proportion of severe cases individuals are placed into aged care facilities (Sloan, et al., 2007).

Interpersonal relationships

Reduced social integration, social isolation and loneliness are described as some of the most significant problems for individuals following a TBI (Struchen, Pappadis, Sander, Burrows, & Myszka, 2011). Pre-injury friendships and opportunities for social interaction through pre-injury leisure activities generally decline (Struchen, et al., 2011). Studies examining the long term implications of severe TBI suggest that 26–45% of individuals are poorly integrated into their community, even with access to rehabilitation services (Sloan, et al., 2007). This has been attributed in part to a range of impairments following a TBI that negatively impact on an individual's ability to undertake positive social interactions (Struchen, et al., 2011). Personality, behavioural and social communication problems can include speech deficits, abruptness, overtalkativeness, inappropriate verbalisations, reduced initiation of social interaction, and insensitivity to others (Lippert-Grüner, et al., 2002; Struchen, et al., 2011).

Social interactions are reciprocal in nature and poor communication skills can impede easy, relaxed communication between individuals and create an uncomfortable environment (Struchen, et al., 2011). This discourages the potential for further positive social interactions thus weakening social networks and contributing to negative self-concept, psychological disorders (e.g. depression, anxiety), loneliness, and social withdrawal (Struchen, et al., 2011). Therefore it is important that support services are provided to enable community reengagement and maximise successful social interactions and community integration as early as possible following discharge (Nalder, et al., 2011).

Work

Successfully returning to work following TBI is an important milestone for many individuals (Khan, et al., 2003). It boosts self-esteem, brings financial benefits and improves satisfaction with quality of life (Khan, et al., 2003). However, there are a range of physical, cognitive and behavioural problems that can impact on an individual's ability to return to work (Nair, et al., 2008). Individuals with TBI, particularly those who have experienced moderate or severe TBI, often experience low levels of employment with rates of 7–50% reported for these individuals gaining employment (Lippert-Grüner, et al., 2002; Nair, et al., 2008). Vocational rehabilitation services play an important role in supporting individuals in their attempts to return to work or find alternative employment through retraining, re-skilling, providing on-the-job training or accessing supported employment options (Khan, et al., 2003; Nair, et al., 2008). Vocational rehabilitation professionals provide job-specific, goal-orientated

rehabilitation in the work setting as well as support in modification of the work environment and workplace education. Involvement of these professionals can increase employment rates up to 70% (Gentleman, 2001).

Transportation

Being able to autonomously get around, whether it is relearning to drive or the successful use of public transport is important for individuals following TBI in regaining independence and facilitating participation in vocational, leisure and social activities (Bivona et al., 2011). It also significantly increases levels of self-esteem and life satisfaction (Bivona, et al., 2011). Some retraining is almost always necessary in order to successfully regain these skills and should form part of rehabilitation efforts (Khan, et al., 2003).

Psychological impact

As previously described, individuals who suffer a TBI are at increased risk of psychological disorders including depression and anxiety (deGuise et al., 2008). One longitudinal study found that whilst overall functioning and integration improves in the three months following discharge into the community, levels of depression and anxiety also increase (Nalder, et al., 2011). Deficits in social communication, the loss of pre-injury friendships and general decline in social interactions following a TBI can contribute to feelings of loneliness and social isolation in these individuals (Struchen, et al., 2011). As such, long term psychological support services should be provided to individuals and their families following TBI to address the higher rates of emotional distress in this population (deGuise, et al., 2008).

Financial strain

Financial stress is a particular concern following discharge into community living (Nalder, et al., 2011). This has been attributed to additional care expenses, a reduction in income for individuals (through restrictions on employment options) as well as, in some instances, for their carers (Nalder, et al., 2011). This financial stress can negatively impact on individuals' abilities to access appropriate community services to support their integration back into the community (Khan, et al., 2003). This may be particularly the case for individuals living in more geographically distant or isolated areas where travel may be required to access appropriate services (Nalder, et al., 2011). Exacerbating this problem, cognitive impairments following TBI can affect an individual's ability to competently undertake important financial decisions (Khan, et al., 2003). This makes access to financial and therapy supports for individuals following TBI all that more important during this time (Nalder, et al., 2011). Social

workers can play a key role in providing individuals and their families with information on accessing benefits and grants, availability of local support agencies for housing and travel assistance as well as how to source information regarding legal and compensation issues (Andrews, 2005).

Conclusion

TBI is a significant health problem worldwide which often results in debilitating impairment to affected individuals as well as placing a significant emotional and financial burden on their families and communities (Gentleman, 2001). Rehabilitation following TBI can be a lengthy and complex process that involves tailoring care to meet the needs of the individual in order to maximise independence and participation in the community long-term (Khan, et al., 2003). Research has found that comprehensive rehabilitation undertaken by an interprofessional team gives consistently better results than natural recovery and results in high satisfaction for both the individual client and health professionals (Gentleman, 2001).

Medical glossary and acronyms

Acquired Brain injury (ABI) Describes all types of brain injury that occur after birth. Brain injury is defined as a loss of brain function which can be caused by accidents, poisoning, alcohol/drug abuse, brain tumour, anoxia (lack of oxygen to the brain), near drowning or disease.

Acute care Refers to the initial care that a person receives on admission to hospital for severe injury or illness. Acute care consists of life saving interventions, surgery, initial treatment and care.

Advanced Life Support (ALS) Is a set of life-saving protocols and skills that extend basic life support. Advanced life support is the level of medical care which is used for patients with life-threatening illnesses or injuries until the patient can be given full medical care at a hospital. It can be provided by trained medical personnel, including emergency medical technicians, paramedics and other trained medical staff with a focus on ensuring adequate circulation, open airways and breathing.

Aphasia Disorder involving difficulty understanding and/or producing spoken or written language.

Case conference A meeting of the healthcare team members to discuss progress, ongoing care, changes and concerns regarding individual client care. The meeting can often include the client and family as part of the healthcare team.

Cerebral perfusion pressure (CPP) Is a parameter that is related to the amount of blood flow to the brain. CPP must be maintained within narrow limits as too little pressure can cause brain tissue to become ischemic (i.e. not receiving adequate blood flow), whilst too much can raise intracranial pressure (ICP). CPP is calculated by subtracting the intracranial pressure from the mean systemic arterial blood pressure.

Computerised Axial Tomography scan (CAT scan)

Pictures of structures within the body created by a computer that takes the data from multiple X-ray images and turns them into pictures on a screen. The CAT scan can reveal some soft-tissue and other structures that cannot be seen in conventional X-rays.

Diffuse Axonal Injury (DAI)

A type of brain injury caused by blunt forces that occur between different parts of the brain as a result of rotational acceleration. The corpus callosum and the brainstem are often affected. DAI most commonly occurs in motor vehicle crashes.

Frontal lobe injury

The most common areas to be damaged and have focal lesions in non penetrating Traumatic Brain Injury are the orbital frontal cortex (the lower surface of the frontal lobes) and the anterior temporal lobes. The frontal lobes are responsible for human behaviour and emotional development and trauma to the front of the cerebral cortex impairs perception and rationality, social behaviour, personality, language skills, attention span, motor skills, sexual behaviour, as well as facial expression.

Glasgow Coma Scale (GCS)

The Glasgow Coma Scale is a neurological scale used to evaluate and quantify level of consciousness or unconscious by determining the best responses to standardized stimuli of which a patient is capable. A score between 3 (deeply unconscious) and 15 (fully conscious and alert) is given depending on the level of response to stimuli. The elements of the scale consist of best eye response, best verbal response and best motor response.

Impairment/Disability

A disability is recognised as a condition which is attributable to an intellectual, psychiatric, cognitive, neurological, sensory or physical impairment or a combination of those

impairments. A disability/impairment may substantially reduce the ability of the person for communication, social interaction, learning mobility and self-care.

Inpatient	A person who is admitted to hospital to receive medical care within a hospital facility and stays overnight in the facility.
Intensive care unit (ICU)	Hospital facility for care of critically ill patients at a more intensive level than is needed by other patients. Staffed by specialised personnel, the ICU contains a complex assortment of monitors and life-support equipment that can sustain life in once-fatal situations.
Interdisciplinary teams	A team that is collaboration-oriented. The team meets regularly to discuss and collaboratively set treatment goals and carry out treatment plans. There is a high level of communication and cooperation among team members (Korner, 2008, p. 2).
Intracranial pressure	The pressure that is exerted on to the brain tissue by external forces, such as cerebrospinal fluid (CSF) and blood. A rise in the volume of cerebrospinal fluid (from hydrocephalus) or blood (from bleeding) can cause an increase in intracranial pressure (ICP).
Magnetic Resonance Imaging (MRI)	Takes pictures of the brain for diagnosis.
Multidisciplinary teams	A team that is discipline-oriented. Each professional works in parallel, with clear role definitions, specified asks and hierarchical lines of authority (Korner, 2008, p. 2).
Outpatient	A person who is receiving care from a hospital or medical provider and does not need to stay overnight. This type of care is referred to as Ambulatory Care.

Pharmacology	Refers to the study of drugs - their sources, their nature and their properties. Pharmacology is also the study of the body's reaction to medications/drugs.
Primary/immediate injuries	Primary or immediate injury in TBI refers to the damage that occurs at the time of the initial trauma and impact.
Posttraumatic amnesia (PTA)	The person often remembers things prior to the accident but will not have recent memory. The length of time a person has PTA is relative to the severity of the diffuse TBI.
Rehabilitation	The process of restoration of skills by a person who has had an illness or injury, to regain maximum self-sufficiency and function in a normal or as near to normal manner as possible. Rehabilitation consists of remediation –intervention to regain lost function; compensation – environmental changes to assist the individual such as splints, aids and technology; and education for the client and family to enable self management and adjustment to changes in function.
Secondary injury	Secondary injury is an indirect result of the initial trauma. It results from the processes initiated by trauma. It occurs in the hours and days following the primary injury and plays a large role in the brain damage and death that can result from TBI.
Traumatic Brain Injury (TBI)	Traumatic brain injury (TBI) is a non-degenerative, non-congenital insult to the brain from an external mechanical force, possibly leading to permanent or temporary impairment of cognitive, physical, and psychosocial functions, with an associated diminished or altered state of consciousness. Traumatic brain injury is classified according to severity (mild-severe) mechanism of injury (closed or penetrating) and the area of brain damaged.

Further information

International Brain Injury Association (IBIA): <http://www.internationalbrain.org/>

IBIA was established to encourage international exchange of information, to support research, to provide training especially in developing countries and to advocate for brain injury.

Brainline.org: <http://www.brainline.org/>

BrainLine.org is a US based website and offers traumatic brain injury (TBI) information, support and resources for preventing, treating, and living with traumatic brain injury.

Brain Injury Australia: <http://braininjuryaustralia.org.au/>
or 1800 BRAIN1

Brain Injury Australia provides information and support for people and families affected by acquired brain injury.

Disability Services Commission (WA): <http://www.disability.wa.gov.au/>

The Western Australian State Government agency responsible for advancing opportunities, community participation and quality of life for people with disabilities. The Commission provides a range of direct services and support and also funds non-government agencies to provide services to people with disabilities, their families and carers.

National Disability Services (NDS): <http://www.nds.org.au/>
or 02 6283 3200

NDS is the Australian national industry association for disability services, representing over 650 not-for-profit organisations.

HealthInsite: <http://www.healthinsite.gov.au/>
or 1800 022 222

A *healthdirect Australia* health information service providing easy access to quality information about human health.

References

- Abelson-Mitchell, N. (2008). Epidemiology and prevention of head injuries: literature review. *Journal of clinical nursing*, 17(1), 46-57.
- Andlin-Sobocki, P., Jonsson, B., Wittchen, H. U., & Olesen, J. (2005). Cost of disorders of the brain in Europe. *European Journal of Neurology*, 12(suppl 1), 1-27.
- Andrews, K. (2005). Rehabilitation practice following profound brain damage. *Neuropsychological rehabilitation*, 15(3-4), 461-472.
- Baker, C., Pulling, C., McGraw, R., Dagnone, J. D., Hopkins-Rosseeeld, D., & Medves, J. (2008). Simulation in Interprofessional education for patient centred collaborative care. *Journal of Advanced Nursing*, 64(4), 372-379.
- Beaulieu, C., Wertheimer, J. C., Pickett, L., Spierre, L., Schnorbus, T., Healy, W., et al. (2008). Behavior Management on an Acute Brain Injury Unit. *Journal of Head Trauma Rehabilitation*, 23(5), 304-311.
- Binder, S., Corrigan, J. D., & Langlois, J. A. (2005). The Public Health Approach to Traumatic Brain Injury. *Journal of Head Trauma Rehabilitation*, 20(3), 189-195.
- Bivona, U., D'Ippolito, M., Giustini, M., Vignally, P., Longo, E., Taggi, F., et al. (2011). Return to driving after severe traumatic brain injury: increased risk of traffic accidents and personal responsibility. *Journal of Head Trauma Rehabilitation*. .
- Boschen, K., Gargaro, J., Gan, C., Gerber, G., & Brandys, C. (2007). Family interventions after acquired brain injury and other chronic conditions: a critical appraisal of the quality of the evidence. *NeuroRehabilitation*, 22(1), 19.
- Boto, G. R., Gómez, P. A., De la Cruz, J., & Lobato, R. D. (2009). A historical analysis of severe head injury. *Neurosurgical review*, 32(3), 4.
- Braithwaite, J., Westbrook, J. I., Foxwell, A. R., Boyce, R., Devinney, T., Budge, M., et al. (2007). An action research protocol to strengthen system-wide inter-professional learning and practice. *BMC Health Services Research*, 13(7), 144.
- Canadian Interprofessional Health Collaborative. (2010). A National Interprofessional Competency Framework. Vancouver: University of British Columbia.
- Canadian Interprofessional Health Collaborative (CIHC). (2008). Knowledge transfer and exchange in interprofessional education: synthesizing the evidence to foster evidence-based decision-making. Vancouver, Canada: University of British Columbia.
- Cattelani, R., Zettin, M., & Zoccolotti, P. (2010). Rehabilitation treatments for adults with behavioral and psychosocial disorders following acquired brain injury: a systematic review. *Neuropsychology review*, 20(1), 52-85.

- Centre for the Advancement of Interprofessional Education. (2002). Defining IPE, from <http://www.caipe.org.uk/about-us/defining-ipe>
- Clark, C., Brown, J., Bailey, C., & Hutchinson, P. (2009). Supporting families in the context of adult traumatic brain injury. *British Journal of Neuroscience Nursing*, 5(5), 216-220.
- Cullen, N. (2007). Canadian healthcare perspective in traumatic brain injury rehabilitation. *The Journal of head trauma rehabilitation*, 22(4), 214-220.
- Curtiss, G., Klemz, S., & Vanderploeg, R. D. (2000). Acute impact of severe traumatic brain injury on family structure and coping responses. *The Journal of Head Trauma Rehabilitation*, 15(5), 1113-1122.
- deGuise, E., LeBlanc, J., Feyz, M., Meyer, K., Duplantie, J., Thomas, H., et al. (2008). Long-term outcome after severe Traumatic Brain Injury. *Journal of Head Trauma Rehabilitation*, 23(5), 294-303.
- Duff, D. (2006). Family impact and influence following severe traumatic brain injury. *US National Library of Medicine*, 27(2), 9.
- Elovic, E. P., Jasey, J. N. N., & Eisenberg, M. E. (2008). The use of atypical antipsychotics after traumatic brain injury. *The Journal of Head Trauma Rehabilitation*, 23(2), 132-135.
- Ergh, T. C., Rapport, L. J., Coleman, R. D., & Hanks, R. A. (2002). Predictors of caregiver and family functioning following Traumatic Brain Injury. *Journal of Head Trauma Rehabilitation*, 17(2), 155-174.
- Ferguson, A., Worrall, L., & Sherratt, S. (2009). The impact of communication disability on interdisciplinary discussion in rehabilitation case conferences. *Disability and rehabilitation*, 31(22), 1795.
- Fleminger, S., Greenwood, R. J., & Oliver, D. L. (2006). Pharmacological management for agitation and aggression in people with acquired brain injury (Publication no. 10.1002/14651858.CD003299.pub2). from Cochrane database of systematic reviews
- Freeth, D. S., Hammick, M., Reeves, S., Barr, H., & Koppel, I. (2005). *Effective interprofessional education: development, delivery, and evaluation*. Noida: Blackwell Publishing.
- Gaba, D. (2004). The Future Vision of simulation in healthcare. *Quality in Health Care*, 13(1), 2-10.
- Gan, C., Campbell, K. A., Gemeinhardt, M., & McFadden, G. T. (2006). Predictors of family system functioning after brain injury. *Brain Injury*, 20(6), 587-587.
- Gentleman, D. (2001). Rehabilitation after traumatic brain injury. *Trauma*, 3(4), 193-204.

- Hart, T., Vaccaro, M. J., Hays, C., & Maiuro, R. D. (2011). Anger self-management training for people with Traumatic Brain Injury. *Journal of Head Trauma Rehabilitation, 1*.
- Helmy, A., Vizcaychipi, M., & Gupta, A. K. (2007). Traumatic brain injury: intensive care management. *British journal of anaesthesia, 99*(1), 32-42.
- Helps, Y., Henley, G., & Harrison, J. E. (2008). Hospital separations due to traumatic brain injury, Australia 2004-2005. In AIHW (Ed.), *Injury research and statistics*. Adelaide. Institutes of Medicine. (2003). Health professions education: A bridge to quality. Retrieved from www.iom.edu/CMS/3809/46345914.aspx
- Kenaszchuk, C., MacMillan, K., van Soeren, M., & Reeves, S. (2011). Interprofessional simulated learning: short term associations between simulation and interprofessional collaboration. *BMC Medicine 2011, 9*(29).
- Khan, F., Baguley, I. J., & Cameron, I. D. (2003). Rehabilitation after traumatic brain injury. *Medical Journal of Australia, 178*(6), 290-295.
- Kim, H., & Colantonio, A. (2010). Effectiveness of rehabilitation in enhancing community integration after acute traumatic brain injury: a systematic review. *The American journal of occupational therapy: official publication of the American Occupational Therapy Association, 64*(5), 709-719.
- Koch, L., Gitchel, D., & Higgins, K. (2009). Preparing students to be empathetic interdisciplinary rehabilitation team members. *Rehabilitation Education, 23*(2), 119-126.
- Korner, M. (2008). Analysis and development of multiprofessional teams in medical rehabilitation. *GMS Psychosocial Medicine, 5*(13), 2.
- Körner, M. (2008). Analysis and development of multiprofessional teams in medical rehabilitation. *GMS Psycho-Social-Medicine, 5*.
- Körner, M. (2010). Interprofessional teamwork in medical rehabilitation: a comparison of multidisciplinary and interdisciplinary team approach. *Clinical rehabilitation, 24*(8), 745-755.
- Kumar, S. K., Macaden, A., & K, S. K. (2009). Cognitive rehabilitation for occupational outcomes after traumatic brain injury (protocol) (Publication no. 10.1002/14651858.CD007935). from Cochrane Database of Systematic Reviews
- Lequerica, A. H., Rapport, L. J., Loehner, K., Axelrod, B. N., Vangel, S. J., & Hanks, R. A. (2007). Agitation in Acquired Brain Injury. *Journal of Head Trauma Rehabilitation, 22*(3), 177-183.
- Lexell, J. (2007). Rehabilitation of traumatic brain injuries in Sweden. *The Journal of head trauma rehabilitation, 22*(4), 229-233.

- Lippert-Grüner, M., Wedekind, C., & Klug, N. (2002). Functional and psychosocial outcome one year after severe traumatic brain injury and early-onset rehabilitation therapy. *Journal of rehabilitation medicine: official journal of the UEMS European Board of Physical and Rehabilitation Medicine*, 34(5), 211-211.
- Maas, A. I. R., Stocchetti, N., & Bullock, R. (2008). Moderate and severe traumatic brain injury in adults. *Lancet Neurology*, 7(8), 728-741.
- McClain, C. (2005). Collaborative rehabilitation goal setting. *Topics in Stroke Rehabilitation*, 12(4), 56.
- Nair, A., Turner-Stokes, L., & Tyerman, A. (2008). Vocational rehabilitation for acquired brain injury in adults (Protocol) (Publication no. 10.1002/14651858.CD006021.pub2). from Cochrane database of systematic reviews
- Nalder, E., Fleming, J., Foster, M., Cornwell, P., Shields, C., & Khan, A. (2011). Identifying factors associated with perceived success in the transition from hospital to home after brain injury. *Journal of Head Trauma Rehabilitation*.
- Neumann, V., Gutenbrunner, C., Fialka-Moser, V., Christodoulou, N., Varela, E., Giustini, A., et al. (2010). Interdisciplinary team working in physical and rehabilitation medicine. *Journal of rehabilitation medicine: official journal of the UEMS European Board of Physical and Rehabilitation Medicine*, 42(1), 4-4.
- Nyein, K., Thu, A., & Turner-Stokes, L. (2007). Complex specialized rehabilitation following severe brain injury: a UK perspective. *The Journal of Head Trauma Rehabilitation*, 22(4), 239.
- Pomeroy, V., Aglioti, S. M., Mark, V. W., McFarland, D., Stinear, C., Wolf, S. L., et al. (2011). Neurological principles and rehabilitation of action disorders: rehabilitation interventions. *Neurorehabilitation and Neural Repair*, 25(5), 33S-43S.
- Ponsford, J., & Schönberger, M. (2010). Family functioning and emotional state two and five years after traumatic brain injury. *Journal of the International Neuropsychological Society*, 16(2), 306-317.
- Reeves, R. R., & Panguluri, R. L. (2011). Neuropsychiatric complications of traumatic brain injury. *Journal of psychosocial nursing and mental health services*, 49(3), 42.
- Ribbers, G. M. (2007). Traumatic brain injury rehabilitation in the Netherlands: dilemmas and challenges. *The Journal of Head Trauma Rehabilitation*, 22(4), 234.
- Rochette, L. M., Conner, K. A., & Smith, G. A. (2009). The contribution of traumatic brain injury to the medical and economic outcomes of motor vehicle-related injuries in Ohio. *Journal of safety research*, 40(5), 353-358.

- Saatman, K. E., Duhaime, A.-C., Bullock, R., Maas, A. I. R., Valadka, A., Manley, G. T., et al. (2008). Classification of traumatic brain injury for targeted therapies: 1. *Journal of neurotrauma*, 25(7), 719-738.
- Sander, A. M., & Constantinidou, F. (2008). The interdisciplinary team. *The Journal of Head Trauma Rehabilitation*, 23(5), 271-272.
- Sandhaug, M., Andelic, N., Vatne, A., Mygland, A., & Seiler, S. (2010). Functional level during sub-acute rehabilitation after traumatic brain injury: Course and predictors of outcome. *Brain Injury*, 24(5), 740-740.
- Sargent, S., Loney, E. & Murphy, G. (2008). Effective Interprofessional Teams: "Contact is not enough" to build a team. *Journal of Continuing Education in the Health Professions*, 28(4), 228-234.
- Seeley, H. M., Dias, C., Hutchinson, P. J., Richards, H., Harkin, C., Pickard, J. D., et al. (2009). Head injury rehabilitation: the role of a neurotrauma clinic. *British Journal of Neurosurgery*, 23(5), 530-530.
- Shore, B. A. (2005). Helping the patient with Traumatic Brain Injury. *Behavioral Health Management*, 25(2), 30.
- Sinclair, L. B., Lingard, L. A., & Mohabeer, R. N. (2009). What's so great about rehabilitation teams? An ethnographic study of interprofessional collaboration in a rehabilitation unit. *Archives of physical medicine and rehabilitation*, 90(7), 1196-1201.
- Sloan, S., Winkler, D., & Anson, K. (2007). Long-term outcome following Traumatic Brain Injury. *Brain Impairment*, 8(3), 251-261.
- Strasser, D. C., Uomoto, J. M., & Smits, S. J. (2008). The interdisciplinary team and polytrauma rehabilitation: prescription for partnership. *Archives of Physical Medicine and Rehabilitation*, 89(1), 179-181.
- Stroud, A. (2009). Understanding and adapting after head injury: impact of awareness on rehabilitation. *British Journal of Neuroscience Nursing*, 5(5), 200-204.
- Struchen, M. A., Pappadis, M. R., Sander, A. M., Burrows, C. S., & Myszka, K. A. (2011). Examining the contribution of social communication abilities and affective/behavioral functioning to social integration outcomes for adults with traumatic brain injury. *The Journal of Head Trauma Rehabilitation*, 26(1), 30.
- Turner-Stokes, L., Nair, A., DSedki, I., Disler, P. B., & Wade, D. (2005). Multi-disciplinary rehabilitation for acquired brain injury in adults of working age (Publication no. 10.1002/14651858.CD004170.pub2). from Cochrane database of systematic reviews
- Wade, D. T. (2005). Describing rehabilitation interventions. *Clinical Rehabilitation*, 19(8), 811-818.

- Wade, D. T. (2009). Adverse effects of rehabilitation - an opportunity to increase quality and effectiveness of rehabilitation. *Clinical Rehabilitation*, 23(5), 387-393.
- Waldron-Perrine, B., Hanks, R. A., & Perrine, S. A. (2008). Pharmacotherapy for postacute traumatic brain injury: a literature review for guidance in psychological practice. *Rehabilitation Psychology*, 53(4), 426-444.
- Weninger, P., & Hertz, H. (2007). Factors influencing the injury pattern and injury severity after high speed motor vehicle accident- a retrospective study. *Resuscitation*, 75(1), 35-41.
- Wertheimer, J. C., Roebuck-Spencer, T. M., Constantinidou, F., Turkstra, L., Pavol, M., & Paul, D. (2008). Collaboration between neuropsychologists and speech-language pathologists in rehabilitation settings. *Journal of Head Trauma Rehabilitation*, 23(5), 273-285.
- Wolters Gregório, G., Stapert, S., Brands, I., & van Heugten, C. (2011). Coping styles within the family system in the chronic phase following acquired brain injury: its relation to families' and patients' functioning. *Journal of rehabilitation medicine : official journal of the UEMS European Board of Physical and Rehabilitation Medicine*, 43(3), 190-193.
- Wood, R. L., Lioffi, C., & Wood, L. (2005). The impact of head injury neurobehavioral sequelae on personal relationships: preliminary findings. *Brain Injury*, 19(10), 845-851.
- World Health Organization. (2010). Framework for action on interprofessional education and collaborative practice. In D. Hopkins (Ed.). Geneva: World Health Organization.