Managing challenging behaviours after traumatic brain injury in the acute hospital setting

By

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SUMMARY

Challenging behaviours after traumatic brain injury (TBI) are common, difficult to manage in acute hospital settings, and present many risks of harm to patients, staff and families. People with TBI can experience a range of physical, sensory, communication, cognitive, and behavioural difficulties. Behavioural changes, commonly referred to as challenging behaviours, can include agitation, aggression, disinhibition impulsivity, perseveration, wandering or absconding, and apathy. TBI patients with challenging behaviours experience risks of self-inflicted harm, falls, delayed transitions from acute care to rehabilitation, and adverse functional outcomes. Acute hospital clinicians working with TBI patients with challenging behaviours are frequently exposed to risks of workplace violence. Families of TBI patients with challenging behaviours experience emotional strain, distress and burden during the acute recovery stage. Management of challenging behaviours after TBI in acute settings is variable, with limited evidence for management interventions. Furthermore, clinicians lack the knowledge, skills and confidence to effectively manage challenging behaviours after TBI in the acute setting. The variability in care, lack of knowledge, skills and confidence impedes delivery of quality and consistent care to patients with TBI. This thesis addresses the critical need to understand implementation of evidence-informed TBI behaviour management within the acute hospital setting. TBI behaviour management is complex within the acute hospital context. With incorporation of implementation science frameworks utilised in the research studies, this thesis has demonstrated vital and novel recognition of the contextual factors that can enhance or impede the implementation of evidence-informed TBI behaviour management to patients with TBI in acute hospital settings.

This thesis outlines six research studies that were undertaken to understand the factors relating to the management of challenging behaviours after TBI in the acute hospital setting. A pragmatic multi methods approach underpinned by implementation science was utilised. The original contribution to knowledge from research presented in this thesis includes:

- Feasibility of implementing a consistent approach to the assessment and management of challenging behaviours after TBI in acute hospital settings.
- Identified and evaluated international evidence and clinical practice guidelines for the management of challenging behaviours after TBI in the acute setting, including applicability and implementation into clinical practice.
- There are barriers, but also enablers and contextual factors to the implementation of evidence-informed TBI behaviour management approaches in the acute hospital setting.
- Developed implementation strategies to support future implementation in clinical practice.

Findings from the research studies incorporated in this thesis have addressed a gap in research and clinical practice by identifying the contextual factors that influence the implementation of

evidence into practice for TBI behaviour management in the acute hospital setting. Further education and training are required to address barriers to clinician's knowledge, confidence and skills in adequately managing challenging behaviours after TBI in acute settings. Hospital environments, staffing workforce, and lack of resources were identified barriers. Supportive multi-disciplinary teams, person-centred approaches, with family involvement in care can leverage effective TBI behaviour management in acute hospital settings. Furthermore, there is a need to provide support and information to families of patients with challenging behaviours after TBI in the acute setting. Considerations for further research, implications for policy, and implications for clinical practice are discussed.

This thesis highlights novel and critical implementation factors for evidence-informed management of challenging behaviours after TBI relevant to the acute hospital context. Recommended implementation strategies are outlined for the implementation of improvements into clinical practice. Further research on the effectiveness of both implementation strategies and interventions for the management of challenging behaviours after TBI in the acute hospital setting is warranted.

DECLARATION

I certify that this thesis:

1. does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university

2. and the research within will not be submitted for any other future degree or diploma without the permission of Flinders University; and

3. to the best of my knowledge and belief, does not contain any material previously published or written by another person except where due reference is made in the text.

Signed.....

Date.....

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Block, H., Hunter, S. C., Bellon, M., & George, S. (2022). Implementing a behavior management approach in the hospital setting for individuals with challenging behaviors during acute traumatic brain injury. *Brain Injury*, 1-11. https://doi.org/10.1080/02699052.2022.2110941

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Block, H., Hunter, S.C., Bellon, M., & George, S. (2023). Implementing evidence-informed practice for managing challenging behaviours after traumatic brain injury in the acute hospital setting: The perspectives of staff. *BMC Health Services Research*. https://doi.org/10.1186/s12913-023-10279-z

Block, H., George, S., Hunter, S.C., & Bellon, M. (2023). Family experiences of the management of challenging behaviours after traumatic brain injury in the acute hospital setting. *Disability and Rehabilitation*. https://doi.org/10.1080/09638288.2023.2280081

Conference presentations and posters

**Denotes presenting author*

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LIST OF ABBREVIATIONS

ABA	Applied Behaviour Analysis
ACSQHC	Australian Commission on Safety and Quality in Health Care
AGREE II	Appraisal of Guidelines for Research and Evaluation II
AOTA	American Occupational Therapy Association
CASP	Critical Appraisal Skills Programme
CBT	Cognitive Behavioural Therapy
CFIR	Consolidated Framework for Implementation Research
COREQ	Consolidated Criteria for Reporting Qualitative Research
CPG	Clinical Practice Guideline
DAI	Diffuse Axonal Injury
DLE/DWC	Department of Labor and Employment and Division of Workers' Compensation
ERIC	Expert Recommendations for Implementing Change
EST	Ecological Systems Theory
FG	Focus Group
GCS	Glasgow Coma Scale
ICC	Intraclass Correlation Coefficient
ICD-10	International Statistical Classification of Diseases and Health Related Problems, 10th Edition
IKT	Integrated Knowledge Translation
INESSS-ONF	Intitut National d'excellence en sante et en services sociaux - Ontario Neurotrauma Foundation
IPA	Interpretive Phenomenological Approach

i-PARIHS	integrated-Promoting Action on Research Implementation in Healthcare Settings
IQR	Interquartile Range
KTA	Knowledge to Action
NGWG	Neurobehavioral Guidelines Working Group
NPT	Normalization Process Theory
NSQHS	National Safety and Quality Health Service
OBS	Overt Behaviour Scale
P	Participant
PBS	Positive Behaviour Support
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PTA	Post-Traumatic Amnesia
RCT	Randomised Controlled Trial
RE-AIM	Reach, Effectiveness, Adoption, Implementation, Maintenance
SD	Standard Deviation
SIGN	Scottish Intercollegiate Guidelines Network
SR	Systematic Review
TBI	Traumatic Brain Injury
TDF	Theoretical Domains Framework
TIDieR	Template for Intervention Description and Replication
TMS	Transcranial Magnetic Stimulation
TRIUMPH	Tele-Rehabilitation Interventions through University-based Medicine for Prevention and Health
1:1	One-on-one

CHAPTER 1 INTRODUCTION

This introductory chapter will provide a general overview, rationale for this thesis, with the research aims, studies undertaken, original contribution to knowledge and structure of the thesis provided.

1.1 Traumatic brain injury in the acute hospital setting

Traumatic brain injury (TBI) is defined as a traumatically induced structural injury with physiological alteration of brain function, as a result of an external force (Menon et al., 2010). Within the Australian context, people with TBI generally receive initial acute management within hospital settings, which may include an emergency department visit, neurosurgical intervention and/or intensive care unit management as necessary (Cullen et al., 2019). Within this thesis, the term "patient" will be used in reference to the person recovering from TBI. Although person-centred language is preferable, the term "patient" is appropriate in relevance to the acute hospital setting.

Early acute hospital care for patients recovering from moderate-severe TBI can encompass promoting medical stability, prevention of further complications, coma treatment, and a period of regaining consciousness following coma emergence (Synapse, 2023). On emergence from coma, the patient with TBI enters a period of post-traumatic amnesia (PTA), characterised by confusion, disorientation and behavioural changes (Marshman et al., 2013; Ponsford et al., 2021). Common behavioural changes exhibited in the early acute recovery phase of TBI include agitation, verbal and physical aggression, disinhibition, perseveration, wandering and absconding, and apathy (Hicks et al., 2017; Kelly et al., 2006). Agitation is often described as restlessness and impulsivity with emotional lability and aggression (Carrier et al., 2021). Verbal aggression is often described as making loud noises, shouting angrily, swearing, personal insults or threats of violence (Kelly et al., 2006). Physical aggression is often described as throwing objects, breaking objects, banging head, hitting fist to objects, throwing self to floor or objects, striking, kicking, pushing or pulling others, attacking others, inflicting injury to self or others (Kelly et al., 2006). Disinhibition involves socially or sexually inappropriate behaviour, such as touching others who do not want to be touched, making comments of a sexual nature, removing clothing, coercion, socially awkward or inappropriate, nuisance or annoyance, noncompliance or oppositional (Kelly et al., 2006). Perseveration is often described as prolonged continuation and repetitive behaviour that may result in physical harm (Kelly et al., 2006). Wandering and absconding involves entering prohibited areas, leaving familiar or 'safe' environment, escaping secure premises (Kelly et al., 2006). Apathy is described as lack of initiation causing difficulty getting tasks started or completed, lack of motivation or initiative (Kelly et al., 2006).

Acute TBI hospital care within an Australian context is routinely provided by multi-disciplinary teams consisting of medical, surgical, nursing, and allied health professionals inclusive of

occupational therapist, physiotherapist, speech pathologist, and social worker (Synapse, 2023). The multi-disciplinary team monitors the patient's recovery, condition, progress, and provides care throughout the acute hospitalisation to support discharge pathways for subacute rehabilitation and community integration (Cullen et al., 2019; Khan et al., 2003).

Across acute settings, the care provided following TBI can be variable (Cullen et al., 2019) due to a range of factors including: resource availability organisation of health services, TBI symptomology, and a lack of evidence-based protocols (Cullen et al., 2019; Khan et al., 2003). The variability in access and provision of acute care to patients recovering from TBI can increase the likelihood of negative consequences (Matney et al., 2022). For some patients there are challenges in the provision of evidence-informed acute management, due to their symptoms after TBI for example, for those with multiple traumas, confounding comorbidities, disorders of consciousness, and cognitive and behavioural effects (Matney et al., 2022). Specifically for patients with acute TBI experiencing challenging behavioural effects, reduced evidence-informed care can increase the likelihood of risk of harm, increased length of hospital stay, and poorer progress in rehabilitation and functional outcomes (Beaulieu et al., 2008; Bogner et al., 2015; Bogner et al., 2001; Kosch et al., 2010; Lequerica et al., 2007; Luauté et al., 2016; McNett et al., 2012; Sandel & Mysiw, 1996). Evidence-informed care for patients with acute TBI experiencing challenging behaviours should encompass a multi-disciplinary, comprehensive approach with regular assessment and monitoring of behaviour change; non-pharmacological management interventions; followed by pharmacological treatments if required (Bayley et al., 2016; Flanagan et al., 2009; Luauté et al., 2016). Evidence-informed TBI rehabilitative behaviour interventions in the acute hospital setting are limited by variability in care practices, lack of rigorous research, and gaps in clinicians' knowledge and skills (Callender et al., 2017). Therefore, there is a need for more research to build evidence-based interventions and implemented improvements for TBI behaviour management in the acute hospital setting to promote best outcomes for patients with TBI.

1.2 General background and rationale for the thesis

Challenging behaviours after TBI are common within acute inpatient hospital settings (McNett et al., 2012; Nott et al., 2006; Phyland et al., 2021). Challenging behaviours after TBI should be routinely assessed, with non-pharmacological management prior to progressing to pharmacological management (Bayley et al., 2016). Currently, there is a lack of evidence for the efficacy for non-pharmacological and pharmacological interventions for challenging behaviours after TBI (Carrier, Ponsford, Phyland, et al., 2022; Hicks et al., 2018; Levy et al., 2005; Luauté et al., 2016; McNett et al., 2012; Phyland et al., 2021; Plantier & Luauté, 2016). There is also variability of clinical practice guidelines, with recommendations predominantly based on expert opinion (Centers fo Disease Control and Prevention, 2015; Flanagan et al., 2009; Seel et al., 2015; Shafi et al., 2014; Shafi et al., 2012). Limited evidence and quality of guideline recommendations

can influence clinician's levels of knowledge, skills and delivery of quality and consistent care (Seel et al., 2015; Shafi et al., 2014; Shafi et al., 2012). Therefore, there is a need for a pilot study to collaboratively develop and implement a consistent, clinically pragmatic approach to the assessment and management of challenging behaviours after TBI within hospital settings. Furthermore, there is a need to review and better understand the quality of the synthesised evidence and clinical practice guidelines (CPGs) for TBI behaviour management relevant to the acute hospital setting. Given the limited evidence and variability of guidelines relating to the management of challenging behaviours after TBI in the acute setting, reviews of evidence in synthesised literature and quality of CPGs relating to TBI behaviour management in the acute hospital setting are warranted.

There are a lack of studies incorporating implementation science for understanding the implementation of evidence-based, evidence-informed, and innovative management approaches of challenging behaviours after TBI relevant to the acute hospital context. Furthermore, there is a gap in understanding the implementation factors that may enhance or impede implementation of evidence-informed improvements for TBI behaviour management in the context of the acute hospital setting.

The acute hospital setting is a complex ecosystem with intertwined barriers and enablers influencing the provision of effective TBI behaviour management. Within acute hospital settings, there is variability in TBI patient presentations with multiple traumas, comorbidities and varied symptoms effecting consciousness, physical, sensory, cognitive and behavioural function (Matney et al., 2022). Hospital settings provide complex health services to treat a range of patient populations with variable health conditions. Furthermore, the physical environment of the acute hospital setting; hospital processes; staff workload and resources; hospital workflow organisation influence delivery of quality care within the hospital context (Geerligs et al., 2018). Implementation science is required to enable a detailed understanding of the context of the acute hospital setting and how contextual factors can influence effective, efficient, and sustainable implementation of effective, evidence-informed TBI behaviour management in acute clinical practice (Lynch et al., 2018). A need has been recognised for implementation frameworks to be incorporated into studies in this thesis to address the gap in understanding the barriers, enablers and contextual factors influencing implementation of evidence-informed TBI behaviour management in the acute setting. Furthermore, by systematically developing an understanding of the contextual factors for implementation, novel opportunities for implementation strategies will inform further research and practice to add to the knowledge base to maximise the uptake of evidence-informed practice for TBI challenging behaviours in the acute setting.

1.3 Objective and aims

The core objective of this thesis is to understand the factors relating to managing challenging behaviours after TBI in the acute hospital setting. To fulfil this broad objective, three important aims are explored:

- Aim 1: To develop and implement a consistent clinically pragmatic behaviour management approach in hospital settings to improve outcomes for patients with TBI.
- Aim 2: To systematically explore, appraise and summarise the evidence in literature and clinical practice guidelines for the management of challenging behaviours after TBI in the acute hospital setting.
- Aim 3: To explore barriers, enablers and contextual factors to the implementation of evidence-informed practice to inform strategies to improve TBI behaviour management in the acute hospital setting.

1.3.1 Studies undertaken to address research aims

Outlined in Figure 1.1, to achieve the aims of this thesis, six studies were conducted in a multi-phase multi methods research design consisting of:

1. Implementing a behaviour management approach in the acute hospital setting for individuals with challenging behaviours during acute traumatic brain injury (Chapter Four).
2. Evidence for the management of challenging behaviours in patients with acute traumatic brain injury or post-traumatic amnesia: An Umbrella Review (Chapter Five).
3. Clinical practice guideline recommendations for the management of challenging behaviours after traumatic brain injury in acute hospital and inpatient rehabilitation settings: A systematic review (Chapter Six).
4. Barriers and enablers to managing challenging behaviours after traumatic brain injury in the acute hospital setting: The perspectives of staff (Chapter Seven).
5. Management of challenging behaviours after TBI in the hospital setting: The perspectives of families (Chapter Eight).
6. Current knowledge and practice of the management of challenging behaviours after TBI in the hospital setting: An audit of practice and a survey of staff (Chapter Nine).

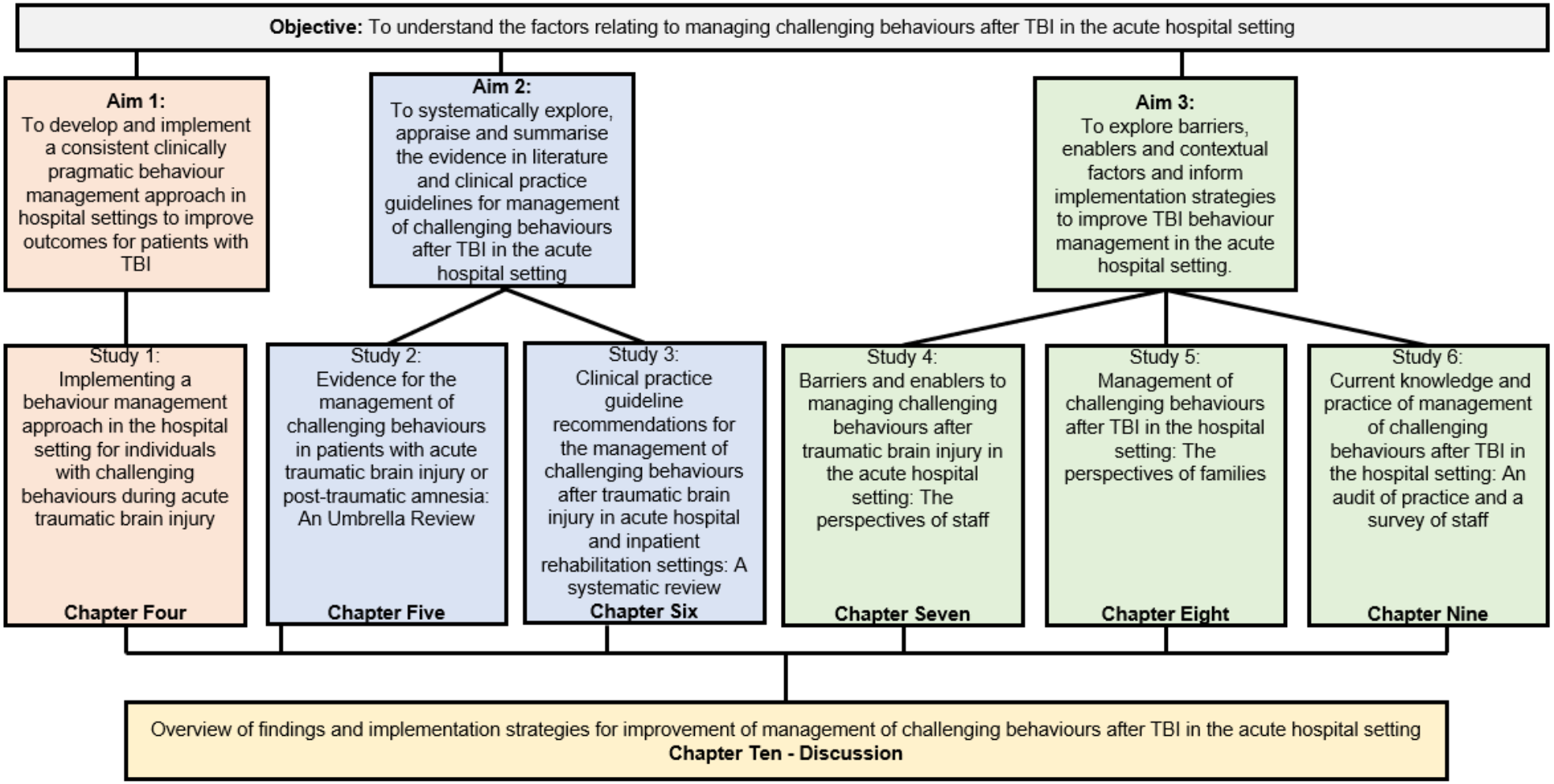


Figure 1.1 Objective, aims, studies and chapters within this thesis

1.3.2 Thesis structure

Following this introductory chapter, an overview of relevant background literature is presented in Chapter Two, followed by an overview of methodology in Chapter Three. Figure 1.1 outlines the structure of this thesis. Studies one to six are presented as six independent but interrelated chapters in this thesis conducted in phases throughout this PhD candidature. Study one was conducted in the first phase during the initial Higher Research Degree Masters by Research enrolment. Following subsequent upgrade to PhD candidature, studies two to six were then completed. A diagram outlining the timeline of the six studies undertaken is available in Appendix 1.

Chapters Four to Eight present work that has been published or currently under review for publication in peer reviewed journals. Chapter Nine is a supporting study that is not intended to be submitted for publication but provides contextual pilot data to inform implementation strategies. For each of the studies in the chapters of this thesis, an introductory background, rationale for each study, methodological approaches, results, and discussion of findings and conclusions will be provided.

1.3.2.1 Outline of chapters

Following this introductory chapter, Chapter Two provides a general overview of literature of TBI, symptoms of TBI and recovery models of care. Challenging behaviours after TBI will be introduced with prevalence, pathophysiology, and associated risks. Current state of knowledge for the principles of behaviour management after TBI will be described including gaps in research and practice relevant to the management of challenging behaviours after TBI in the acute hospital setting. Implementation science will be introduced with relevant frameworks to this thesis discussed.

Chapter Three provides an overview of theoretical and methodological approaches for this thesis, including methods utilised for each study. Ethical considerations for the integrity of research conducted will be briefly described.

Chapter Four presents the first study, a pilot study of implementing a behaviour management approach for people with challenging behaviours after acute TBI in the hospital setting. The clinically pragmatic approach, utilising an integrated knowledge translation framework is provided, and results discussed. A concluding summary of findings and the need for further investigation of evidence and implementation factors is presented.

Chapter Five is an umbrella review of the evidence for the management of challenging behaviours in patients with acute TBI or PTA. The methodological overview, results and discussion will be provided.

Chapter Six presents a systematic review, synthesising recommendations and examining the quality of clinical practice guidelines relating to the management of challenging behaviours after TBI in acute hospital and inpatient rehabilitation settings.

The implementation barriers, enablers and contextual factors are introduced in Chapter Seven through a qualitative study gaining perspectives of staff on managing challenging behaviours following TBI in the acute setting. In addition to understanding the service-related implementation factors, the perspectives of families on the management of challenging behaviours after TBI in the hospital setting is presented in Chapter Eight.

Chapter Nine presents an audit of current practice of the use of TBI behaviour management clinical practice guideline recommendations, to understand current evidence-practice gaps, and a survey of acute staffs' confidence in managing challenging behaviours.

The thesis will conclude with Chapter Ten, a discussion of the summary of findings addressing the research aims. Considerations for improvements in clinical practice with recommendations of implementation strategies, future research and policy provided.

1.3.3 Original contribution to knowledge

The studies included in this thesis will address gaps in research and clinical practice, and provide original contributions to knowledge through:

- Feasibility of implementing a consistent approach to the assessment and management of challenging behaviours after TBI in acute hospital settings.
- Identified and evaluated international evidence and clinical practice guidelines for the management of challenging behaviours after TBI in the acute setting, including applicability and implementation into clinical practice.
- There are barriers, but also enablers and contextual factors to the implementation of evidence-informed TBI behaviour management approaches in the acute hospital setting.
- Developed implementation strategies to support future implementation in clinical practice.

Except where reference is made in the thesis, no person's work has been included in this thesis without acknowledgement in the main text. This thesis has not been submitted for assessment at any other tertiary institution. All research studies included in this thesis were approved by the relevant Human Research Ethics Committees before the commencement of each study. All participants included in this study provided consent to participate.

CHAPTER 2 LITERATURE REVIEW

This chapter will provide a general overview of TBI, symptoms of TBI and recovery models of care. Challenging behaviours after TBI are introduced with prevalence, pathophysiology and associated risks. Current state of knowledge for the principles of behaviour management after TBI are described including gaps in research, and practice relevant to the management of challenging behaviours after TBI in the acute hospital setting. Implementation science will be introduced, with a specific description of the acute hospital context and definition of implementation strategies.

2.1 Traumatic Brain Injury (TBI)

2.1.1 Epidemiology of TBI

TBI has a high incidence internationally, with 69 million individuals estimated to sustain a TBI each year (Dewan et al., 2019). The estimated incidence of hospitalisations involving TBI is 275,000 per annum in the United States (Faul et al., 2010), and 22,710 in Australia (Helps et al., 2008). Motor vehicle accidents are the most common cause of TBI, followed by falls, violence, and injuries from sporting activities (Rao & Lyketsos, 2000). People with TBI can experience a range of physical, sensory, communication, cognitive, behavioural, and psychosocial difficulties (Glenn & Shih, 2020; Menon & Bryant, 2019; Rao & Lyketsos, 2000; Zasler & Martelli, 2003).

There are different classifications of severity of TBI, ranging from mild to moderate or severe (Andriessen et al., 2011; Malec et al., 2007). TBI severity is commonly classified based on level of consciousness according to the Glasgow Coma Scale (GCS) and duration of post-traumatic amnesia (PTA) (Andriessen et al., 2011; Moore et al., 2020; Schönberger et al., 2009). Whilst the majority (75%) of TBI are mild (Rao et al., 2009), moderate to severe TBI often require neurosurgical intervention within acute hospital settings (Marshman et al., 2013; Moore et al., 2020). More severe injuries with prolonged symptoms of TBI benefit from extensive rehabilitation care and therapeutic intervention (Glenn & Shih, 2020; Moore et al., 2020). Outcomes of TBI are influenced by both injury related variables, including the severity and complications, and the intensive rehabilitation interventions provided (Rabinowitz & Levin, 2014; Rao & Lyketsos, 2000; Slade et al., 2002).

Within Australia, TBI models of care vary across health care organisations in their delivery and associated funding (including state and federal government funding) of services (Laver et al., 2014). Typically, models of care following TBI include: 1) acute care; 2) inpatient rehabilitation; 3) outpatient rehabilitation and community reintegration (Cullen et al., 2019; Parreiras de Menezes, 2015). Acute care involves emergency care, neurosurgical intervention, intensive care, and ward-based acute multi-disciplinary management of the injury within a hospital setting. Once patients are medically stable, they are transitioned from acute care to subacute care for inpatient rehabilitation

(Cullen et al., 2019). Subacute inpatient rehabilitation centres provide interdisciplinary specialised rehabilitation for recovery encompassing physical, cognitive, behavioural and emotional needs of patients with TBI (Becker, 2012; Cullen et al., 2019; Khan et al., 2003). Following subacute inpatient rehabilitation, patients with TBI are discharged to the community with varying levels of support for outpatient rehabilitation and community integration (Khan et al., 2003). Refer to Figure 2.1 for an overview of TBI models of care. This thesis will focus on the setting of acute ward-based hospital care following TBI. Some studies within this thesis involve insights from the specialised subacute inpatient rehabilitation setting for translation of improvements to the acute setting .

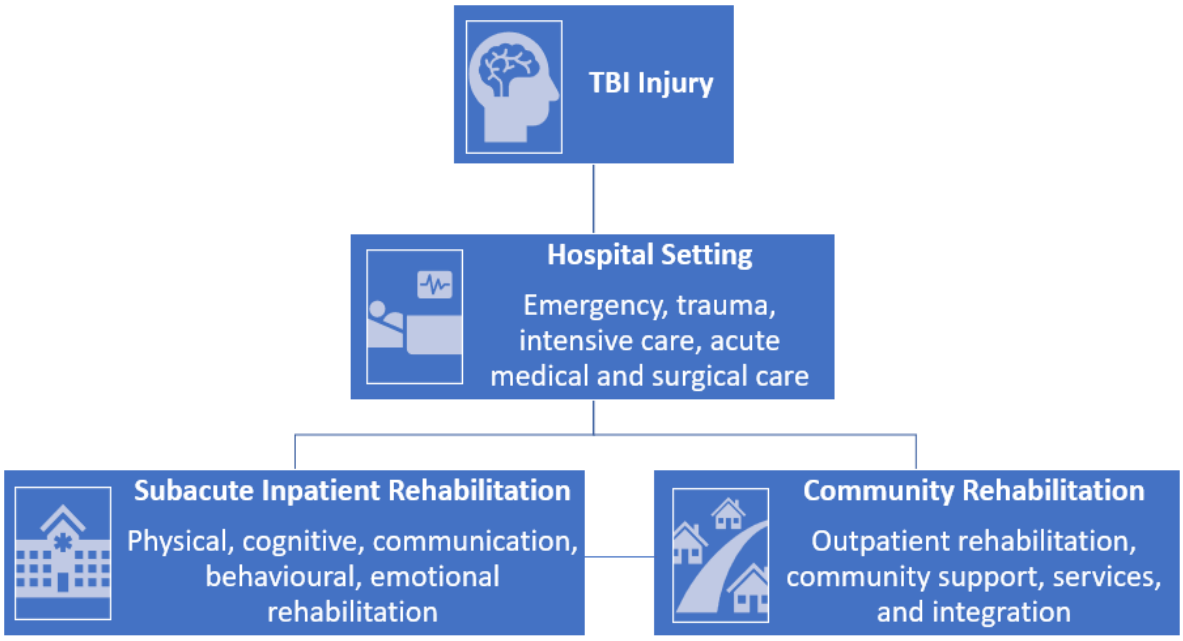


Figure 2.1 Model of care following traumatic brain injury

People with moderate to severe TBI are usually admitted to acute hospitals and commonly experience a period of confusion after emergence from coma, having limited ability to remember ongoing events or form new memories (Ponsford, 2012b). This period of recovery is known as post-traumatic amnesia (PTA) (Marshman et al., 2013; Ponsford et al., 2021). PTA is a passing state characterised by disorientation, confusion, memory impairment, a disturbed sleep-wake cycle, decreased daytime arousal, affective lability, perceptual disturbance and behavioural changes (Marshman et al., 2013; Ponsford et al., 2021). These behavioural changes after TBI can persist beyond the acute and rehabilitative phases (Ponsford, Downing, et al., 2014), impacting community integration and further distress and burden to families in the community (Anderson et

al., 2002; Braine, 2011; Fisher et al., 2020; Murray et al., 2006). This thesis will focus on studies relating to people with behavioural changes after TBI in the acute hospital setting.

2.1.2 Challenging behaviours after TBI

Within a clinical setting behavioural changes are often referred to as challenging behaviours (Banks et al., 2007). Challenging behaviours following TBI can include agitation and irritability, physical or verbal aggression, disinhibited behaviour (including sexual and social disinhibition), impulsivity, perseveration, wandering or absconding, and apathy (Hicks et al., 2017; Kelly et al., 2006; Lequerica et al., 2007; Nott et al., 2006; Sabaz et al., 2014; Sandel & Mysiw, 1996).

Across healthcare settings and studies published in literature, the terminology relating to behaviour changes after TBI is inconsistent. Within hospital settings in Australia, the terminology for behaviour changes is commonly referred to as “challenging behaviour”, “unpredictable behaviour” and more recently, “responsive behaviours” (Australian Commission on Safety and Quality in Health Care, 2017; Government of South Australia, 2020; Government of Western Australia, 2021; The Agency for Clinical Innovation NSW Government, 2010). Within published literature, the terminology varies including: “agitated behaviours” (Carrier et al., 2021; Phyland et al., 2021; Ponsford et al., 2021), “behaviours of concern” (Hicks et al., 2017), “neurobehavioural symptoms” (Francisco et al., 2007; Hicks et al., 2018), “behavioural changes” (Fisher et al., 2020) “behavioural challenges” (Brain Injury Alliance New Jersey, 2006) and “challenging behaviour” (Banks et al., 2007; Gould, Ponsford, et al., 2019). The term “challenging behaviour” is commonly used within the clinical settings and by the local health network governing committees when the studies for this PhD was undertaken. Henceforth, within this thesis, the terminology of “challenging behaviour” will be used.

The extent of challenging behaviours after TBI is heterogeneous, according to the site and extent of the brain injury (Ponsford, 2012b). Symptomology of TBI will also vary greatly between individuals with similar injuries (Arciniegas & McAllister, 2008). Given the variability in behavioural characteristics of TBI, it is possible the behaviour change is the consequence of combined effects of more than one lesion of the brain in moderate-severe TBI (Mysiw & Sandel, 1997). TBI often represents the neuropathological combined effects of discrete focal injuries, diffuse axonal injuries (DAI), ischemic, or anoxic injuries within the brain (Mysiw & Sandel, 1997). The common sites of focal injuries after TBI are the anterior and orbito-frontal cortices and anteromedial and inferior temporal cortices (Arciniegas & McAllister, 2008; Mysiw & Sandel, 1997). Additionally, DAI, commonly observed in moderate-severe TBI affect connecting pathways, such as the corpus callosum, cortical-subcortical systems, or brainstem-cortical systems due to inertial forces and compression of brain tissue (Arciniegas & McAllister, 2008; Mysiw & Sandel, 1997). Injuries to fronto-temporal systems, which contribute to arousal, attention, memory and limbic behavioural functions likely contribute to the pathophysiology for the development of post-traumatic challenging

behaviours after acute TBI, particularly for agitation in PTA (Arciniegas & McAllister, 2008; Mysiw & Sandel, 1997). Challenging behaviours after TBI may vary in both pathophysiology and between individuals, resulting in a significant impact on the person's capacity to benefit from rehabilitation, and staffs difficulty in managing the challenging behaviours (Ponsford, 2012b).

Recent studies have estimated 25 – 70% of patients with TBI exhibit challenging behaviours in the inpatient setting (McNett et al., 2012; Nott et al., 2006; Phyland et al., 2021). McNett et al. (2012) estimated 41% of TBI patients exhibited agitated behaviour during the acute admission. Phyland et al. (2021) conducted a systematic review and meta-analysis of the prevalence of agitated behaviours in the early phase of TBI in inpatient (hospital and rehabilitation) settings. Results from the meta-analysis demonstrated agitation prevalence ranged from 0 – 42% in the inpatient rehabilitation setting, and 25 – 57% in the acute setting (Phyland et al., 2021). For patients in the acute phase of TBI experiencing PTA, the pooled prevalence of agitation is estimated to be 44% (Phyland et al., 2021). Aggression is a common type of challenging behaviour which presents after an acute TBI, with 11% of patients experiencing aggression on acute hospital wards immediately following a TBI (Brooke et al., 1992).

2.1.3 Risks associated with challenging behaviours and TBI

Challenging behaviours after TBI are associated with risks of harm to the patient and staff, increased length of hospital stay, poorer progress in rehabilitation and functional outcomes for patients with TBI (Beaulieu et al., 2008; Bogner et al., 2015; Bogner et al., 2001; Kosch et al., 2010; Lequerica et al., 2007; Luauté et al., 2016; McNett et al., 2012; Sandel & Mysiw, 1996). Risks to the TBI patient associated with challenging behaviours include falls, self-inflicted harm (Luauté et al., 2016) and impeded rehabilitation compliance, resulting in adverse effects on function (Beaulieu et al., 2008; Rao & Lyketsos, 2000). Challenging behaviours increase hospital length of stay due to delays in engagement in the rehabilitation process (Beaulieu et al., 2008; Bogner et al., 2001; McNett et al., 2012). Furthermore, challenging behaviours contribute to workplace violence and frequent security incidents within the hospital setting (Nikathil et al., 2017), causing stress to hospital and rehabilitation staff (Ponsford, 2012a). Challenging behaviours can also cause increased burden, emotional strain and distress, and lower quality of life and mood for family members of patients with TBI (Brooks et al., 1986; Norup et al., 2010; Rao & Lyketsos, 2000; Rao et al., 2009). Given the significant impact of challenging behaviours on patients with TBI, families, and healthcare staff, effective management of challenging behaviours in the acute phase of TBI is critical (Carrier, Ponsford, Phyland, et al., 2022).

2.2 Current state of knowledge

2.2.1 TBI behaviour management

Resolution of challenging behaviours after acute TBI has been shown to be a predictive variable for improving functional outcomes for patients with TBI (Beaulieu et al., 2008; Hall & Cope, 1995). Management of challenging behaviours after TBI in the acute setting entails: assessment and regular monitoring of behaviour change; non-pharmacological interventions; followed by pharmacological treatments if required (Bayley et al., 2016). Assessment and management of challenging behaviours after TBI in the acute setting requires involvement of a comprehensive, multi-disciplinary team. The multi-disciplinary team commonly consists of medical, surgical, nursing, and allied health professionals inclusive of occupational therapist, physiotherapist, speech pathologist, dietitian, psychologist, and social worker (Cullen et al., 2019; Khan et al., 2003; Synapse, 2023).

Challenging behaviour management strategies can be roughly divided into two groups: non-pharmacological interventions and pharmacological interventions. Non-pharmacological interventions include any intervention which does not include pharmacological intervention, such as environmental modifications, psychological interventions, reorientation strategies, training programs, or physical restraints (Block et al., 2021). Pharmacological interventions include any intervention which utilises a pharmaceutical component, for example sedatives, anti-depressants and anti-convulsants (Block et al., 2021).

2.2.2 Behaviour assessment

TBI behaviour management in the acute hospital setting requires a comprehensive, multi-disciplinary, and consistent approach with careful assessment of the individual and their environment (Bayley et al., 2016; Fisher et al., 2020; Flanagan et al., 2009). Previous studies emphasise the importance of acknowledging causative premorbid, medical, psychosocial, and environmental factors contributing to challenging behaviours (Fisher et al., 2020; Flanagan et al., 2009). Premorbid factors, such as pre-injury coping style, personality, motivation, can be described as factors relating to the ‘person’ who sustained the TBI (Fisher et al., 2020; Ponsford, 2012a). These ‘person factors’ can include family, developmental, medical, psychiatric, and personal histories of the person, which can all contribute to escalation and vulnerability of challenging behaviours after TBI (Ponsford, 2012a). Medical and psychosocial factors include both the physical and cognitive sequelae of the injury, and medications with side effects (Fisher et al., 2020; Ponsford, 2012a). Underlying medical causes contributing to challenging behaviours should be identified and understood, for example pain, sepsis, withdrawal and anxiety (Luauté et al., 2016). Environmental factors may include the noise, interactions with others (for example caregivers and visitors), stimulation or activity within the environment (Ponsford, 2012a). Overstimulation within the environment may provoke fatigue and associated escalation of agitated and aggressive

challenging behaviours (Ponsford, 2012a; Pryor, 2004; Rahman et al., 2010). Assessment of challenging behaviours entails recognising fluctuations and changes in behaviours, but also understanding the underlying medical, premorbid and environmental factors contributing to the behaviour change (Flanagan et al., 2009). This form of comprehensive assessment may assist the identification of precipitating factors, also referred to as antecedents or triggers (Bayley et al., 2016), to assist in the development of individualised behaviour support strategies (Bayley et al., 2016).

Comprehensive assessments are often incorporated within functional behaviour assessment, preceding applied behaviour analysis (ABA) and positive behaviour support (PBS) interventions (Fisher et al., 2020). ABA and PBS approaches are based on learning theory and emphasise the personalised management of challenging behaviours by manipulating triggers or antecedents and consequences to the behaviour (Alderman et al., 2013; Cattelani et al., 2010; Fisher et al., 2020; Gore et al., 2013; Ylvisaker et al., 2003; Ylvisaker et al., 2007). These behaviour therapies have a strong evidence base when carried out in the context of neurobehavioural inpatient rehabilitation, residential and community settings (Alderman et al., 2013). Within the acute recovery phase of TBI and during PTA, structured behaviour modification programmes, such as ABA and PBS approaches have limited applicability due to a patient's limited ability to retain new memories impeding neurocognitive involvement for active engagement in positive behaviour principles. Therefore, ABA and PBS may not be productive with patients with TBI and PTA in the acute hospital setting (Alderman et al., 2013; Ponsford, 2012a; Snow & Ponsford, 2012).

Objective assessment of the patient with TBI should be the first component of behaviour management, prior to attempting other strategies (Ponsford, 2012a). Observational assessment tools allow for the consistent, objective and regular monitoring of challenging behaviours. A range of objective assessment scales exist to systematically assess challenging behaviours after TBI, including the Overt Behaviour Scale (OBS) (Kelly et al., 2006), adapted from the Overt Aggression Scale (Yudofsky et al., 1986), which is validated for use in community settings. The Agitated Behavior Scale (ABS) is a valid and reliable measure for the assessment of agitation during the acute recovery phase of TBI in inpatient rehabilitation settings (Corrigan, 1989; Corrigan & Bogner, 1994). There is considerable variability in the description of behaviours such as 'agitation', 'aggression', 'violence' and 'irritability' (Alderman et al., 2013; Fugate et al., 1997) impacting on the consistent differentiation of behavioural symptoms, descriptions and severity of challenging behaviours following TBI.

Following behavioural assessment, acute TBI behaviour management should commence with multi-disciplinary non-pharmacological approaches (McNett et al., 2012; Plantier & Luauté, 2016). It is when non-pharmacological interventions are unsuccessful in modifying the challenging behaviour that pharmacological intervention is necessary (Levy et al., 2005).

2.2.3 Non-pharmacological management

Non-pharmacological approaches to behaviour management are commonly accepted as best-practice for first line management (Eisenberg et al., 2009; McNett et al., 2012; Ponsford, 2012a; Ponsford, Janzen, et al., 2014; Wiart et al., 2016). Non-pharmacological management strategies involve environmental modifications, program modifications, behavioural modification techniques, and education (Carrier, Ponsford, Phyland, et al., 2022). Environmental modifications involve minimising stimulation within the environment which may be contributing to the challenging behaviours (Snow & Ponsford, 2012). Challenging behaviours can be triggered by overstimulation within the environment, such as too much noise, presence of too many people, activities placing too much demand on the patient, causing fatigue and frustration (Ponsford, 2012a). Patients with TBI can become confused and disoriented by multiple ward and bed moves within the hospital environment (Ponsford, 2012a). Program modifications can include providing adequate rest breaks, consistent staffing, and structured care (Carrier, Ponsford, Phyland, et al., 2022). Behaviour modification techniques include ABA and PBS approaches to identify antecedents, positive reinforcement strategies (Carrier, Ponsford, Phyland, et al., 2022), as mentioned in section 2.2.2 of this thesis, have limited applicability to patients with TBI in the acute phase of recovery (Ponsford, 2012a; Snow & Ponsford, 2012). Education should also be provided to staff working with patients with TBI and family members (Bayley et al., 2016; Carrier, Ponsford, Phyland, et al., 2022).

Non-pharmacological strategies outlined in clinical practice guidelines (Bayley et al., 2016; Ponsford et al., 2023; Snow & Ponsford, 2012; University of Arkansas Medical Sciences, 2020) to minimise triggers to challenging behaviours while a person is in PTA after TBI include:

- A quiet, safe and consistent environment.
- Avoid overstimulation (for example, low stimulation single room with lights off, blinds or curtains shut, reduced noise and clutter, minimise ward moves).
- Minimise the number of visitors and length of visits.
- Structured care, assessments and therapy to minimise fatigue.
- Allow for regular rest breaks and facilitate day-night routine.
- Minimise use of physical restraints.
- Allow patient to pace or walk (if safe) with supervision and safety.
- Closed unit, or sensors to ensure patient does not leave the ward.
- Falls prevention strategies (for example low bed, mats on the floor).
- Provide familiarising items and information to the person (for example allow family to bring in personal possessions).
- Frequent orientation and reassurance.
- Communicate in the most simple and reliable means.

- Consistent staff trained in working with people with TBI.
- Provide education to the person with TBI and their family.

Evidence for the efficacy of non-pharmacological interventions for the management of challenging behaviours after acute TBI is limited (Carrier, Ponsford, Phyland, et al., 2022). A systematic review was conducted by Luauté et al. (2016) with proposed non-pharmacological and practice recommendations entirely based on expert opinion. Similarly, Ponsford et al. (2023) recently updated cognitive rehabilitation guidelines for PTA following TBI providing non-pharmacological recommendations based on Level C evidence, supported primarily by expert opinion. Guideline recommendations for non-pharmacological interventions are predominantly based on expert opinion due to low quality studies and lack of empirical evidence (Carrier, Ponsford, Phyland, et al., 2022).

In clinical practice, the use of restraints is occasionally medically necessary to prevent and manage the risk of harm (Gerace & Muir-Cochrane, 2019), for example to restrain a hand to prevent the removal of life-sustaining tubes. Restraints are defined as physical, mechanical or environmental interventions to restrict a person's voluntary movement or behaviour (Dickson & Pywell, 2014; Gerace & Muir-Cochrane, 2019). Use of physical or mechanical restraints, such as soft or hard shackles, mittens, belts, vests and enclosed beds are also considered as non-pharmacological interventions. In Australian health care settings however, restraints are not routinely recommended, and are recommended to be minimised (Australian Commission on Safety and Quality in Health Care, 2017; Beaulieu et al., 2008; Luauté et al., 2016).

When non-pharmacological strategies do not influence behaviour change in the presence of severe challenging behaviours (such as severe agitation and aggression) that threatens staff and patient safety, the use of pharmacological agents are required (Bayley et al., 2016; Levy et al., 2005; Ponsford, Janzen, et al., 2014).

2.2.4 Pharmacological management

Pharmacological management include the use of pharmaceutical agents such as antipsychotics/neuroleptics, anti-depressants, psychostimulants, anti-parkinsonians and anti-convulsants (Luauté et al., 2016; McNett et al., 2012). Only after non-pharmacological strategies have been tried without successfully reducing challenging behaviours should pharmacological management be initiated (Bayley et al., 2016; Luauté et al., 2016; Ponsford, 2012a). Pharmacological agents, particularly antipsychotics, can have negative side effects to patients recovering from TBI, such as increased confusion, heightened agitation, excessive sedation, swallowing disorders, prolonged duration of PTA and hospital length of stay, and ultimately deleterious effects on recovery (Alderman et al., 2013; Arciniegas et al., 2000; Hicks et al., 2018; Luauté et al., 2016; Mysiw & Sandel, 1997; Phyland et al., 2020; Plantier & Luauté, 2016;

Ponsford, 2012a). Considered selection of medication is important, and ideally, prescribing should be managed by specialists in rehabilitation medicine or psychiatrists experienced in management of TBI (Ponsford, 2012a).

Surveys of specialist physicians working in TBI rehabilitation conducted by Francisco et al. (2007) and Fugate et al. (1997) found the most commonly prescribed medications for challenging behaviours were anti-convulsants, tricyclic anti-depressants, and antipsychotics (Francisco et al., 2007; Fugate et al., 1997). Janzen et al. (2014) conducted a retrospective audit of patients admitted to a TBI rehabilitation unit to assess current practices. Audit results found antipsychotic medications were administered to 30 – 50% of TBI patients to manage agitation. Similarly McKay et al. (2021) found atypical antipsychotics were used for managing agitated behaviour in one-third of patients admitted to an inpatient rehabilitation hospital for TBI, however many patients had antipsychotics administered with mild to no agitation according to the ABS (McKay et al., 2021). Pharmacological agents are commonly used to treat challenging behaviours after TBI, despite the risks of harmful side-effects and lack of evidence for the efficacy of pharmacological treatments (Phyland et al., 2020). Hicks et al. (2018) conducted a systematic review concluding there is a lack of high-quality studies to support use of pharmacological intervention for challenging behaviours in the acute recovery phase of TBI and PTA. Few clinical practice guidelines exist, with recommendations for pharmacological interventions primarily based on low-quality studies and expert opinion (Fleminger et al., 2006; Luauté et al., 2016; Plantier & Luauté, 2016; Warden et al., 2006)

2.2.5 Gaps in TBI behaviour management evidence and practice

Current knowledge indicates the efficacy for non-pharmacological and pharmacological interventions for challenging behaviours after TBI is limited, with studies lacking or of low-quality (Carrier, Ponsford, Phyland, et al., 2022; Hicks et al., 2018; Levy et al., 2005; Luauté et al., 2016; McNett et al., 2012; Phyland et al., 2021; Plantier & Luauté, 2016). Further review of the quality of the evidence in synthesised literature for the non-pharmacological and pharmacological management of challenging behaviours after TBI in the acute phase is warranted. In the absence of high-quality studies, clinicians often rely upon clinical practice guidelines (CPGs), expert opinion and clinical experience to guide treatment strategies. CPGs exist for the management and rehabilitation of TBI that include recommendations for behaviour management (Bayley et al., 2016; Department of Labor and Employment & Division of Workers Compensation, 2019; Luauté et al., 2016; Ponsford et al., 2023; Scottish Intercollegiate Guidelines Network, 2013; University of Arkansas Medical Sciences, 2020; Warden et al., 2006; Wheeler & Acord-Vira, 2016). The quality of CPGs for management of challenging behaviours after TBI is not known.

Furthermore, the application of guideline recommendations for TBI behaviour management into acute clinical practice is limited, leading to variability in the delivery of services (Centers for

Disease Control and Prevention, 2010; Flanagan et al., 2009; Seel et al., 2015; Shafi et al., 2012). Variability in care also entails inconsistent assessment to interpret behaviour symptoms and severity, influencing recommended non-pharmacological management prior to utilising pharmacological management (Bayley et al., 2016; McNett et al., 2012). These variations in care indicate a need for a more consistent approach to the assessment and management of challenging behaviours after TBI in acute hospital settings. Greater implementation of recommended management strategies for challenging behaviours may lead to a reduction in the prevalence of challenging behaviours within the acute hospital setting (Phyland et al., 2021). There is a need for more research investigating the effectiveness of management treatments for the evidence-based management of challenging behaviours after acute TBI (Block et al., 2021; Carrier, Ponsford, Phyland, et al., 2022; Hicks et al., 2018). Evidence-based practice involves the integration of efficacious research, clinical expertise, and the patient's values and circumstances (Straus et al., 2018). The absence of empirical evidence and guidelines for efficacious interventions can limit evidence-based practice. However, in the absence of high-quality, efficacious research, evidence-informed practice involves a focus of the current evidence relevant to the clinical context, incorporating the clinical experience and capability of clinicians (Nevo & Slonim-Nevo, 2011; Rycroft-Malone, 2008).

Further research and strong evidence alone is not sufficient to change practice in healthcare settings (Lynch et al., 2018). Further understanding of the context of the acute hospital setting and how contextual factors can influence the implementation of effective, evidence-informed behaviour management approaches to patients with TBI is also required. Implementation science involves theoretical approaches that can help us understand the multiple factors relating to effectively, efficiently, and sustainably implementing evidence-informed practice (Lynch et al., 2018).

2.3 Overview of implementation science in healthcare settings

Implementation science involves the planning, implementation and evaluation of the uptake of effective innovations into clinical practice (Bauer et al., 2015). For this thesis, implementation science underpins the investigation of the uptake of evidence-informed innovations dependent on contextual factors within the acute TBI hospital context.

Implementation science is defined as "the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice, and, hence, to improve the quality and effectiveness of health services" (Eccles & Mittman, 2006, p. 1). Implementation science aims to achieve and sustain more evidence-based practice in healthcare settings (McNett et al., 2019; Nilsen, 2015). Implementation science can either assess naturalistic variability or measure change in response to a planned intervention using mixed method designs to identify factors that impact uptake across multiple system-levels of healthcare (for example, individual, organisational, broader community and policy) (Bauer et al., 2015).

An implementation intervention is “a single method or technique to facilitate change” (Bauer et al., 2015, p. 4). Examples of implementation interventions may include education and training, audit-feedback, and performance incentives (Bauer et al., 2015). An implementation strategy is “an integrated set, bundle or package of discreet implementation interventions ideally selected to address specific identified barriers to implementation success” (Bauer et al., 2015, p. 4). Examples of implementation strategies may include quality improvement techniques, system redesigns, team-based performance incentives, learning collaboratives, or community engagement (Bauer et al., 2015). Facilitation is a multifaceted strategy that supports implementation depending on the context and the characteristics of the innovation (Kirchner et al., 2020). Facilitation of implementation strategies is critical to the success of implementation to support multiple levels of system change (Harvey & Kitson, 2015; Kirchner et al., 2020).

Implementation of evidence, particularly complex or multi-component innovations, into practice can be difficult due to a range of factors that influence the implementation, adaptation, integration, diffusion and sustainability of evidence-based healthcare (Rye & Kimberly, 2007). Due to the complex nature of implementation, theories, models and frameworks are recommended to systematically guide implementation (Damschroder et al., 2009; Proctor et al., 2009). A theory implies some predictive capacity and attempts to explain the causal mechanism of implementation (Nilsen, 2015). A model operationalises theory as a simplified depiction with relatively precise assumptions for cause and effect (Bauer et al., 2015). Frameworks provide a broad set of constructs to describe and organise concepts, do not specify causal relationships and may describe phenomena by fitting them into a set of categories (Bauer et al., 2015; Nilsen, 2015).

A range of theories, models and frameworks can be used to understand how and why implementation succeeds or fails. Furthermore, theoretical models and frameworks can provide a rationale for implementation strategies and systematically guide the implementation process (Nilsen, 2015). Implementation science encapsulates a range of models and frameworks that can: 1) describe and/or guide the process of translating research into practice (process models); 2) understand/explain what influences implementation outcomes (determinant frameworks); and 3) evaluate implementation (evaluation frameworks) (Nilsen, 2015). Implementation theories are used for a deep understanding of certain aspects of implementation, allowing researchers to prioritise aspects considered to be critical to analysis for successful implementation (Nilsen, 2015). Process models can describe and/or guide the process of implementing research into practice (Nilsen, 2015). Determinant frameworks describe the types of determinants (classes or domains) that are hypothesised to influence implementation outcomes (Nilsen, 2015). Each type of determinant typically comprises of barriers and/or enablers that influence implementation outcomes (Nilsen, 2015). Evaluation frameworks provide a structure for evaluating implementation endeavours (Nilsen, 2015). Section 2.3.1 of this thesis will provide an overview of commonly used implementation theories, models and frameworks.

In summary, research shows many patients do not receive appropriate care, or receive unnecessary or harmful care in healthcare settings (Grol & Grimshaw, 2003). Implementation science is a critical component to advance and sustain evidence-based practice, as it evaluates enablers and barriers for the implementation of evidence into practice (McNett et al., 2019). The healthcare organisational context is a critical factor for influencing successful implementation of evidence into clinical practice.

2.3.1 Implementation theories, models and frameworks in healthcare settings

Over the past two decades, multiple implementation theories, models and frameworks have emerged to facilitate evidence-based practice to improve healthcare quality, safety and outcomes (McNett et al., 2019; Tucker et al., 2021). Some commonly used theoretical models and frameworks in implementation science are detailed in Table 2.1. These commonly used models and frameworks include: Consolidated Framework for Implementation Research (CFIR) (Damschroder et al., 2009); Integrated Knowledge Translation (IKT) (Kothari et al., 2017); integrated-Promoting Action on Research Implementation in Health Services (i-PARIHS) (Harvey & Kitson, 2016); Knowledge to Action (KTA) framework (Graham et al., 2006); Normalization Process Theory (May & Finch, 2009; May et al., 2007);RE-AIM (Reach, Effectiveness, Adoption, Implementation Maintenance) (Glasgow et al., 1999; Holtrop et al., 2021); and Theoretical Domains Framework (TDF) (Michie et al., 2005). Different theoretical approaches can be used to develop knowledge about an ongoing implementation process (for example, KTA, IKT); to measure a specific change (for example, TDF); or generate a better understanding of contextual barriers and enablers to inform implementation approaches (for example, i-PARIHS, CFIR); or provide a framework of relevant implementation outcomes (for example CFIR, RE-AIM) (Damschroder, 2020; Lynch et al., 2018).

Theoretical approaches to implementation can help researchers and clinicians formulate how to evaluate the quality of implementation research, support improvements in clinical settings, and understand factors influencing implementation (Lynch et al., 2018). In summary, implementation frameworks can be used to plan, guide, and evaluate the current state, consider contextual factors, identify and address barriers and enablers, facilitate and sustain the evidence or innovation into practice (Damschroder, 2020; Lynch et al., 2018; Nilsen, 2015; Tucker et al., 2021).

Table 2.1 Summary of commonly used theoretical models and frameworks to implementation

Implementation Framework	Type of Framework	Purpose of Framework
Consolidated Framework for Implementation Research (CFIR)	Determinant	Framework to promote implementation theory development and verification about what works, where and why across multiple contexts (Damschroder, 2020; Damschroder et al., 2009; Lynch et al., 2018).
Integrated Knowledge Translation (IKT)	Process model	A model of collaborative research, where researchers work with knowledge users who identify a problem, co-production of knowledge to implement the research in a relevant and actionable approach (Esmail et al., 2020; Gagliardi et al., 2016; Kothari et al., 2017).
Integrated-Promoting Action on Research Implementation in Health Services (i-PARIHS)	Process and Determinant	Organisational or conceptual framework to help explain and predict successful implementation of evidence into practice and to understand the complexities involved with facilitation to ensure a success change process (Damschroder, 2020; Harvey & Kitson, 2016; Lynch et al., 2018).
Knowledge to Action (KTA)	Process model	A framework to conceptualise the process of knowledge translation which integrates the roles of knowledge creation and knowledge application. A framework that provides conceptual clarity to understand the key processes of planning, implementing and evaluation knowledge translation (Damschroder, 2020; Graham et al., 2006; Lynch et al., 2018)

Normalization Process Theory (NPT)	Implementation theory	A theory as change mechanisms and interrelations between various constructs to understand how practices are embedded and integrated into contexts. Four constructs for embedding (i.e., normalising) complex interventions into practice (coherence or sense making, cognitive participation or engagement, collective action and reflexive monitoring), and the relationships between these constructs (May & Finch, 2009; May et al., 2007; Nilsen, 2015).
RE-AIM	Evaluation	A framework to guide consistent reporting of evaluations regarding the public health impact of health promotion interventions, thereby used for determining what programs are worth sustained investment and for identifying those that work in real-world environments. To improve the sustainable adoption and implementation of effective, generalisable, evidence-based interventions (Damschroder, 2020; Glasgow et al., 1999; Holtrop et al., 2021; Lynch et al., 2018).
Theoretical Domains Framework (TDF)	Process and Determinant	An integrative theoretical framework, developed for cross-disciplinary implementation and other behaviour change research to assess implementation and other behavioural problems and to inform intervention design (Atkins et al., 2017; Lynch et al., 2018; Michie et al., 2005).

2.3.2 The acute hospital context

Complex interventions in healthcare are multi-component; target a range of behaviours; require expertise and skills from those delivering the intervention; and flexibility in tailoring to the targeted individual or healthcare setting (Skivington et al., 2021). Complex innovations, such as management interventions for challenging behaviours after TBI, should be considered with the factors that influence the interaction of the innovation to the context in which it is implemented in a dynamic way (Skivington et al., 2021). The effectiveness of complex innovations, and their success in reaching relevant populations is influenced by the context of implementation (Pfadenhauer et al., 2017; Skivington et al., 2021). Context reflects the unique and active factors that interact, influence or constrain the evidence innovation and its implementation (Pfadenhauer et al., 2017). To increase the likelihood of successful implementation, researchers need to assess and address contextual barriers and/or enablers that promote or hinder implementation (Squires et al., 2019).

Squires et al. (2019) identified the following 14 attributes to context relevant to healthcare professionals' use of research evidence in clinical practice within healthcare settings:

- Resource access (time required to complete tasks).
- Work structure (scheduling of tasks and designated work times).
- Patient characteristics (demographics of patients).
- Professional role (clinical skill set).
- Culture (organisational culture).
- Facility characteristics (type of healthcare facility).
- System features (efficient systems for record-keeping).
- Healthcare professional characteristics (experience of healthcare professionals).
- Financial (funding system).
- Collaboration (working jointly with others).
- Leadership (mentorship of clinical team or organisation).
- Evaluation (audit activities).
- Regulatory or legislative standards (legal responsibilities).
- Societal influences (social knowledge and attitudes).

Acute hospitals are specific contexts offering an array of services to a range of population groups with differing health conditions. The variability of patient populations, complex health services, health conditions, the clinical environment, hospital processes and microsystems may all present unique barriers to implementation within the hospital context (Geerligs et al., 2018). A systematic review conducted by Geerligs et al. (2018) identified staff-reported barriers to the implementation of patient-focused interventions within the hospital context. System level barriers related to the

environmental context were staff workload and lack of time; hospital workflow organisation and staff movement, physical structure (including hospital wards, new technology systems), and resources (including staffing shortages). Workplace culture incongruence and staffs' low-level readiness for change, lack of collaborative and effective communication processes were also found to be barriers (Geerligs et al., 2018). Design of evidence innovations and pre-implementation planning relevant to the specific hospital system, is therefore important to increase the likelihood of effective and sustainable implementation of evidence innovations in acute hospital settings (Geerligs et al., 2018). This thesis focuses on exploring implementation factors in the context of the acute healthcare setting.

2.3.3 Implementation strategies

Implementation strategies are an integrated package of strategies to address identified barriers, and support identified enablers to support successful implementation of evidence or improvement interventions into practice (Bauer et al., 2015; McNett et al., 2019). A published compilation of implementation strategy terms and definitions have been developed by experts in implementation science and clinical practice for Expert Recommendations for Implementing Change (ERIC) (Powell et al., 2015). Implementation strategies may include a range of approaches, including quality improvement techniques, reminders, audit and feedback, system redesigns, team-based performance incentives, access to new funding, learning collaboratives, communities of practice, involvement of patients and families (Bauer et al., 2015; Powell et al., 2015). Implementation strategies can be tailored and facilitated for successful implementation of improvement interventions into practice relevant to the healthcare setting (Eccles & Mittman, 2006; Kirchner et al., 2020; Squires et al., 2019; Tucker et al., 2021).

Pre-implementation planning involves understanding the organisational, system, clinician and patient/caregiver contextual factors, to then develop specific, tailored implementation strategies to facilitate successful adoption of evidence into practice relevant to the healthcare setting (Eccles & Mittman, 2006; Kirchner et al., 2020; McNett et al., 2019; Squires et al., 2019; Tucker et al., 2021). Therefore, this thesis will incorporate implementation frameworks to explore the contextual barriers and enablers, to understand the factors for pre-implementation planning within the acute hospital context. This will enable the development of implementation strategies to promote successful implementation of evidence-informed practice and improvements for TBI behaviour management in acute hospital settings.

2.4 Chapter summary

Challenging behaviours are common during the acute recovery phase after TBI within acute hospital settings. Despite the prevalence of challenging behaviours after acute TBI, there is limited

evidence for non-pharmacological and pharmacological management strategies with variability in the delivery of services within the acute hospital context. Implementation science is the study of methods by which research evidence is applied and adopted into clinical practice. There are many theoretical models and frameworks to facilitate and evaluate the implementation of evidence into practice. This chapter has discussed the literature relating to TBI, challenging behaviours, behaviour management and implementation science. The gaps in TBI behaviour management have been defined with rationale for the importance of implementation frameworks to describe barriers, enablers and contextual factors relating to the implementation of TBI behaviour management in the acute hospital context.

CHAPTER 3 OVERVIEW OF METHODOLOGY

This chapter will provide a general overview of the pragmatic multi method approaches, with rationale for selecting methodologies and frameworks utilised within this thesis. Quality reporting guides and ethical considerations will also be discussed.

3.1 Pragmatic multi methods

The research within this thesis adopted a pragmatic multi method approach to address the core aims of this thesis. The worldview of pragmatism provides the epistemological justification and foundation that underpins the multi method approach in this thesis (Johnson et al., 2007). Pragmatism focuses on the consequences of health research including the usefulness, application and context to translate research into clinical practice (Glasgow, 2013). It addresses specific practice needs and questions, using multiple methods of data collection to inform the problems under investigation. Multi method research involve quantitative and qualitative research techniques to achieve breadth and depth across a research topic (Cresswell & Plano Clark, 2017; Johnson et al., 2007). Quantitative research seeks information that can be generalised and is broadly relevant, measuring quantities or amounts between different groups of people (Minichiello, 2004). Qualitative research goes beyond observed measured amounts, to understand individual perspectives and meanings they attach to situations (Minichiello, 2004). The focus of qualitative research is to discover the nature of phenomena as humanly experienced (Minichiello, 2004). The reasons for adopting a multi methods approach within this thesis was to address the specific practice issue of managing challenging behaviours after TBI, identified by the researcher whilst working as a senior clinician, contributing to the understanding of evidence-informed practice, and contextual factors for implementation in the acute hospital setting (Cresswell & Plano Clark, 2017). Synthesis of findings from all studies formed recommendations of strategies to translate evidence-informed improvements to TBI behaviour management within the acute hospital context. The quantitative and qualitative methodologies utilised in this thesis will be outlined in each chapter presenting a study. To ensure quality reporting of methodologies for the published studies in this thesis, quality reporting templates were used to guide reporting the description of the research methods. Table 3.1 provides an overview of methodological approaches used and quality reporting guides for studies included in this thesis.

Table 3.1 Methodology of studies included in this thesis

Study number	Title	Methodology	Quality guide
1	Implementing a behaviour management approach in the hospital setting for individuals with challenging behaviours during acute traumatic brain injury (Chapter Four).	Quantitative methodology utilising IKT framework to evaluate service outcomes for patients with TBI and determine feasibility of the implemented intervention.	The template for intervention description and replication (TIDieR) checklist was used to guide description and reporting of the implemented behaviour management approach (Hoffmann et al., 2014).
2	Evidence for the management of challenging behaviours in patients with acute traumatic brain injury or post-traumatic amnesia: An Umbrella Review (Chapter Five).	An umbrella review with quantitative critical appraisal to examine the evidence for pharmacological and non-pharmacological management of challenging behaviours in the acute phase of TBI. An umbrella review methodology was utilised to provide an overall appraisal of a body of information that is available in already undertaken primary research syntheses (Aromataris et al., 2020).	Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009; M. J. Page et al., 2021).
3	Clinical practice guideline recommendations for the management of challenging	Systematic review to identify, synthesise and quantitively appraise clinical practice guidelines.	Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

	behaviours after traumatic brain injury in acute hospital and inpatient rehabilitation settings: A systematic review (Chapter Six)		guidelines (Moher et al., 2009; M. J. Page et al., 2021).
4	Implementing evidence-informed practice for managing challenging behaviours following traumatic brain injury in the acute setting: The perspectives of staff (Chapter Seven)	Qualitative focus groups to gain the perspectives of staff on barriers and enablers to managing challenging behaviours after TBI in the acute hospital setting. Qualitative data were inductively and deductively analysed using reflexive thematic analysis (Braun & Clarke, 2006, 2019) to elucidate barriers and enablers	The consolidated criteria for reporting qualitative research (COREQ) checklist (Tong et al., 2007).
5	Management of challenging behaviours after TBI in the hospital setting: The perspectives of families (Chapter Eight).	Qualitative interviews to gain the experience of family members of people with TBI who exhibited challenging behaviours in the acute phase of recovery. Interview data were analysed using an interpretive phenomenological approach (IPA) (Charmaz & McMullen, 2011; Matua, 2015; Smith & Osborn, 2021), with findings applied to Ecological Systems Theory (EST) (Bronfenbrenner, 1979).	The consolidated criteria for reporting qualitative research (COREQ) checklist (Tong et al., 2007).

6	Current knowledge and practice of the management of challenging behaviours after TBI in the hospital setting: A survey of staff and audit of practice (Chapter Nine).	Quantitative approach through surveys and an audit of current practice to identify contextual factors influencing implementation based on the i-PARIHS framework.	Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for reporting observational studies (von Elm et al., 2007).

3.2 Theories and frameworks used in this thesis

Three frameworks were used in studies in this thesis. Two implementation frameworks were used, including Integrated Knowledge Translation (IKT) (Kothari et al., 2017), and integrated-Promoting Action on Research Implementation in Health Services (i-PARIHS) framework (Harvey & Kitson, 2016). Additionally, the Ecological Systems Theory (EST) (Bronfenbrenner, 1979) provided a guiding theoretical framework to interpret the emerging themes of the family experiences of the management of challenging behaviours after TBI in acute hospital setting. The following sections of this methodology chapter will provide an overview of IKT, i-PARIHS and EST, and rationale for the use of these frameworks in this thesis.

3.2.1 Integrated knowledge translation framework

IKT is a model of collaborative research, involving knowledge users who identity a problem and implement the research recommendations (Kothari et al., 2017). This collaborative implementation approach can describe and/or guide the process of generating knowledge for evidence-based, optimal health care delivery, and improving health system performance (Esmail et al., 2020; Lohr & Steinwachs, 2002; Nilsen, 2015). As mentioned in sections 1.2 and 2.3.2, the acute hospital setting is a complex ecosystem. Complex problems in healthcare settings require complex solutions, which require input from individuals with different expertise to address and develop solutions (Denis et al., 2002; Gagliardi et al., 2016). A collaborative approach involves ongoing dynamic interactions between researchers, clinicians, and decision makers to develop and implement relevant knowledge into practice to address complex healthcare problems (Bowen & Graham, 2013; Dooley, 1997; Gagliardi et al., 2016). Collaboration between researchers, clinicians and decision makers can lead to a greater perspective of the clinical problem, increasing understanding and shared vision to enable effective implementation into practice (Gagliardi et al., 2016). Due to the collaborative nature of IKT, this approach was deemed suitable to investigate consistent, clinically pragmatic strategies for behaviour management with patients with TBI in hospital settings. Clinicians and clinical decision-makers are fundamental to inform the research question, provide knowledge of the context of the hospital setting, develop relevant intervention strategies, and can actively implement behaviour management strategies or approaches. Researchers involved in this IKT approach can refine the research methodology and gain an understanding of the clinical contextual environment for real-world applicability of results. In Chapter Four, an IKT approach was used to underpin the study to develop and implement a clinically pragmatic TBI behaviour management approach for hospital settings, with dynamic collaboration between the researchers and clinical stakeholders.

3.2.2 Integrated-Promoting Action on Research Implementation in Health Services (iPARIHS) framework

Harvey and Kitson (2016) describe the i-PARIHS framework as portraying successful implementation in healthcare from the facilitation of the evidence/innovation with the intended recipients in their contextual setting. The core constructs of the i-PARIHS framework are facilitation, innovation, recipients, and context (Harvey & Kitson, 2016). Facilitation is the active element assessing, aligning and integrating the other three constructs for successful implementation (Harvey & Kitson, 2015; Harvey & Kitson, 2016). Based on Harvey and Kitson (2016) the i-PARIHS constructs are described below:

- Innovation – Evidence comprising of research information, patient and local experience, and how the evidence is adopted to suit different healthcare settings.
- Recipients – People who are affected by and influence implementation at both the individual and collective team level.
- Context – Different layers of context that can enable or constrain implementation. This includes factors such as resources, culture, leadership, evaluation and learning in relation to the healthcare setting's immediate local context, wider organisational context, and wider external context of health system.
- Facilitation – Active ingredient that activates implementation through assessing and responding to characteristics of the innovation, recipients, and context.

As a hybrid process and determinant implementation framework, i-PARIHS can be used to specify the steps in the process of translating research into practice; and the types of determinants which act as barriers and enablers that influence implementation outcomes (Nilsen, 2015). The i-PARIHS implementation framework is well recognised to support multi-disciplinary, complex interventions in acute healthcare settings (Harvey & Kitson, 2016; Hunter et al., 2020; Mudge et al., 2022), therefore is relevant to understanding the implementation factors and guide future strategies for improvements in care to people with challenging behaviours after TBI in the acute hospital context.

Within this thesis, the i-PARIHS framework has been woven into multiple studies and chapters, as described below, to further understand implementation factors related to the management of challenging behaviours after TBI in the acute hospital setting. The construct of innovation will be explored through reviews of evidence and CPGs (Chapters Five and Six). Investigation of evidence-practice gaps through auditing current practice and surveying staff knowledge will explore adoption of evidence/innovation into practice (Chapter Nine). Clinical staff who work with patients with TBI in the acute hospital setting, and family members of people with TBI are the recipients who can elucidate barriers and enablers to implementing evidence-informed behaviour management after TBI in the acute hospital setting (Chapters Seven and Eight). The contextual

factors of the acute hospital setting that influence implementation into practice will be explored through audits, staff focus groups and family interviews (Chapters Seven, Eight, Nine). Results from studies included in this thesis will formulate implementation strategies for facilitation for future evidence-informed improvements in this area of practice (Chapter Ten – Discussion).

3.2.3 Ecological Systems Theory

EST can be used to consider how the complex and dynamic factors of a person's environment influences their experience (Bronfenbrenner, 1979). The different levels of EST when considered in an acute hospital setting include the microsystem (interactions between the person/patient and other people in the acute ward including hospital staff, family members and other patients), the mesosystem (interactions between elements of the microsystem, for example interactions between different staff, between staff and family, and the dynamics of these interactions), the exosystem (the impact of formal structures and systems, for example ward layout, hospital procedures and ward routines), and the macrosystem (national health policies, legislation and cultural views). The EST framework has been widely used in health and socio-ecological science to understand structural barriers relevant to complex interventions in healthcare (Coetzee et al., 2011; Pask et al., 2018; Phelan & Kirwan, 2020).The EST was a relevant framework to guide interpretation of findings from the perspectives of families to identify ecological factors that influence the effective management of challenging behaviours after TBI in the acute hospital context.

3.3 Ethical considerations

Ethical approval was gained through the Southern Adelaide Human Research Ethics Committee for study one (ID number: 281.17), and studies four, five, and six (ID number: 178.20), with ethics approval letters available in Appendix 2. Recruitment of potential participants involved in the included studies was conducted in collaboration with clinicians and clinical leads working with participants, rather than directly approached by the researcher. Participants were purposefully recruited at each setting. For participants involved in the staff focus group, a purposeful sample of relevant multi-disciplinary staff (medical, nursing, pharmacy, and allied health professionals) were recruited. Staff participants had experience in working with patients with TBI in either the acute hospital setting, or specialised inpatient subacute rehabilitation setting. Potential participants were contacted via email, inviting staff to participate in the study. Emails inviting staff with study information were sent by the clinical leads at the acute and subacute settings who had an existing working relationship with the staff. For participants involved in the family interviews, a clinician external to the research team identified potential participants who met the inclusion criteria. The clinician provided family members with the study information. The clinician then informed the researcher of family members who were interested in participating, who were then contacted by the researcher.

Participants provided informed consent to participate. Family members who participated in interviews were renumerated with a small gift card. Participants had the option to access counselling services should they feel distressed or upset in participating in the research studies. This was important for staff and family participants who discussed their experiences of challenging behaviours after TBI which had the risk to evoke emotional distress. Data were not identifiable and stored as coded re-identifiable data. Data collected from the medical records was accessed by clinicians employed through South Australian Health. Re-identifiable data was stored in a networked password protected file accessible to the researcher only and will be kept for a duration of seven years. The research studies were conducted in compliance of the approved protocols, as stipulated by ethics committee approval in accordance of the National Statement on Ethical Conduct in Human Research and Note for Guidance on Good Clinical Practice (The National Health and Medical Research Council the Australian Research Council and Universities Australia, 2018; Therapeutic Goods Administration Commonwealth Department of Health and Aged Care, 2000).

3.4 Chapter summary

This chapter has provided an overview of the pragmatic multi methods approach used within this thesis to gain a broader understanding of challenging behaviours after TBI in the acute hospital setting, to inform the development of implementation strategies for evidence-informed practice of TBI behaviour management within the acute hospital context. Ethical considerations were discussed with an overview of frameworks and quality reporting templates used for studies within this thesis. Further detail of the methodology for each study will be discussed in subsequent chapters.

CHAPTER 4 IMPLEMENTING A BEHAVIOUR MANAGEMENT APPROACH IN THE HOSPITAL SETTING FOR INDIVIDUALS WITH CHALLENGING BEHAVIOURS DURING ACUTE TRAUMATIC BRAIN INJURY

This chapter addresses Aim 1 of the thesis: To develop and implement a consistent clinically pragmatic behaviour management approach in hospital settings to improve outcomes for patients with TBI. This chapter describes a pilot study conducted and is presented with minor changes for thesis formatting from the publication: “Implementing a behaviour management approach in the hospital setting for individuals with challenging behaviours during acute traumatic brain injury” published in Brain Injury.

This study was initially conducted as part of a Masters by Research candidature prior to upgrading to PhD. Therefore, this pilot study was conducted prior to the remaining studies in this thesis. This study describes the implementation of a clinically pragmatic approach to the management of challenging behaviours after TBI within hospital settings, and to determine if the implemented approach would improve outcomes for patients with TBI in hospital settings. After completion of this first study and upgrade to PhD, it was deemed necessary to then conduct reviews of evidence and clinical practice guidelines.

As the lead author of this publication, the candidate’s contribution was 80% of this chapter. The candidate conceived the idea and conceptualisation of this pilot study with co-authors guidance in the study design; consulted, collaborated, developed and implemented the TBI behaviour management approach at two hospital settings; collected data; analysed data with guidance from co-authors; and was the major contributor to the write up and editing of this publication. Co-author approval was obtained for permission to include this publication in the thesis.

4.1 Introduction

As outlined in Chapter Two, challenging behaviours are estimated to be prevalent in 25 – 57% of patients with TBI in the acute hospital setting (McNett et al., 2012; Nott et al., 2006; Phyland et al., 2021), with risks of harm, prolonged hospital stay and adverse effects on function for patients with TBI (Beaulieu et al., 2008; Bogner et al., 2001; Luauté et al., 2016; McNett et al., 2012; Rao & Lyketsos, 2000). Challenging behaviours also contribute to workplace violence and frequent security incidents for hospital staff (Nikathil et al., 2017). Within South Australian hospital settings, where this study is based, a Code Black is a security incident relating to escalating or threatening behaviour of patients that pose a risk to staffs’ health or safety, resulting in immediate assistance from clinical and security staff to appraise and support management of the incident.

Management strategies for challenging behaviours after acute TBI were described in Chapter Two. Behaviour management strategies for patients with acute TBI need to be implemented consistently with the approach flexible and tailored to the patient (Carrier, Ponsford, & McKay, 2022; Flanagan et al., 2009). A dearth of literature exists of the effectiveness of comprehensive, consistent behaviour management approaches with people with acute TBI in hospital settings.

Clinically pragmatic approaches involve interventions implemented by health system personnel through usual communication channels and quality improvement infrastructure (Weinfurt et al., 2017). To ensure embedded implementation of a clinically pragmatic behaviour management approach, an integrated knowledge translation framework (IKT) encourages the engagement of clinical staff within the development and implementation process (Bowen & Graham, 2013).

TBI behaviour management involves comprehensive assessment using validated tools to guide a management approach commencing with non-pharmacological strategies and progressing to pharmacological treatments, if required (Bayley et al., 2016). There is a gap in practice of how clinician's make clinical judgements for behaviour management interventions after a challenging behaviour has been identified with patients with acute TBI.

The aims of this pilot study were to:

- develop and implement a clinically pragmatic behaviour management approach for challenging behaviours during acute TBI,
- determine if implementing the behaviour management approach for challenging behaviours during acute TBI reduced the use of restraints, Code Black security incidences, and the acute length of stay admission and cost, thereby improving progress to rehabilitation.

4.2 Methods

4.2.1 Design

A pilot intervention study with a historical control group was conducted at two hospital sites. Outcomes were assessed retrospectively for the historical control group. The intervention group received care following the implementation of a behaviour management approach for challenging behaviours during acute TBI (details outlined in section 4.2.3). Outcomes were evaluated by a researcher independent of the treating clinicians who did not provide clinical services.

4.2.2 Participants and setting

Two acute hospitals in Adelaide, Australia were the setting for this study. Participants in the prospective intervention group included adult inpatients with acute TBI admitted to either of the 16 bed neurosurgery wards from both hospitals between August 2018 – May 2019 who exhibited

challenging behaviours according to the Ranchos Los Amigos Revised Scale, Level IV (Confused, Agitated) (Gouvier et al., 1987). Participants may have been experiencing PTA and were not excluded if PTA was not experienced or had resolved. Participants were excluded if their care was palliative or if they had passed away; or if the acute TBI patient did not exhibit challenging behaviours, according to the Ranchos Los Amigos Revised Scale, Level VI and above (Gouvier et al., 1987). Retrospective data was collected from historical patients forming a control group from both hospitals. Selection criteria included all adult patients admitted with acute TBI to either of the two included hospital wards during January 2013 – December 2016 and met inclusion criteria as identified above. The historical group received usual practice including the use of a hospital wide generic pharmacological guideline for adults with challenging behaviours which did not emphasise TBI recommended pharmacological interventions. Challenging behaviours were not assessed objectively to guide management interventions, nor was individualised management explicitly used for the historical group. A state-wide policy on minimising restrictive devices was developed during the pre-evaluation stage of this study, and the policy remained current and with content unchanged during the post-evaluation stage. At the time of data collection on both wards the intervention was the only notable difference to current practice at the second timepoint.

4.2.3 Intervention and implementation

Integrated knowledge translation approach involves the collaboration of researchers with clinicians, managers, and policy makers to develop and implement knowledge into complex health care practice (Gagliardi et al., 2016). In this study, integrated knowledge translation involved iterative processes to develop and implement a clinically pragmatic behaviour management approach, with dynamic collaboration between researchers and clinical stakeholders. This hybrid approach involved the intent to overlap of intervention and implementation. To ensure the behaviour management approach was design ready and clinically pragmatic, consultation with clinical stakeholders was imperative. Implementation of the behaviour management approach focused on driving change in clinical action. Process evaluation was not completed. The behaviour management approach and implementation strategy were as follows:

4.2.3.1 Behaviour Management Approach

For consistent and sustained uptake in clinical practice, the behaviour management approach for challenging behaviours during acute TBI was developed through consultation and planning with multi-disciplinary clinical stakeholders from both hospital sites. Rehabilitation doctors from the statewide Brain Injury Rehabilitation Services provided expert opinion and recommendations. Review of based on primary studies in the literature (Luauté et al., 2016; Plantier & Luauté, 2016) and clinical practice guidelines (Bayley et al., 2016; University of Arkansas Medical Sciences, 2020) was completed. The planning phase involved working parties with clinical stakeholders,

brain injury rehabilitation doctors to develop the behaviour management approach based on literature, expert opinion and applicability to the acute ward setting. A project steering committee was developed for project oversight. Consultation and feedback was received from neurosurgical clinical staff, clinical managers, heads of unit and the steering committee. Amendments and disagreements were resolved through working groups (informal consensus process) and escalated to the steering committee. The behaviour management approach was approved by both hospitals' governance committees prior to implementation.

Prospectively recruited participants received care following the implementation of a pragmatic clinical behaviour management approach for challenging behaviours during acute TBI on the two hospital wards. The TBI behaviour management approach used within the hospital setting consisted of two components: an assessment component, and a management protocol (detailed below):

- A TBI Behaviour Scale and Record form. This behaviour assessment form was adapted from the OBS (Kelly et al., 2006) for pragmatic use within the ward setting, and formatted into a hospital medical record. It provided TBI specific descriptors of behaviours and severity of behaviours as described in the OBS (Kelly et al., 2006). Psychometric properties of the adapted behaviour scale within the acute hospital setting were not evaluated. The TBI Behaviour Scale and Record form was adapted to promote clinical staffs' objective assessment in identifying, describing, and reporting challenging behaviours. This form was completed by nursing staff at a minimum of every four hours or in line with neurological observations.
- A TBI – Management of behaviours in the acute phase protocol. This protocol detailed recommendations for non-pharmacological and pharmacological interventions used in conjunction with the TBI Behaviour Scale and Record. The protocol emphasised that first line management for challenging behaviours should involve excluding differential causes of agitation, then starting treatment with non-pharmacological interventions prior to progressing to pharmacological interventions (see Figure 4.1). First line and second line pharmacological management strategies were outlined in the protocol based on best-practice and expert opinion, with pharmacological treatment initiated at low doses with a gradual increase (start low and go slow approach) and post-sedation monitoring, as supported in the literature (Luauté et al., 2016; Plantier & Luauté, 2016). Figure 4.1 outlines pharmacological agents that were recommended for patients with acute TBI. The TBI – Management of behaviours in the acute phase protocol used with the TBI Behaviour Scale and Record supported clinicians to objectively identify and monitor behaviour change and guide clinical decision making for acute behaviour management interventions.

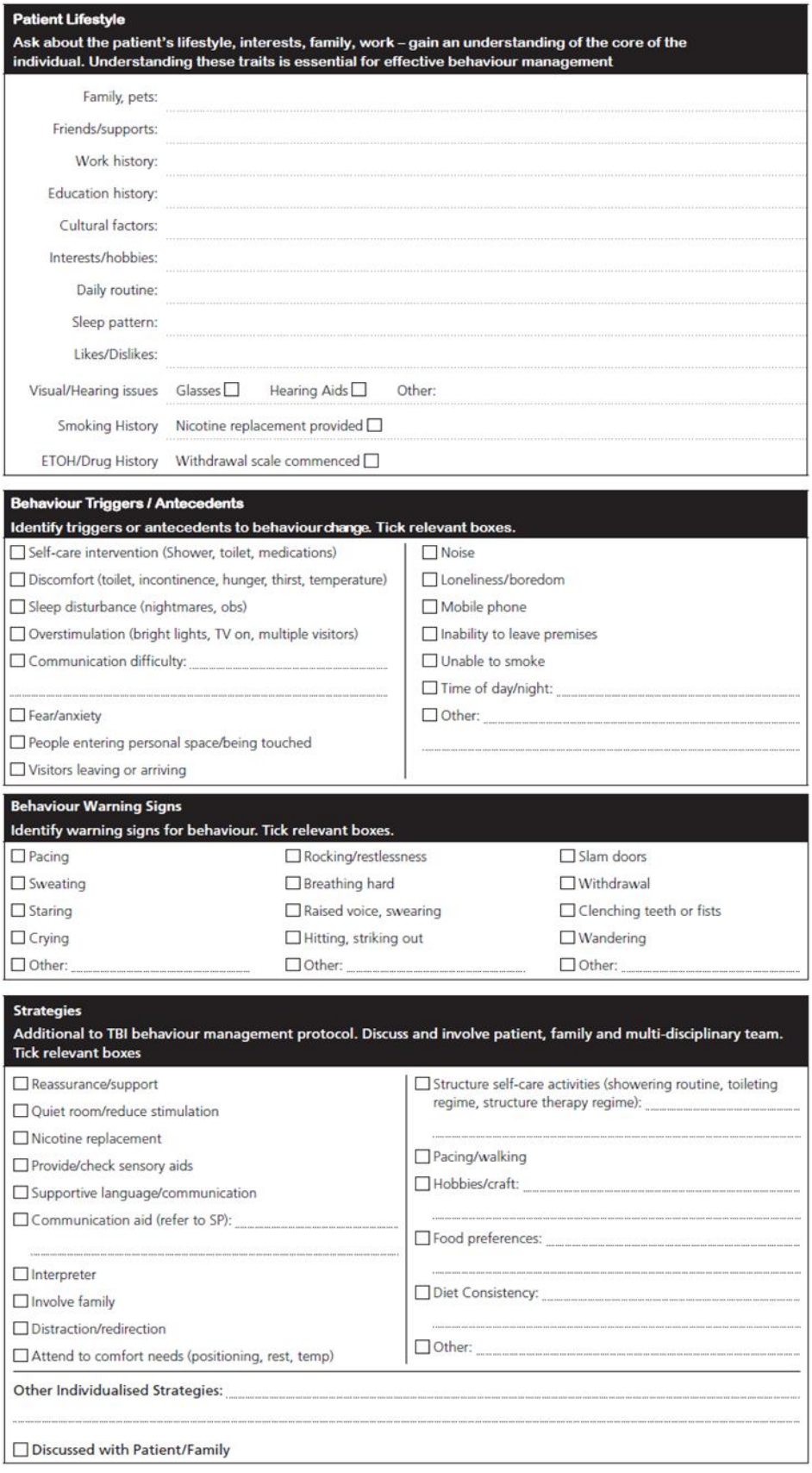
Within the implemented TBI – Management of behaviours in the acute phase protocol, a discretionary strategy to tailor behaviour management interventions based on individual factors was available for staff to complete with patients and patient's families. The individualised management form included family involvement to identify individual's lifestyle factors to assist in the identification of behavioural triggers/antecedents, warning signs of escalating behaviour and individualised management strategies (see Figure 4.2).

The TBI – Management of behaviours in the acute phase protocol was displayed within the ward setting and accessible online via both hospital's intranet. The TBI behaviour management approach was routinely used by the multi-disciplinary team working with the acute TBI patient.

<table>
<tr><th colspan="4">First Line Management – Non-Pharmacological Management</th></tr>
<tr><td colspan="2">Exclude Differentials:
Intracranial pathology
Infection
Pain
Metabolic disturbance
Discomfort
Delirium
Constipation / urinary retention
Medication reaction / side effects
Alcohol or drug withdrawal
Seizures / epilepsy
Neuroendocrine dysfunction
Emotional impact from trauma
Sleep disruption
Intellectual factors
Concurrent neuropsychiatric disorder
Smoking history and withdrawal
Premorbid factors: e.g., dementia</td><td colspan="2">Non-Pharmacological management:
Screen for post-traumatic amnesia (PTA)
Low stimulus environment
Single room
Visitor restrictions – limit to 2 at a time
Orientation board and reorientation to surroundings
Familiar items / photos
Implement communication strategies
Use signage and labelling for environment
Nicotine replacement
Remove mobility restrictor
Check sensory aids (hearing aids / glasses)
Continuity of staff
Frequent supervision
Scheduled therapy & diversional activity
Promote normal day / night cycle</td></tr>
<tr><td colspan="4">Acute Traumatic Brain Injury (TBI) – Management of Challenging Behaviours
Pharmacological Management
Start Low and Go Slow | Keep under direct clinical monitoring</td></tr>
<tr><td colspan="2">Pharmacological Management – 1st Line
Oral administration preferred</td><td colspan="2">Pharmacological Management – 2nd Line</td></tr>
<tr><td>Under 65 years old</td><td>Over 65 years old</td><td>Under 65 years old</td><td>Over 65 years old + Patients with Parkinson’s Disease or Lewy Body Dementia</td></tr>
<tr><td>Olanzapine ODT
Dose: 1.25-5mg
Route: Oral
Max dose: 10-15mg/24hrs
Min time between doses: 2 hours

AND / OR
Lorazepam tablet
Dose: 0.5-2.5mg
Route: oral/sublingual
Max dose: 10mg/24hrs
Min time between doses: 2 hrs</td><td>Olanzapine ODT
Dose: 0.5-2.5mg
Route: Oral
Max dose: 10-15mg/24hrs
Min time between doses: 2 hours
If oral therapy refused give:
Olanzapine IM
Dose: 5mg STAT
Route: intramuscular
Max dose: 10mg combined IM and oral in 24hrs
Time to max effect: 15-45mins</td><td>Clonazepam
Dose: 0.5-2mg
Route: intramuscular
Max dose: 6mg/24hrs
Min time between doses: 2hrs</td><td>Clonazepam
Dose: 0.25-0.5mg
Route: intramuscular
Max dose: 1mg/24hrs
Min time between doses: 2hrs</td></tr>
<tr><td>If oral therapy refused give:
Olanzapine IM
Dose: 5-10mg STAT
Route: intramuscular
Max dose: 30mg combined IM and oral in 24hrs
Time to max effect: 15-45mins</td><td>If the patient has Parkinson’s Disease, Lewy Body Dementia, these patients may be prescribed:
Quetiapine
Dose: 12.5-25mg
Route: oral
Max dose: 50mg/24hrs
Time to max effect:
1-1.5 hrs</td><td colspan="2">Contact Brain Injury Rehabilitation Services for consult:
If symptoms do not improve
For expert input for TBI pharmacological management
For long term management (>6 weeks)
Age criteria is a guide only. Use lower doses for the very sick, frail, elderly, Indigenous population, low body weight, dehydration, and antipsychotic naivety.</td></tr>
<tr><td colspan="4">Objectively monitor and document behaviours using TBI Behaviour Scale and Record.</td></tr>
</table>

Figure 4.1 Non-pharmacological and pharmacological interventions as outlined in the TBI – management of behaviours in the acute phase protocol



Patient Lifestyle

Ask about the patient's lifestyle, interests, family, work – gain an understanding of the core of the individual. Understanding these traits is essential for effective behaviour management

Family, pets:

Friends/supports:

Work history:

Education history:

Cultural factors:

Interests/hobbies:

Daily routine:

Sleep pattern:

Likes/Dislikes:

Visual/Hearing issues Glasses ☐ Hearing Aids ☐ Other:

Smoking History Nicotine replacement provided ☐

ETOH/Drug History Withdrawal scale commenced ☐

Behaviour Triggers / Antecedents

Identify triggers or antecedents to behaviour change. Tick relevant boxes.

- ☐ Self-care intervention (Shower, toilet, medications)
- ☐ Discomfort (toilet, incontinence, hunger, thirst, temperature)
- ☐ Sleep disturbance (nightmares, obs)
- ☐ Overstimulation (bright lights, TV on, multiple visitors)
- ☐ Communication difficulty:
- ☐ Fear/anxiety
- ☐ People entering personal space/being touched
- ☐ Visitors leaving or arriving
- ☐ Noise
- ☐ Loneliness/boredom
- ☐ Mobile phone
- ☐ Inability to leave premises
- ☐ Unable to smoke
- ☐ Time of day/night:
- ☐ Other:

Behaviour Warning Signs

Identify warning signs for behaviour. Tick relevant boxes.

☐ Pacing	☐ Rocking/restlessness	☐ Slam doors
☐ Sweating	☐ Breathing hard	☐ Withdrawal
☐ Staring	☐ Raised voice, swearing	☐ Clenching teeth or fists
☐ Crying	☐ Hitting, striking out	☐ Wandering
☐ Other:	☐ Other:	☐ Other:

Strategies

Additional to TBI behaviour management protocol. Discuss and involve patient, family and multi-disciplinary team. Tick relevant boxes

- ☐ Reassurance/support
- ☐ Quiet room/reduce stimulation
- ☐ Nicotine replacement
- ☐ Provide/check sensory aids
- ☐ Supportive language/communication
- ☐ Communication aid (refer to SP):
- ☐ Interpreter
- ☐ Involve family
- ☐ Distraction/redirection
- ☐ Attend to comfort needs (positioning, rest, temp)
- ☐ Structure self-care activities (showering routine, toileting regime, structure therapy regime):
- ☐ Pacing/walking
- ☐ Hobbies/craft:
- ☐ Food preferences:
- ☐ Diet Consistency:
- ☐ Other:

Other Individualised Strategies:

☐ Discussed with Patient/Family

Figure 4.2 Lifestyle factors, triggers, and warning signs to tailor individualised behaviour management strategies for patients with acute TBI

4.2.3.2 Implementation strategy

Implementation of the behaviour management approach used a multi-faceted integrated knowledge translation approach involving development and consultation with clinical stakeholders and steering committee (described above). Formal group education sessions were facilitated by the principal investigator. Multiple 45-minute sessions were conducted at each ward to capture a range of multi-disciplinary staff across shifts. Education sessions were attended by over 120 staff across both wards conducted several weeks in the early implementation phase. Two online scenario-based learning modules on behavioural changes after brain injury were developed for ongoing sustainability of education to clinical staff. Clinical staff have ongoing access to the online learning modules through the hospital education and training website. Two clinical 'champions' were involved at each site. Clinical champions were influential clinicians from each ward who could promote use of the behaviour management approach and drive change in practice. Two champions ensured a buddy system to capture staff across a range of shifts and rotations. Information education and process of using the behaviour management approach was provided through champions and facilitation at the ward level. Reminders and cues were provided at team meetings and shift handovers. Fidelity of the intervention was assessed through audits of the medical records for included participants to identify staff's use of the implemented resources.

This implementation strategy promoted the change process on each ward, to increase likelihood for embedded implementation success (Harvey & Kitson, 2015). Throughout the implementation process at both hospital sites, an evaluation of outcome measures for the intervention group was undertaken continuously during the admissions.

4.2.4 Data collection

Clinical and demographic information were collected as follows: age, gender, Glasgow Coma Scale (GCS) on admission, PTA duration measured using the Westmead PTA Scale (Marosszeky et al., 1998), Code Black security incidences and one-on-one (1:1) nursing. The clinician teams involved in this study were interested in understanding results regarding patients who receive one separate form of restraint and combined forms of restraints (pharmacological and mechanical). Therefore outcomes were collected regarding separate use of restraints (mechanical or pharmacological) and combined mechanical and pharmacological use. Participant's admission flow details were collected, including acute admission length of stay, discharge destination, time from admission to acceptance for rehabilitation, and acute admission cost. These were identified through documentation in medical records. Code Black security incidents and restraint data were then verified against data on the South Australian Health Safety Learning System database. Hospital length of stay, discharge destination, and acute admission cost was obtained through South Australian Health Casemix activity based funding (South Australian Department of Health

and Wellbeing, 2020). Casemix activity based funding refers to the method of funding hospital services based on the level of activity undertaken, at an agreed price (South Australian Department of Health and Wellbeing, 2020). The inpatient hospital services have a specific classification, including diagnoses based on the International Statistical Classification of Diseases and Health Related Problems, 10th Edition (ICD-10) (World Health Organization, 2019). Classification of inpatient hospital services allows activities provided during the acute admission to be grouped according to clinical need and relative cost (South Australian Department of Health and Wellbeing, 2020). Ethics approval (no: 281.17) from the Southern Adelaide Clinical Human Research Ethics Committee.

4.2.5 Data analysis

Data was analysed with IBM SPSS Statistics for Windows, version 25 (IBM Corp., 2017). Descriptive statistics including number (n) and percentages (%), or median and interquartile ranges (IQR), where relevant were used for clinical diagnostic and demographic data for the participants in the intervention group and historical control group. Results are presented as tables of scores with percentages. Non-parametric statistical analyses were conducted as the scores on continuous variables were not normally distributed. Statistical analysis determined the association between the change in the continuous variables of clinical outcome measures using Mann-Whitney *U*-tests and X^2 for categorical variables in the intervention and historical cohort data. P was set at less than 0.05.

4.3 Results

Twenty-three participants were included in the intervention group (16 from one hospital, 7 from another), and 74 participants identified for the historical group (33 from one hospital, 41 from another). Participants in the intervention group received the behaviour management approach as outlined in the section 4.2.3. Participant selection data identifying patient activity admitted to each ward meeting inclusion and exclusion criteria was not recorded.

Demographics and clinical information for participants in both the intervention group and historical group are outlined in Table 4.1. Overall, demographic details of participants in the historical and intervention groups were comparable with no significant differences between groups for age, gender, PTA duration or GCS on admission.

Table 4.1 Demographic and clinical information for participants

	Behaviour management group	**Historical group**	**p value**
Demographics			
Age median, (IQR)	41, (27)	45, (36)	p = 0.68[a]
Male (%, n)	96% (n = 22)	80% (n = 59)	p = 0.07[b]
TBI Clinical Diagnostics			
PTA duration (%, n)			p = 0.19[c]
Not assessed	30% (n = 7)	14% (n = 10)	
<24hrs	4% (n = 1)	0% (n = 0)	
>24 hrs, <14 days	22% (n = 5)	20% (n = 15)	
>=14 days	43% (n = 10)	66% (n = 49)	
GCS on admission mean, (SD)	10, (4)	10, (4)	p = 0.48[a]
TOTAL	n = 23	n = 74	

[a] Results of Mann-Whitney U test
[b] Results of Chi-squared test
[c] Results of Fisher's Exact test of Probability

Fidelity assessment revealed that the TBI behaviour assessment scale and record was used with 93% of participants. The TBI – Management of behaviours in the acute phase protocol was used with 100% of participants which included non-pharmacological interventions documented for all participants in the intervention group. The form to identify individualised behaviour management strategies available for staff to use at their discretion was used with 41% of participants.

Outcome measures for the intervention and historical group are presented in Table 4.2. There was a significant difference between the intervention and historical group in the proportion of mechanical restraints with patients with acute TBI (X^2 (1) = 5.38, p = 0.02), with the intervention group receiving fewer mechanical restraints. There was a non-significant trend in a reduction in use of pharmacological restraints (p = 0.73) and both pharmacological and mechanical restraints

for the intervention group compared to the historical group (p = 0.15). The TBI Management of behaviours in the acute phase protocol outlined TBI specific pharmaceutical agents and TBI recommended doses for pharmacological management strategies. Some of these pharmaceutical agents are classified as sedating agents, hence were included as a pharmacological restraint. Within the intervention group, 63% of participants required pharmacological restraint, and from this group 71% adhered to the TBI specific recommendations outlined in the management protocol. There were no significant differences in the occurrences of Code Black security incidents or 1:1 nurse special within the ward setting.

Table 4.2 Outcomes for the behaviour management and historical groups

Outcomes	**Behaviour management group**	**Historical group**	**p value**
Pharmacological Restraints (%, n)	61% (n = 14)	65% (n = 48)	p = 0.73 [a]
Mechanical Restraints (%, n)	30% (n = 7)	58% (n = 43)	p = 0.02 [a*]
Both Pharmacological and Mechanical Restraints (%, n)	30% (n = 7)	47% (n = 35)	p = 0.15 [a]
Code blacks (%, n)	30% (n = 7)	12% (n = 9)	p = 0.88[a]
1:1 Special on ward (%, n)	61% (n = 14)	59% (n = 44)	p = 0.90 [a]
TOTAL	n = 23	n = 74	

[a] Results of Chi-squared test
*Significance at p< 0.05

Patient flow and admission cost during acute hospital admission for the intervention and historical groups are presented in Table 4.3. Length of stay within the hospital setting during acute TBI was not significantly different between the intervention and historical group, however there was a slightly lower length of stay for the intervention group compared with the historical group. There was also a slightly lower time from admission to acceptance for rehabilitation for the intervention group, however this was not significant when compared with the historical group. There was a significantly lower acute admission cost for the intervention group compared to the historical group, despite no significant difference in admission length of stay between the two groups. Further analysis of the admission costs for both acute hospital sites for the historical group were not significant (Mann-Whitney $U = 609.00$, $p = 0.94$), hence it can be extrapolated there were also no significant differences in admission cost between the two hospital sites for the intervention group. There were no significant differences in discharge destinations between the intervention group and historical group.

Table 4.3 Hospital flow and admission cost for the behaviour management and historical groups

Hospital Flow	Behaviour management group	Historical group	p value
Acute hospital length of stay in days (median, IQR [c])	17, (27.5)	25, (21)	p = 0.12 [b]
Time from admission to rehabilitation acceptance in days median, (IQR [c])	11.5, (25.5)	17, (25)	p = 0 .28 [b]
Acute admission cost in AUD median, (IQR [c])	$25,942, (103,682)	$87,743, (92,634)	p = 0.01 [b*]
Discharge Destination:			p = 0.08 [d]
Inpatient rehabilitation (%, n) [a]	65% (n = 15)	87% (n = 64)	
Acute transfer (%, n)	4% (n = 1)	5% (n = 4)	
Home (%, n)	4% (n = 1)	1% (n = 1))	
Home with rehabilitation (%, n)	17% (n = 4)	3% (n = 2)	
Care facility (%, n)	9% (n = 2)	4% (n = 3)	
TOTAL	n = 23	n = 74	

a Results of Chi-squared test
b Results of Mann-Whitney U test
c Interquartile range
d Results of Fisher's Exact test of Probability
*Significance at p<0.05

4.4 Discussion

This study describes the implementation of a clinically pragmatic behaviour management approach to challenging behaviours during acute TBI. Fidelity assessment identified a positive uptake of the implemented behaviour management approach, demonstrating staffs' positive receptiveness to the intervention with motivation to change practices and adherence to quality improvement recommendations to support clinical decision making for behaviour management strategies. These

fidelity findings support results from previous implementation studies, whereby fidelity can represent ideal circumstances to support employees delivery of a new intervention (Lawton et al., 2015).

Results from this study demonstrated the proportion of patients being restrained by mechanical restrictive devices was significantly lower than the historical control group. There were trends in lowered usage of pharmacological restraint for the intervention group. These outcomes support both the Australian national comprehensive care recommendations (Australian Commission on Safety and Quality in Health Care, 2017), and previous studies (Beaulieu et al., 2008; Luauté et al., 2016) to minimise the use of restrictive devices within health care settings, and as a form of behaviour management intervention following acute TBI. These positive outcomes have led to changes in clinical practice to support the recommendations of the Australian comprehensive care standards to reduce risks of harm to patients receiving health care (Australian Commission on Safety and Quality in Health Care, 2017).

The trend in lowered usage of pharmacological restraints for patients with acute TBI may subsequently support the patient with TBI to increase alertness, engage in therapy and progress to rehabilitation (Plantier & Luauté, 2016). Code Black security incidents and 1:1 nursing care on the ward were not significantly different between the intervention and historical control groups. It was observed that nursing staff providing 1:1 care was a clinically effective approach for providing non-pharmacological behaviour management strategies, such as supervision, regular verbal reassurance and cognitive reorientation to TBI patients with challenging behaviours.

This study demonstrated acute hospital admission costs were significantly lower in the intervention group compared to the historical group, following the implementation of the behaviour management approach for challenging behaviours during acute TBI. A non-significant trend in lower length of acute hospital admission and lower time from admission to rehabilitation acceptance for the intervention group compared to historical group was also observed. The reason for this cost efficiency, despite the unchanged length of stay, was unclear from the data collected. Admission cost analysis using the Australian Refined Diagnosis Related Group (AR-DRG) classifications may have been useful in highlighting differences between groups in complexities of the TBI admissions and subsequent procedures during the admissions, however AR-DRG data were not available for this study.

This study was broadly informed by an IKT approach (Bowen & Graham, 2013), with the behaviour management approach developed via consultation and a multifaceted facilitated implementation approach with clinical champions. This clinically pragmatic behaviour management approach follows the recommendations to effectively treat challenging behaviours for acute TBI patients with

a consistent, comprehensive approach (Flanagan et al., 2009). This involved comprehensive assessment of the individual and their environment, emphasising the importance of commencing with non-pharmacological approaches, elimination of antecedents or triggers, and pharmacological treatment if required (McNett et al., 2012; Plantier & Luauté, 2016).

This study involved the comparison of outcomes between groups following the implementation of a clinically pragmatic TBI behaviour management approach. Although study outcomes indicate a contribution to quality improvement in health care, some methodological limitations need to be considered. The methodological design of this study limits the ability to determine if the intervention directly resulted in the lowered use of mechanical restraints and the trends in lowered use of pharmacological restraint. Whilst the results of lowered use of mechanical restraint are a measure of the proportion of patients that required restraints, it is not the absolute number and use of these restraints for each participant. Therefore, it cannot be concluded that the number of mechanical restraints reduced for each participant. A lack of randomised control methodology and contextual process data to describe confounding variables limits the ability to conclude that the intervention directly influenced the study outcomes.

Fidelity assessment was limited to the number of times the behaviour management approach was documented in the medical records and demonstrates a basic uptake. Future studies may benefit from consideration of a theoretical framework for fidelity outcomes to guide scale up and sustainability beyond the pilot phase. Other implementation outcomes including feasibility, acceptability, resistance and sustainability were not recorded. A more rigorous knowledge translation methodology would account for these implementation outcomes and identify confounding variables contributing or hindering change of outcomes. Context analysis to identify changing policies, resources, barriers and enablers, staff knowledge, skills and confidence, and measurement of change processes would more robustly and systematically evaluate the integrity of the implemented intervention (Bowen et al., 2009).

The differences in the numbers of participants in each group, missing admission cost data, non-blinded outcome assessment, potential bias and the non-randomised nature of the historical group comparator are further limitations. Differences in the number of participants in the intervention and historical group raises the potential for a lack of comparability except for the intervention. This difference between groups was due to the intervention group evaluation being time limited due to research funding reporting requirements, hence a smaller number of participants were included. Admission flow details identifying participants included or excluded was not recorded. This was due to the pragmatic clinical application of the implemented behaviour management approach however could contribute to biases. The caveat of the results demonstrating lowered admission cost for the intervention group is the limitation of missing costing data from one hospital site for the

intervention group, which was not accessible by the researchers. Further analysis revealed there were no significant differences between costs associated with the historical group between the two acute hospital sites. Therefore, it can be extrapolated that there would be no significant differences in admission cost between the two hospitals in the intervention group. Furthermore, retrospective and prospective evaluation of data were limited only to those instances documented in the medical records. Retrospective data involves limitations of the potential of missing data and inaccurate recording, however overall, the completeness of retrospective data was high.

4.5 Conclusion

In conclusion, a clinically pragmatic, behaviour management approach for challenging behaviours during acute TBI was implemented in two acute hospital settings. High fidelity demonstrated the positive uptake of the implemented behaviour management approach. Adherence to the newly implemented behaviour management approach demonstrated staff receptiveness and motivation to use best practice interventions and to improve clinical practice. Results of this study indicate patients with TBI in the intervention group had a lower usage of mechanical restraints and lowered acute hospital admission cost. Trends in lowered usage of pharmacological restraints, lowered acute hospital length of stay and time from admission to rehabilitation acceptance were also demonstrated. These results contribute to improving quality of health care for patients in the acute stage of TBI.

4.6 Chapter summary

This chapter describes the implementation of a consistent behaviour management approach for challenging behaviours after TBI in two acute hospital settings. As discussed in this chapter, the results found high fidelity to the implemented behaviour management approach, and lowered use of mechanical restraints and acute hospital admission cost for patients with TBI. The implemented behaviour management approach outlined recommended non-pharmacological and pharmacological strategies for patients with TBI and challenging behaviours. However, the evidence relating to management strategies for challenging behaviours during acute TBI was not explored prior to implementation of this behaviour management approach. For this reason, a review of evidence of the management of challenging behaviours during the acute phase of TBI is warranted. Chapter Five will describe an umbrella review of evidence for management of challenging behaviours after TBI and PTA.

CHAPTER 5 EVIDENCE FOR THE MANAGEMENT OF CHALLENGING BEHAVIOURS IN PATIENTS WITH ACUTE TRAUMATIC BRAIN INJURY OR POST-TRAUMATIC AMNESIA: AN UMBRELLA REVIEW

This chapter addresses Aim 2 of the thesis: To systematically explore, appraise and summarise the evidence in literature and clinical practice guidelines for management of challenging behaviours after TBI in the acute hospital setting. This chapter describes an umbrella review conducted and is presented with minor changes for thesis formatting from the publication: "Evidence for the management of challenging behaviours in patients with acute traumatic brain injury or post-traumatic amnesia: An umbrella review" published in Brain Impairment.

This umbrella review was conducted to better understand the quality of the synthesised evidence for management of challenging behaviours with patients with TBI (and PTA) within the acute hospital setting. After implementing a consistent TBI behaviour management approach across two hospitals in study one, it was important to explore the synthesised evidence relating to non-pharmacological and pharmacological management strategies for patients with TBI in the acute hospital setting.

As the lead author of this publication, the candidate's contribution was 75% of this chapter. The candidate conceived the idea and conceptualisation of this review; developed and confirmed the search strategy in collaboration with the co-authors; and was the major contributor to the write up and editing of this publication. Co-author approval was obtained for permission to include this publication in the thesis.

5.1 Introduction

Preceding chapters of this thesis have detailed the incidence, epidemiology, prevalence, risks, and management strategies for challenging behaviours after TBI in the acute hospital setting. However, gaps exist in understanding the quality of the evidence relating to the management of challenging behaviours in the acute phase of TBI in hospital settings (Luauté et al., 2016).

Challenging behaviours are not limited to the acute TBI period and can often accumulate in chronic behavioural disabilities. Psychological and behavioural problems can exceed physical problems in causes of chronic disability, or even death, following brain injury (Jennett et al., 1981). This, in conjunction with a need to ensure a safe working environment for carers and hospital staff who are involved with this population group, stresses the need for improving the management of challenging behaviours after TBI in an acute setting.

The objective of this review was to examine the evidence for both pharmacological and non-pharmacological management strategies for challenging behaviours for patients with TBI or PTA. The aim of this review was to synthesise and evaluate the quality of the current best evidence on the different intervention types to manage challenging behaviours in patients with TBI or PTA in the acute hospital setting.

5.2 Methods

As this review sought to provide an overall examination of a body of information that is available for a range of management strategies for challenging behaviours in patients with TBI and PTA, an umbrella review was undertaken. The principle focus of an umbrella review is to provide a summary of already undertaken primary research syntheses and not to re-synthesise the literature or incorporate primary studies (Aromataris et al., 2020). This umbrella review was not registered but followed the JBI methodology for umbrella reviews (Aromataris et al., 2020). This umbrella review was conducted and reported in accordance of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009).

5.2.1 Inclusion criteria

This umbrella review included systematic reviews (SR) involving:

- Participants: any adult patients with challenging behaviours related to TBI or PTA in the acute phase after injury (i.e., first 0 – 6 months following TBI).
- Interventions: any management strategy used with the stated aim of reducing the challenging behaviour.
- Context: the tertiary health care service (acute hospital setting)
- Outcomes: behavioural change and impact on rehabilitation progress.
- Types of Studies: due to the nature of the intervention we chose not to limit the study designs included in the SRs. All SRs had to be published in the English language, in a peer reviewed journal and be available in full text. No time period restrictions were applied, and the latest search was undertaken on 27th September 2018.

5.2.2 Exclusion criteria

Opinion pieces or non-peer-reviewed publications, published study protocols, conference abstracts, articles not available in English language and where full text copies were not accessible were excluded.

5.2.3 Literature search strategy and article selection

The keywords (presented in Table 5.1) were used to search ten electronic databases, EMBASE, MEDLINE, AMED, PsycINFO, ICONDA, CINAHL, Pre-Medline, The Cochrane Library, Scopus and Web of Science. The MEDLINE search strategy is listed in Appendix 3. The search focused on studies regarding clinical effectiveness of interventions for the management of challenging behaviours in patients with acute TBI or PTA. Attempts to identify further articles were made by searching the reference lists of these studies. The title and abstract of articles identified in the search were examined independently by two reviewers against inclusion and exclusion criteria and the full text retrieved. In case of disagreement, the reviewers met to discuss the article and reached consensus.

5.2.4 Assessment of methodological quality

Following article retrieval the studies were reviewed for methodological quality independently by two reviewers using the Critical Appraisal Skills Programme (CASP) Tool for Systematic Reviews. The CASP checklist includes eight questions with “yes”, “no”, “can’t say” or “not applicable” as responses with the appraiser giving an overall rating of quality, based on the responses to questions of either high quality (++), acceptable (+), low quality (-) or unacceptable (Critical Appraisal Skills Programme, 2018). There is no defined cut off for low to moderate or high quality based on scores using the CASP critical appraisal tool, however scores of seven and eight reflected high-quality evidence. Quality of evidence within each SR was reported as is described in the SR.

Table 5.1 Search terms utilised for the review

Search terms 1	Search terms 2	Search terms 3	Search terms 4	Search terms 5
•Craniocerebral trauma • Brain Injuries • Post traumatic amnesia • Brain • Craniocerebral • Forebrain • Skull • Forehead • Frontal region • Head • Occipital region • Parietal region • Temporal region • Diffuse axonal • Intracranial • Intra-cranial • Cerebral	• injur* • trauma* • concuss* • damage • contusion • lacerat*	• acute	• affective disturbances • affective symptom* • aggression • agonistic behavior • agonistic behaviour • bullying • delusions •depersonalization • depression • malingering • obsessive behavior • obsessive behaviour • stalking • paranoid behavior • paranoid behaviour • problem behavior • problem behaviour • schizophrenic language • self-injurious behaviour • self-injurious behavior • self-mutilation • self-mutilation • suicide • suicidal • wandering behaviour • agitation • anxiety • behaviour change • behavior change • challenging behaviour* • challenging behavior* • confusion • delirium	• therap* • treatment* • therapeutic* • management • behaviour management* • behavior management* • behavior control* • behaviour control* • behavioral manipulation* • behavioural manipulation*

			• irritab* • mood disorder* • mood swing* • violen* • emotional disturbance* • alexithymia* • disinhibition • apathy • withdrawal • lack of initiation • social inappropriateness • sexual inappropriateness • perseveration • behaviours of concern • behaviors of concern	

5.2.5 Data collection

Following quality scoring, data were extracted from the studies using a specially designed data extraction sheet. The data extraction table was developed based on the recommendations of the JBI Methodology for JBI Umbrella Reviews (Aromataris et al., 2020). Two independent researchers synthesised the data in tabular format. The data extracted from each SR was as follows: author, year, objectives, sources searched, inclusion criteria, exclusion criteria, population participants (characteristics/total number), description of interventions/phenomena of interest, comparator, number of studies included, range (years) of included studies, types of studies included, country of origin of included studies, appraisal, appraisal instruments used, appraisal rating, analysis, method of analysis, outcome assessed, results/findings, significance/direction, and heterogeneity.

5.3 Results

5.3.1 Description of studies

As shown in the flow chart in Figure 5.1, the initial search resulted in 4604 citations, which left 2916 for title and abstract screening following removal of duplicates. From screening, 2909 articles failed to meet the inclusion criteria leaving seven studies for inclusion investigating the clinical effectiveness of interventions for the management of challenging behaviours in patients with acute TBI.

5.3.2 Data synthesis and quantitative analysis

Seven SRs identified explored different approaches to the management of challenging behaviours following TBI (Deb & Crownshaw, 2004; Fleminger et al., 2006; Levy et al., 2005; Luauté et al., 2016; Neville et al., 2018; Soo & Tate, 2007; Stelmaschuk et al., 2015). Whilst this review aimed to explore the evidence related to PTA, no review specifically focussed on this phase of post TBI recovery. Four reviews included PTA as part of the acute TBI presentation (Deb & Crownshaw, 2004; Levy et al., 2005; Luauté et al., 2016; Soo & Tate, 2007).

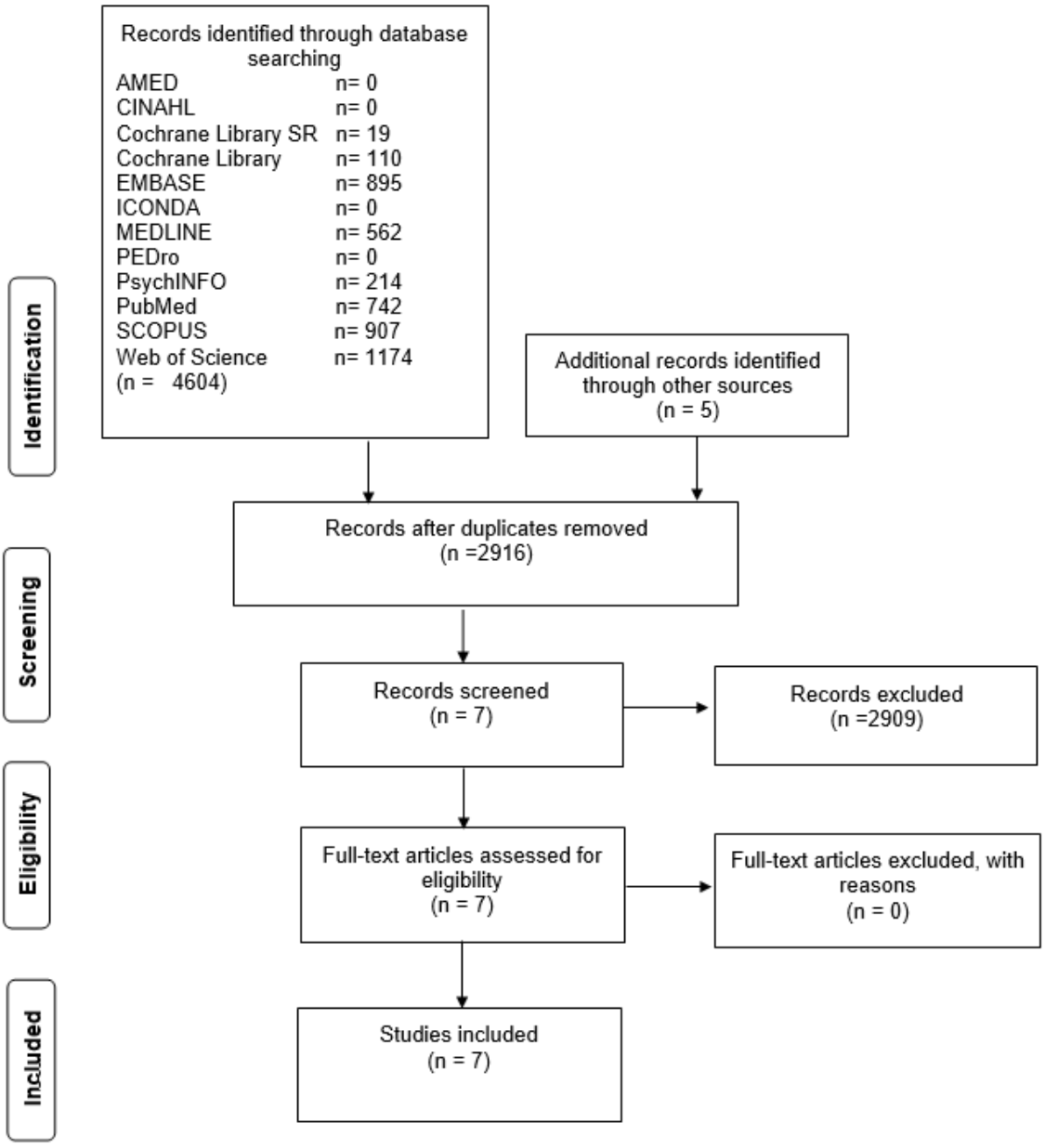


Figure 5.1 Flow chart of search results for this umbrella review

5.3.3 Methodological quality

Apart from the two Cochrane reviews (Fleminger et al., 2006; Soo & Tate, 2007) the SRs identified in this review were generally of low to moderate quality, with quality scores ranging from four to seven out of eight, and characterised by limited search strategies, limited reporting of the critical appraisal of the included literature and limited consideration to the methodological rigour of the review process (i.e. independent reviewers), reflecting the age of the publications. High-quality systematic reviews that focused on randomised controlled trial level evidence were characterised by low numbers of studies which make conclusions hard to draw. The assessments of methodological quality of the systematic reviews included in this review are presented in Table 5.2.

Table 5.2 Assessment of methodological quality using CASP critical appraisal tool

	Deb and Crownshaw (2004)	Levy et al. (2005)	Fleminger et al. (2006)	Soo and Tate (2007)	Stelmaschuk et al. (2015)	Luauté et al. (2016)	Neville et al. (2018)
Is the review question clear and explicitly stated?	Y	Y	Y	Y	Y	Y	Y
Were the inclusion criteria appropriate for the review question?	Y	Y	Y	Y	Y	Y	Y
Was the search strategy appropriate?	N	N	Y	Y	Y	N	N
Were the sources and resources used to search for the studies adequate?	N	N	Y	Y	N	N	N
Was the criteria for appraising studies appropriate?	N	Y	Y	Y	N	Y	N

Was critical appraisal conducted by two or more reviewers independently?	N	N	Y	Y	N	N	N
Were there methods to minimise errors in data extraction?	N	N	Y	Y	N	N	N
Were the methods used to combine studies appropriate?	Y	Y	Y	Y	Y	Y	N
Was the likelihood of publication bias assessed?	N	N	N	N	N	N	N
Were recommendations for policy and/or practice supported by the reported data?	Y	Y	Y	Y	Y	Y	N
Were the specific directives for new research appropriate?	N	y	Y	Y	N	N	N
Total (out of 11)	**4**	**6**	**10**	**10**	**5**	**5**	**2**

5.3.4 Findings

The SRs that were identified could be broken down into two main treatment approaches: pharmacological management (Deb & Crownshaw, 2004; Fleminger et al., 2006; Levy et al., 2005; Luauté et al., 2016; Stelmaschuk et al., 2015) and non-pharmacological approaches (Luauté et al., 2016; Neville et al., 2018; Soo & Tate, 2007). Whilst one review (Stelmaschuk et al., 2015) included non-human studies and TBI greater than six months, only one of the seven studies reviewed included non-human subjects (rats) and one study included TBI greater than six months. A pragmatic decision was made to include this SR, however findings from the two irrelevant primary studies were not included in this umbrella review.

5.3.5 Pharmacological treatments

The data extraction from studies involving pharmacological agents is presented in Table 5.3. Five systematic reviews reported on pharmacological management approaches.

Table 5.3 Studies involving pharmacological interventions

Author	Deb and Crownshaw (2004)	Levy et al. (2005)	Fleminger et al. (2006)	Stelmaschuk et al. (2015)	Luauté et al. (2016)
Objectives	To review the research on the effectiveness of drugs for the treatment of neurobehavioural disorders in patients with TBI.	To examine the evidence on the pharmacological treatment of agitation in TBI patients.	To evaluate the effects of drugs for agitation and/or aggression following acquired brain injury (ABI).	To determine whether amantadine improves cognitive function post-TBI	To evaluate the therapeutic strategies for treatment of agitation and aggressiveness in patients with TBI.
Sources searched	1) MEDLINE, Pre-Medline, Embase, Psychlit and Cochrane Library 2) hand search of Brain Injury	MEDLINE and CINAHL	1) The Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE and other electronic databases. 2) Reference lists of included studies and recent reviews. 3) Hand search of the journals Brain Injury and the Journal of Head Trauma Rehabilitation.	1) PubMed and CINAHL, 2) Reference lists of included trials were scanned.	MEDLINE
Inclusion criteria	1) Patients with TBI. 2) were adults (aged over 16 years) (although younger'	1) Human subjects. 2) English language studies. 3) Patients with TBI. 4)	1) RCTs 2) Studies investigating the efficacy of drugs acting on the central	1) Studies in English language, 2) Studies pertaining to	1) Studies evaluating a therapeutic strategy for the agitation or

	individuals were included when they were part of a series of cases consisting of mainly adults). 3) patients demonstrated psychological/behavioural issues.	Involving drugs specifically targeting behaviour either directly or indirectly	nervous system for agitation and/or aggression, secondary to ABI. 3) Patients over ten years of age.	pharmacologic treatment with amantadine within the first year of moderate to severe TBI. 3) Peer-reviewed articles available in full-text.	aggressive crisis in adult patients with TBI. 2) Studies in English or French
Exclusion criteria	Studies that used non-psychotropic drugs at the very acute stage of head injury treatment	Not reported	Not reported	Not reported	Not reported
Population Participants (characteristics/total number)	Adult patients with TBI (n = 1076)	Patients with TBI (n = 447)	Patients with ABI over ten years of age (n = 89)	Patients with cognitive dysfunction and moderate to severe TBI (n = 631)	Patients in the agitation crisis in the awakening phase after TBI (n = 376).
Description of Interventions/phenomena of interest	Any drug that may affect behaviour directly or indirectly. Drugs reviewed included: lithium, neuroleptics, anti-depressants, psychostimulants, anticonvulsants,	Pharmacological agents for agitation, delirium, aggression.	Any drug acting on the central nervous system	Amantadine	Any therapeutic strategies (pharmacological interventions and non-pharmacological) for the agitation or aggressive crisis in

	buspirone, dopaminergic drugs, beta-blockers, hormonal drugs.				adult patients with TBI.
Number of studies included	N = 63	N = 61	N = 6	N = 14	N = 28
Range (years) of included studies	Up to January 2003	From 1985 to 2005	Up to 2006	1994-2004	Jan 1990 to March 2012
Types of studies included	RCT (n = 13), non-randomised clinical trials (n = 8), retrospective cohort studies (n = 4), case series (n = 25) and case reports (n = 13).	RCTs (n = 5), Clinical trials (n = 1), prospective cohort (n = 4), retrospective reviews (n = 4), case series (n = 8), individual case reports (n = 39).	RCT (n = 6).	systematic reviews (n = 1), meta-analysis (n = 1), guideline (n = 1), RCT (n = 5), case series (n = 1), case study (n = 1), retrospective studies (n = 3), prospective studies (n = 1).	RCTs (n = 6), controlled studies (n = 5), case control (n = 4), case studies (n = 4), case series (n = 9).
Country of origin of included studies	Not reported	Not reported	Not reported	United States, Europe, and Taiwan	Not reported
Appraisal instruments used	Not reported	The Criteria for Level of Evidence Assignment from the Canadian Network for Mood and Anxiety Treatments (CANMAT)	Jadad scale	Not Reported	Specific tool not reported

Appraisal rating	Not reported	All ratings included	Not reported	Not reported	Not reported
Method of analysis	Narrative	Narrative	Narrative	Narrative	Narrative
Outcome assessed	Not reported	Behavioural modification following treatment with the medication and any side effects	Primary outcome measure was agitation and/or aggression (changes in the severity, frequency, or type of agitation and/or aggression). Additional outcome measures included independent living status, participation in rehabilitation, adverse events (increased cognitive impairment, side effects, death), health service utilisation (in particular length of stay).	Standard outcome measures used included the Glasgow Outcome Scale (GOS), Functional Independence Measure (FIM) and its FIM-cog subscale, Disability Rating Scale (DRS), and the Mini-Mental Status Examination (MMSE).	Agitation or aggressiveness in patients with TBI
Results/ Findings	No strong evidence to suggest that drugs are effective in the treatment of behaviour disorders in patients with TBI. Some	Despite numerous studies there is limited evidence to help guide the clinician. The prescription of pharmacotherapy must be	Six RCTs were included of which four evaluated beta-blockers (propranolol and pindolol), one evaluated a CNS stimulant	Amantadine pharmacologic therapy can produce favourable outcomes (improved cognitive function related	The level of evidence was low and dated. The efficacy of betablockers and antiepileptics with

	weak evidence that psychostimulants are effective in the treatment of apathy, inattention and slowness; high dose beta-blockers in the treatment of agitation and aggression; anti-convulsants and anti-depressants in the treatment of agitation and aggression, particularly in the context of an affective disorder; and possibly a specific neuroleptic methotrimeprazine in the treatment of agitation in the post-acute stage of TBI Individual responses to drugs varied. Some drugs, such as lithium and dopaminergic drugs could	closely monitored and a multi-disciplinary approach combining both pharmacological and non-pharmacological interventions may be necessary.	(methylphenidate) and one evaluated amantadine. Two RCTs found propranolol to be effective (one in acute stage and one in late stage). However, these studies used relatively small numbers, have not been replicated, used large doses, and did not use a global outcome measure or long-term follow-up. Comparing early agitation to late aggression, there was no evidence for a differential drug response. Strong evidence that carbamazepine or valproate is effective in the management of agitation and/or aggression following acquired brain injury is lacking.	to arousal, memory, and aggression compared with placebo) for patients with TBI. Based on higher-level evidence, amantadine can be started at 100 mg bid anytime from 3 days to 6 months post-TBI for most patients. However, dose and time of therapy should be individualized to each patient.	mood regulation effects like carbamazepine and valproate provide the strongest evidence (grade B for beta-blocker and C for antiepileptics) and should be preferably used.

	cause adverse effects in some patients				

Overall, the evidence for the pharmacological management of challenging behaviours in acute TBI is limited. The evidence is summarised below relating to pharmacological management for challenging behaviours, in particular agitation and aggression.

5.3.5.1 Beta-blockers

Although the exact mechanism remains unclear (Luauté et al., 2016) there is some evidence, albeit weak, that beta-blockers may be effective in the management of agitation and aggression following TBI. Based on their review of the evidence, Luauté et al. (2016) supported beta-blocker use and assigned a Grade B recommendation (. scientific presumption). This supported the earlier findings of Fleminger et al. (2006) in their Cochrane review where they reported that the best evidence for the management of agitation and aggression following TBI was for the use of beta-blockers. Levy et al. (2005) also reported Level I evidence (good research-based evidence) in support of use of Propranolol. Deb and Crownshaw (2004) reported that whilst there was preliminary evidence in support of beta-blockers for the reduction of assaultive behaviour and temper outbursts in patients with TBI, they were required to be taken at such high doses that adverse effects were a greater risk. Authors cautioned on the lack of high-level evidence, with a lack of long-term follow-up, small subject numbers and heterogenic populations.

5.3.5.2 Anti-epileptics

The effects of anti-epileptic or anti-convulsant medications may occur through their action on neurotransmitters involved in agitation and aggressiveness, or through the phenomenon of kindling in the limbic system observed in certain patients with aggression or agitation (Eames & Wood, 2003). Anti-epileptics have been recommended for the management of agitation and aggressiveness following TBI, however the evidence for the use of these drugs was equivocal. Deb and Crownshaw (2004) reported on the evidence associated with the anti-convulsant drugs: Sodium Valproate, Phenytoin, Carbamazepine, Divalproex Sodium, Lamotrigine and reported weak evidence in favour of their use, a finding that was supported by (Luauté et al., 2016) who reported Grade C (low level of evidence) in favour of the use of mood regulating anti-epileptics. Whilst the use of anti-epileptic medications was the standard treatment for aggression according to expert opinion, methodological biases in the evidence limit the strength of evidence for example heterogeneity of the population, treatment of agitation and aggressiveness at a chronic stage and not specifically during a crisis, and use of associated medical treatments. The authors also noted the adverse effects on cognitive performances and time needed to perform psychomotor tasks which were relatively common with Carbamazepine and Valproate. Levy et al. (2005) reported Level II (fair research-based evidence) and Level III (expert clinical opinion) evidence in favour of Valproic Acid/Divalproex (two studies), Carbamazepine (four studies), Lithium Carbonate (three studies), and Level III evidence against use of Gabapentin (one study) and Buspirone (six studies).

5.3.5.3 Neuroleptics/antipsychotics

Neuroleptics are commonly used to obtain a quick sedation in order to protect the patient from himself/herself, or to protect the members of the healthcare team. Deb and Crownshaw (2004) concluded from their review of four studies involving Thioridazine, Clozapine, and Methotrimeprazine, that there was no convincing evidence for the use of neuroleptics in the management of behaviour disorders in TBI, and a significant incidence of adverse events. Levy et al. (2005) reported Level II evidence in support of the use of Methotrimeprazine (one study), Droperidol (one study), Haloperidol (six studies), Clozapine (one study) and Level III evidence in support of Chlorpromazine (one study), Olanzapine (one study) and Risperidone (one study). Luauté et al. (2016) concluded that there was limited and low-level evidence in support of the use of Olanzapine (one study), Clozapine (one study), Quetiapine (one study), and Ziprasidone (one study) and that expert opinion was that neuroleptics should not be used as first line treatment and only in case of crisis and for a short period of time.

5.3.5.4 Anti-depressants

It has been proposed that anti-depressants work on the levels of neurotransmitters related to behavioural disorders, with serotonin shown to influence personality changes, agitation and aggressiveness. Luauté et al. (2016) concluded that there was low level of evidence for the use of anti-depressants for the management of agitation and aggressiveness. They reported Grade C evidence (low level of evidence) in support of Sertraline, and Amitriptyline for agitation from 25 mg/day as a second-line treatment (Grade C). Levy et al. (2005) reported Level I and II evidence in support of Sertraline (two studies), Level II evidence in support of Citalopram (one study) and Level III evidence in favour of Bupropion (one study), Fluoxetine (one study), Protriptyline (four studies) and Amitriptyline (three studies). Deb and Crownshaw (2004) reviewed 11 studies and concluded that anti-depressants lead to a demonstrable improvement in behaviour but that this behaviour was affective in nature. They felt that as depression and other affective disorders are common following TBI, anti-depressants may treat the affective condition which reduces the development of agitation and aggression.

5.3.5.5 Psychostimulants

This group of medications is thought to work by improving the neurochemical transmission of both dopamine and norepinephrine (Levy et al., 2005), and is commonly used to treat behavioural problems such as impaired vigilance and attention, impaired initiation and difficulty in concentrating (Deb & Crownshaw, 2004). Deb and Crownshaw (2004) identified eight studies relating to this class of medication and concluded that whilst there was evidence that these drugs were effective in treating symptoms such as slowness of behaviour and lack of initiation and attention, there was the potential risk of significant adverse effects and, hence, their use needed to be monitored closely. Levy et al. (2005) reported Level I evidence in support of Methylphenidate (four studies)

and Level III evidence in support of Dextroamphetamine (two studies). Luauté et al. (2016) reported on three studies that explored the use of Methylphenidate with two controlled studies showing a reduction in aggression and a third case study showing an increase in agitation in a patient with TBI treated with Methylphenidate.

5.3.5.6 Anti-parkinsonian agents

It has been observed that following severe TBI, particularly involving the frontal lobe, there are significant effects on brain monoamines, such as dopamine. Amantadine, an anti-parkinsonian medication, increases dopaminergic neurotransmission and has been used in TBI patients for improving cognitive function, concentration, processing time and psychomotor speed, and for reducing fatigue. Deb and Crownshaw (2004) identified five studies looking at the effect of Amantadine (two RCTs and three case studies) and concluded that the evidence in favour of the use of the drugs for improving behaviour in TBI was equivocal, with a significant risk of adverse events. Levy et al. (2005) reported Level I - III evidence (nine studies) supporting the use of Amantadine however the high-level evidence was again equivocal with one RCT showing no difference in effect compared to placebo and one RCT demonstrating improved initiation and progress/participation in therapy within a few days following commencement of treatment. Luauté et al. (2016) also identified contradictory findings in the two high level studies they reviewed and concluded that the benefit of Amantadine on agitation and aggressiveness remained to be validated. Stelmaschuk et al. (2015) in their review of the use of Amantadine identified 11 primary studies of varying levels and concluded that whilst the older (pre-2004 studies) were equivocal, they were of low level and of poor quality. More recent studies (since 2004) were higher-level studies, with larger sample sizes. These studies included randomisation and placebo-controls, and favoured Amantadine for increased arousal and/or cognition.

5.3.6 Non-pharmacological treatments

Three systematic reviews reported on non-pharmacological management approaches. The findings from the reviews investigating non-pharmacological interventions are presented in Table 5.4. The evidence is summarised below under non-pharmacological management for agitation/aggression specifically and other behavioural symptoms.

Luauté et al. (2016) found no primary research into the use of non-pharmacological therapeutic interventions for the management of agitation or aggression in patients with TBI.

Table 5.4 Studies involving non- pharmacological interventions

Author	**Soo and Tate (2007)**	**Luauté et al. (2016)**	**Neville et al. (2018)**
Objectives	To assess the effects of psychological treatments for anxiety in people with TBI.	To evaluate the therapeutic strategies for treatment of agitation and aggressiveness in patients with TBI.	To evaluate the role of transcranial magnetic stimulation in the assessment and treatment of TBI.
Sources searched	1) Cochrane Injuries Group's specialised register, Cochrane Depression, Anxiety and Neurosis Group's specialised register, Cochrane Central Register of Controlled Trials, MEDLINE, PsycINFO, EMBASE, CINAHL, AMED, ERIC, and PsycBITE, 2) key journals were hand searched, 3) reference lists were scanned.	MEDLINE	MEDLINE, PubMed
Inclusion criteria	1) RCT, 2) studies involving psychological treatments for anxiety, with or without pharmacological treatment. 3) patients with TBI. 4) Trials using a mixed sample of participants with different neurological conditions were included if the majority (80% or greater) of the sample comprised individuals with TBI.	1) Studies evaluating a therapeutic strategy for the agitation or aggressive crisis in adult patients with TBI. 2) Studies in English or French.	1) Psychiatric, rehabilitation or psychological assessment as the main aim/outcome of the study, 2) TBI symptom as independent variable; 3) published in a peer reviewed journal, 4) full text written in English.
Exclusion criteria	1) Pharmacological treatments for anxiety in isolation (without psychological	Not reported	Not reported

	intervention), 2) patients with acquired brain impairment other than TBI (for example, stroke).		
Population Participants (characteristics/total number)	Patients with TBI aged five years and over (n = 60).	Patients in the agitation crisis in the awakening phase after TBI (n = 376).	Adults (aged over 18 years) with TBI (n = 20).
Description of Interventions/phenomena of interest	Any form of psychological treatment aimed at reducing anxiety (including behaviour therapy, cognitive therapy, psychoanalytic therapy, education, counselling, social skills training, cognitive rehabilitation, neurorehabilitation or other (for example, family therapy), with or without pharmacological treatment.	Any therapeutic strategies (pharmacological interventions and non-pharmacological) for the agitation or aggressive crisis in adult patients with TBI.	Any type of transcranial magnetic stimulation (TMS) for assessment and treatment in TBI.
Number of studies included	N =3	N = 28	N = 6
Range (years) of included studies	Up to 2006	January 1990 to March 2012	Up to December 2015

Types of studies included	RCT (n = 3)	RCTs (n = 6), controlled studies (n = 5), case control (n = 4), case studies (n = 4), case series (n = 9)	Case studies (n = 5), case series (n = 1)
Country of origin of included studies	Not reported	Not reported	Not reported
Appraisal instruments used	PEDro scale	Specific tool not reported	Not reported
Method of analysis	Narrative	Narrative	Narrative
Outcome assessed	Diagnostic status of anxiety as determined by use of a standardised structured interview or scale. Self or observer report of symptoms of anxiety using standardised and non-standardised questionnaires. Neuropsychological functioning, psychosocial adjustment, everyday functioning and psychosocial or community participation. Medication usage, service usage. Treatment compliance, as indexed by the number of withdrawals or drop-outs.	Agitation or aggressiveness in patients with TBI.	TBI symptoms including motor recovery, mood disorders (depression, post-traumatic stress disorder), pain, spasticity, gait disturbances, and cognitive decline.

Results/ Findings	Some (limited) evidence for the effectiveness of CBT for treatment of acute stress disorder following mild TBI and CBT combined with neurorehabilitation for targeting general anxiety symptomatology in mild to moderate TBI. Studies had small sample size and heterogeneous characteristics. More trials focusing on comparable psychological interventions, severity of injury of participants and diagnosis of anxiety disorder(s) are needed.	The level of evidence was low and dated. No experimental study has been found of non-pharmacological therapeutic intervention for the agitation or aggressiveness crisis.	There are no controlled trials of TMS in patients with TBI. The authors concluded that there was evidence supporting the use of TMS in depressive and cognitive disorders.

5.3.6.1 Cognitive behavioural therapy

There was some evidence in support of the use of cognitive behavioural therapy (CBT) (Soo & Tate, 2007) for treatment of acute stress disorder following mild TBI, and combining CBT with neurorehabilitation for targeting general anxiety symptomatology in people with mild-moderate TBI (two RCT studies). The authors identified that treatment effects appeared to be linked to the disorder rather than general anxiety, suggesting that further research should focus on interventions which are specific to the disorder. The authors warned that the current research was limited with small sample sizes.

5.3.6.2 Transcranial magnetic stimulation

Neville et al. (2018) explored the evidence related to the use of transcranial magnetic stimulation (TMS) in the assessment and treatment of TBI. The authors identified five case studies and one case series of which two case studies reported improvement in neurobehavioural symptoms, and two case studies reported improved cognition and depression.

5.4 Discussion

This umbrella review summarised the evidence from seven systematic reviews including 203 relevant studies, involving 2699 participants. The majority of included reviews examined pharmacological interventions (n = 5), including beta-blockers, anti-depressants, anti-epileptics/anti-convulsants, neuroleptics/antipsychotics, psychostimulants and anti-parkinsonian agents. Despite their widespread use in the management of challenging behaviours following TBI the evidence is generally equivocal, potentially reflecting the heterogeneity of patients with TBI and their clinical behaviours. There is a lack of evidence relating to the appropriate dosage of pharmacological interventions during the acute phase of TBI or PTA. The evidence relating to the non-pharmacological management of challenging behaviours following acute TBI or PTA is scarce, with three reviews reporting on non-pharmacological approaches, with limited evidence in support of the use of CBT for the management of anxiety in cases of mild TBI. Similarly with the reviews reporting on pharmacological management approaches, the low level quality of reviews relating to non-pharmacological approaches is likely due to the heterogeneity of patients with TBI and the lack of high quality primary research relating to non-pharmacological behaviour management approaches following acute TBI and PTA. High quality randomised controlled trials are challenging within the TBI population due to the inherent heterogeneity of TBI type, symptoms, severity, and prognosis impacting on the ability to recruit TBI participants to strict enrolment groups and draw outcomes between treatment groups (Roozenbeek et al., 2009). Thus, there were more low-level sources of evidence in most of the SRs included in this umbrella review.

Of the SRs included in this umbrella review, most reported on behaviour management approaches related to agitation and aggression (Deb & Crownshaw, 2004; Fleminger et al., 2006; Levy et al., 2005; Luauté et al., 2016). Agitation is a prevalent behavioural change following TBI, with over 40% of patients with TBI exhibiting agitation within the acute hospital setting (McNett et al., 2012) and posing risks in poorer functional outcomes and prolonged hospital admissions for the patient with TBI (Bogner et al., 2015; McNett et al., 2012). Hence agitation may be the focus in the primary research included in the SRs given its high prevalence and risks to staff, patients and hospital efficiencies. There is also considerable variability in the definition of agitation (Fugate et al., 1997) potentially impacting on the differentiation of behavioural disturbances following acute TBI within the SRs included and primary research.

No SRs were identified focussing on behaviour management approaches during PTA. Of the primary studies included in the SRs examined, only one related to PTA, however, was included in the SRs as part of the acute TBI presentation (Luauté et al., 2016). There is a lack of primary research relating to behaviour management approaches for patients experiencing PTA, hence no SRs were identified. This umbrella review has highlighted a gap in primary research relating of PTA and behaviour management approaches.

The strengths of this umbrella review are that it provides a summary of existing research syntheses related to the evidence for management strategies for challenging behaviours for patients with TBI. Due to the amount of evidence syntheses already undertaken on this topic this review of reviews allowed consideration of the evidence associated with both pharmacological and non-pharmacologic management in the same review.

A limitation of this umbrella review is that the findings are dependent on the reporting of the included systematic research syntheses. Primary data searching, quality appraisal and data extraction, all potentially at risk of bias, have been performed in the systematic reviews and are outside the control of the current authors. Also, the focus on systematic reviews means that any new and developing intervention, which may not have had sufficient primary evidence to be included in a systematic review will not be identified in an umbrella review. A further limitation of this umbrella review is the currency of findings. Majority of the evidence reported within the included SRs reflect research up to 2015, with this umbrella review excluding primary research within the past five years. Since the review period, there have been more recent studies published investigating the efficacy of pharmacological interventions for neurobehavioural symptoms in PTA (Hicks et al., 2018); pharmacological interventions for aggression after TBI (Hicks et al., 2019), and more recently, effectiveness of non-pharmacological interventions for agitation during PTA after TBI (Carrier, Ponsford, Phyland, et al., 2022).

5.5 Conclusion

This is the first umbrella review examining the effect of management strategies for challenging behaviours after TBI in the acute hospital setting, to the best of our knowledge. The review sought to determine the most effective management strategy for challenging behaviours in this population. The results compiled from the SRs indicate that the current evidence for the management of challenging behaviours in patients with acute TBI is characterised by low levels of methodological quality with significant biases. The results indicate there is scarce evidence relating to management of challenging behaviours in patients experiencing PTA highlighting this as a gap in primary research.

5.6 Chapter summary

This novel umbrella review is an original contribution to research, examining the effect of management strategies for challenging behaviours after TBI in the acute hospital setting. The umbrella review sought to examine the evidence for both pharmacological and non-pharmacological management strategies for challenging behaviours for patients with TBI or PTA. Results indicate that the current evidence for the management of challenging behaviours in patients with acute TBI is equivocal, characterised by low levels of methodological quality with significant biases. The evidence for the management of challenging behaviours in the acute phase of TBI, particularly during PTA is scarce.

In the absence of high-quality evidence, clinicians rely on clinical practice guidelines or expert opinion to guide clinical reasoning and decision making for behaviour management approaches for the acute patient with TBI or PTA. Therefore, further understanding of the quality of clinical practice guidelines outlining management of challenging behaviours after TBI is required. Chapter Six presents a systematic review, synthesising recommendations and examining the quality of clinical practice guidelines relating to the management of challenging behaviours after traumatic brain injury in acute hospital and inpatient rehabilitation settings.

CHAPTER 6 CLINICAL PRACTICE GUIDELINE RECOMMENDATIONS FOR THE MANAGEMENT OF CHALLENGING BEHAVIOURS AFTER TRAUMATIC BRAIN INJURY IN ACUTE HOSPITAL AND INPATIENT REHABILITATION SETTINGS: A SYSTEMATIC REVIEW

This chapter addresses Aim 2 of the thesis: To systematically explore, appraise and summarise the evidence in literature and clinical practice guidelines for management of challenging behaviours after TBI in the acute hospital setting. This chapter describes a systematic review conducted with minor changes for thesis formatting from the publication: “Clinical practice guideline recommendations for the management of challenging behaviours after traumatic brain injury in acute hospital and inpatient rehabilitation settings: A systematic review” published in Disability and Rehabilitation.

On completion of the umbrella review described in Chapter Five, the need to review the clinical practice guidelines (CPGs) for the management of challenging behaviours after TBI in the acute and inpatient setting was identified, to understand what constitutes evidence-informed practice in acute hospital and inpatient rehabilitation settings.

As the lead author of this publication, the candidate’s contribution was 80% of this chapter. The candidate conceived the idea and conceptualisation of this review; developed and confirmed the search strategy in collaboration with the co-authors; conducted the search; screened for included records; conducted data extraction and quality appraisal; completed analysis of data; and was the major contributor to the write up and editing of this publication. Co-author approval was obtained for permission to include this publication in the thesis.

6.1 Introduction

Due to a range of non-pharmacological and pharmacological treatment options and equivocal evidence for TBI behaviour management, CPGs can provide clinicians with advice on standard treatment options (Callender et al., 2017). CPGs are systematically developed, evidence-based recommendations to guide clinicians and patients about appropriate healthcare treatment relevant to specific clinical circumstances (Woolf et al., 2012). Robust development of CPGs with rigorous methodologies are important for the successful implementation of the CPG recommendations into practice (Brouwers, Kho, Browman, Burgers, Cluzeau, Feder, Fervers, Graham, Grimshaw, et al., 2010). Robust development of CPGs by a multi-disciplinary panel of experts should involve systematic review of literature, provide ratings of the quality of evidence and strength of recommendations, consider patient values, balance benefits and harms, feasibility of

implementation and acceptability by stakeholders and effect on health equity (Brouwers, Kho, et al., 2010a; Brouwers, Kho, et al., 2010b; Murad, 2017). Adherence to CPGs improves patient outcomes in healthcare by recommending treatments that will be most beneficial to patients (Murad, 2017), and thus reducing the risk of treatments being ineffective or having adverse effects (Woolf et al., 2012). However, the adherence of CPG recommendations in practice is variable (Murad, 2017; Shafi et al., 2014), as is the quality of many CPGs (Brouwers, Kho, Browman, Burgers, Cluzeau, Feder, Fervers, Graham, Grimshaw, et al., 2010).

There is variability in the application of CPG recommendations for non-pharmacological and pharmacological treatments for patients with TBI in acute and inpatient rehabilitation practice (Block et al., 2021; Centers for Disease Control and Prevention, 2010; Flanagan et al., 2009; Seel et al., 2015; Shafi et al., 2012). These variations in care may result due to different hospital and patient characteristics, experience of clinicians, and processes of care from suboptimal adoption of CPG recommendations (Callender et al., 2017; Seel et al., 2015), demonstrating a need for a more consistent approach. Current TBI rehabilitation CPGs encompass multicomponent rehabilitation recommendations, with few specifically relating to the management of challenging behaviours after TBI in acute hospital and inpatient rehabilitation settings. Therefore, there was a need to incorporate CPGs with recommendations for the acute recovery phase of TBI relevant to acute hospital and inpatient rehabilitation settings. Learnings from TBI behaviour management in the inpatient rehabilitation setting could be considered for translation for improvements in acute care.

There is a gap in the literature of appraised CPGs relevant to the management of challenging behaviours after TBI in both acute hospital and inpatient rehabilitation settings. There is a critical need to identify high-quality CPG recommendations to guide clinicians in their decision making with applicable standards of care for consistent management of challenging behaviours after TBI in acute hospitals and inpatient rehabilitation settings.

The aims of this review were to:

- systematically identify and appraise CPGs for assessment and management of challenging behaviours after TBI relevant in acute hospital and inpatient rehabilitation settings,
- summarise high-quality CPG recommendations for assessment and management of challenging behaviours after TBI.

6.2 Methods

This systematic review was conducted and reported in accordance with Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines (M. J. Page et al., 2021). This

systematic review protocol was registered with PROSPERO on 19th August 2022 (ID number: CRD42022352349).

6.2.1 Search strategy

A search of CPGs was undertaken on 1st December 2020 and updated on 30th August 2022 using a 3-step search strategy and hand searching references: 1) literature search of databases; 2) search of CPG websites; and 3) internet search of grey literature (see Table 6.1). The 3-step search strategy aimed to locate both published and unpublished CPGs. Various keywords were used to search MEDLINE, CINAHL, Cochrane, Scopus, PubMed, and Google Scholar databases (see Table 6.1). The search strategy, including all identified title and abstract keywords and index terms, was verified by an experienced academic librarian and translated to each database (see Appendix 4 for MEDLINE search strategy for this review). Table 6.1 also describes CPG clearinghouse websites, CPG developer websites, and grey literature websites included in the search. In addition, websites of various healthcare institutions, and governmental and non-governmental organisations associated with the management of TBI were screened. Attempts to identify further CPGs were made by handsearching references of included studies.

Table 6.1 Search strategy

Database search terms			
Search term 1	Search term 2	Search term 3	Search term 4
"brain hemorrhage, traumatic" OR "brain stem hemorrhage" OR "traumatic" OR "cerebral hemorrhage, traumatic" OR "brain injuries" OR "diffuse" OR "diffuse axonal injury" OR "brain injuries, traumatic" OR "brain contusion" "TBI OR TBIs" OR "diffuse axonal	"guideline*" OR "practice guideline" OR "management or clinical or practice" OR "Clinical practice guideline" OR "clinical protocol"	"psychomotor agitation" OR "agitation" OR "hyperactivity OR restless" OR "aggression or self injur*"	"challenging behaviour" OR "challenging behavior" OR "behaviour of concern" OR "behavior of concern" OR "problem behaviour" OR "neurobehaviour" OR "neurobehavior"

injur*" OR "DAI or DAIs"			
CPG Website Search			
Website searched:			Country:
Agency for Healthcare Research and Quality (AHRQ)			United States
Australian Clinical Practice Guidelines			Australia
Australian National Health and Medical Research Council			Australia
National Institute for Health and Care Excellence (NICE)			United Kingdom
New Zealand Guidelines Group			New Zealand
Guideline Central			United States
eGuidelines			United Kingdom
Guidelines International Network (GIN)			International
Agency for Healthcare Research and Quality			United Kingdom
Grey Literature Website Search			
Website Searched:			Country:
MedNar			United States
ProQuest Dissertations and Theses			International
OpenGrey			Europe
Brain Trauma Foundation			United States
International Society of Physical and Rehabilitation Medicine			International
World Federation for NeuroRehabilitation			International
World Health Organisation			International

Ontario Neurotrauma Foundation Advanced Google	Canada International

6.2.2 Eligibility criteria

CPGs were included if they (i) targeted adult humans aged over18 years with moderate to severe TBI; (ii) summarised recommendations in English for assessment, management or rehabilitation of challenging behaviours after TBI; (iii) involved acute care (hospital setting) and/or subacute inpatient rehabilitation settings. Mild TBI, concussion, non-traumatic brain injury (stroke, hypoxia, birth trauma), paediatric populations and community and residential settings were excluded. CPGs which did not include or explicitly describe TBI challenging behaviour assessment or management interventions were excluded (such as surgical management or paramedical care guidelines). Conference presentations and abstracts were not included. Due to the limited evidence and existing CPGs on this topic, no date range was selected to limit eligibility.

6.2.3 Selection of CPGs

Records obtained through the search strategy were exported to EndNote-X9 reference manager and subsequently uploaded to Covidence systematic review software (Veritas Health Innovation, 2021) with duplicates removed. Two independent reviewers (HB/MP) screened titles, abstracts and/or full text of all articles against the eligibility criteria. Any disagreement between the two reviewers were resolved by discussion and/or consultation with a third reviewer (SH) to arrive at a consensus.

6.2.4 Data extraction

A data extraction template was jointly developed by the researchers to extract relevant information from articles. Data were extracted independently by two reviewers (HB/SH) using Covidence software. The two reviewers discussed results to resolve inconsistencies and verify data in an iterative process. As with the selection of CPGs where inconsistencies could not be resolved by the two reviewers, consultation occurred with a third reviewer (SG/MB) to arrive at consensus. Data extracted included CPG title, authors, year of publication, country, aim, population, context/setting, concept, guideline development methodology, key findings. In this review, the primary outcomes were recommendations for TBI behaviour assessment, non-pharmacological management and pharmacological management and other challenging behaviour recommendations.

6.2.5 Critical appraisal

The Appraisal of Guidelines for Research and Evaluation (AGREE) II instrument was used to determine the quality of development for each included CPG (AGREE Next Steps Consortium, 2017; Brouwers, Kho, Browman, Burgers, Cluzeau, Feder, Fervers, Graham, Grimshaw, et al., 2010). The AGREE II is a validated instrument to guide development, evaluate quality and predict adaptation of clinical practice guidelines (Brouwers, Kho, et al., 2010a; Brouwers, Kho, et al., 2010b). The AGREE II consists of 23 items organised into six domains followed by two global rating items for 'Overall Assessment' (AGREE Next Steps Consortium, 2017). Each of the six domains of the AGREE II captures a unique dimension of guideline quality, including: scope and purpose; stakeholder involvement; rigor of development; clarity of presentation; applicability; and editorial independence (AGREE Next Steps Consortium, 2017). Each of the AGREE II items are rated on a seven-point scale. A score of one (strongly disagree) is given when there is no information that is relevant to the AGREE II item. A score of seven (strongly agree) is given if the quality of reporting is exceptional and full criteria articulated in the User's Manual have been met. The six domains are calculated into domain scores (AGREE Next Steps Consortium, 2017). Domain scores can be interpreted to identify strengths and limitations of guidelines, to compare methodological quality and to select high-quality guidelines for implementation (AGREE Next Steps Consortium, 2017; Brouwers, Kho, Browman, Burgers, Cluzeau, Feder, Fervers, Graham, Grimshaw, et al., 2010). At present the AGREE II instrument does not provide validated guidance for differentiating guidelines as high-quality or poor-quality based on domain scores leaving these decisions to the user and guided by the context in which AGREE II is being applied (Brouwers, Kho, Browman, Burgers, Cluzeau, Feder, Fervers, Graham, Grimshaw, et al., 2010). Previous studies (Dijkers et al., 2021; Hatakeyama et al., 2019) have identified the following domains significantly influence the overall assessment of quality of guidelines: rigor of development (domain 3), clarity of presentation (domain 4), applicability (domain 5), and editorial independence (domain 6). Thus, in this review the CPGs were classified as 'high-quality' if they adequately addressed these four AGREE II domains, consistent with published literature (Dijkers et al., 2021; Hatakeyama et al., 2019). To be considered as having adequately addressed a domain, a calculated AGREE-II result threshold of 50% or more had to be attained. This threshold scoring approach has been used in previous appraisals of CPGs (Johnston et al., 2018; McMahon et al., 2021; Mehta et al., 2021). The reviewers' made a consensus decision not to further differentiate the classification of CPG quality beyond 'high-quality' due to inconsistent classification of 'moderate' and 'low' quality across previous studies. For this reason, the reviewers classified CPGs as either 'high-quality' or 'not high-quality'.

Two reviewers (HB/SH) independently graded each of the 23 items and calculated the six domain scores according to the criteria in the AGREE II manual, and the overall assessment of the

included CPGs (AGREE Next Steps Consortium, 2017). Upon completing scoring the AGREE II items, determining domain scores and overall assessment of the guideline quality, the reviewers also judged whether the guideline would be recommended for use in practice (AGREE Next Steps Consortium, 2017). Any disagreement in grading items and quality scoring was resolved by discussion between the reviewers, and consultation with an independent reviewer (SG) if consensus was not achieved.

Inter-rater agreement was determined using intraclass correlation coefficients (ICC) (Liljequist et al., 2019) with a two-way mixed effects model with 95% confidence interval for each AGREE II domain and overall rating scores using SPSS (IBM SPSS Statistics V.25) (IBM Corp., 2017). ICC values less than 0.50 are indicative of poor reliability, values between 0.5 and 0.75 indicate moderate reliability, values between 0.75 and 0.9 indicate good reliability, and values greater than 0.90 indicate excellent reliability (Koo & Li, 2016; Liljequist et al., 2019). ICC analysis for inter-rater reliability has been used in previous studies appraising CPGs (Lin et al., 2020).

6.2.6 Synthesis of results

Following data extraction and critical appraisal, recommendations were compiled to identify recommendations among the included high-quality CPGs. Recommendations were grouped into topics of behaviour assessment, non-pharmacological treatment, pharmacological treatment, models of care, and education and training with guideline evidence rating. High-quality CPG recommendations are described in table and narrative format.

6.3 Results

The initial search yielded 408 records. Twenty-two duplicates were removed, leaving 386 articles for eligibility screening. Seven CPGs met the inclusion criteria: Neurobehavioral Guidelines Working Group (NGWG) (Warden et al., 2006); Scottish Intercollegiate Guidelines Network (SIGN) (Scottish Intercollegiate Guidelines Network, 2013); Intitut National d'excellence en sante et en services sociaux - Ontario Neurotrauma Foundation (INESSS-ONF) (Bayley et al., 2016); SOFMER group (SOFMER) (Luauté et al., 2016); American Occupational Therapy Association (AOTA) (Wheeler & Acord-Vira, 2016); Colorado Department of Labor and Employment, Division of Workers' Compensation (DLE/DWC) (Department of Labor and Employment & Division of Workers Compensation, 2019); and Tele-Rehabilitation Interventions through University-based Medicine for Prevention and Health team (TRIUMPH) (University of Arkansas Medical Sciences, 2020). The search process, screening, and reasons for exclusion of remaining articles are outlined in Figure 6.1.

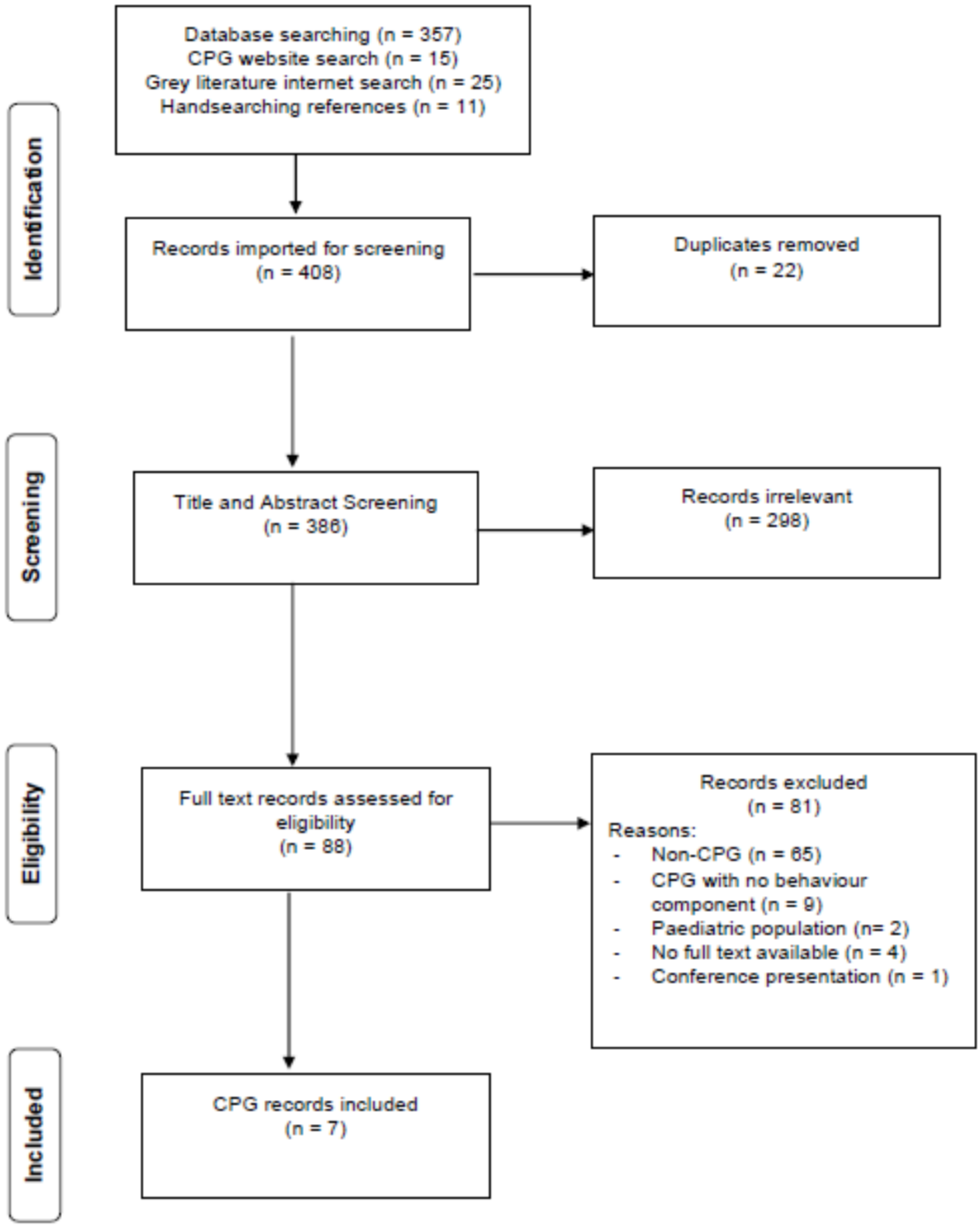


Figure 6.1 PRISMA flow chart of search results and selection process

6.3.1 CPG characteristics

Characteristics of the included CPGs are summarised in Table 6.2. All the included CPGs indicated the management or rehabilitation of TBI in the aim, with SIGN, TRIUMPH, SOFMER, NGWG CPGs explicitly stating management/rehabilitation of a component of challenging behaviour (Luauté et al., 2016; Scottish Intercollegiate Guidelines Network, 2013; University of Arkansas Medical Sciences, 2020; Warden et al., 2006). Each CPG defined the target population as adults or individuals with TBI. NGWG, SIGN, INESSS-ONF, DLE/DWC defined acute hospital care or inpatient rehabilitation settings, whereas AOTA and TRIUMPH did not stipulate the clinical context relevant for their CPG recommendations (University of Arkansas Medical Sciences, 2020; Wheeler & Acord-Vira, 2016). TRIUMPH was the only CPG that did not provide funding sources (University of Arkansas Medical Sciences, 2020). CPGs used differing approaches for grading evidence. SOFMER and AOTA used evidence-based medicine grading (Luauté et al., 2016; Wheeler & Acord-Vira, 2016); NGWG adapted a grading criterion; SIGN, INESSS-ONF, DLE/DWC created their own grading criteria; and TRIUMPH did not report any grading criteria of evidence levels. All CPGs were accessible online via either peer reviewed article, website, electronic book or fact sheet.

Table 6.2 Characteristics of included CPGs

Title, abbreviation	Year	Country	Target Population	Context	Funding Source	Grade and level of evidence used	CPG format
Guidelines for the Pharmacologic Treatment of Neurobehavioral Sequelae of Traumatic Brain Injury (NGWG)	2006	USA	Individuals with brain injury	Rehabilitation (subacute or outpatient)	National Brain Injury Research Treatment and Training Foundation, Centers for Disease Control, and Defense and Veterans Brain Injury Center	Adapted from Brain Trauma Foundation Guidelines for the Management of Severe Head Injury *Standards* - Class I and overwhelming Class II Evidence. *Guidelines* – Well-designed Class II Evidence. *Options* – Class II and Class III evidence.	Peer reviewed journal article
Brain Injury Rehabilitation in Adults. A National Clinical Guideline (SIGN)	2013	Scotland	Adults aged over 16 years with brain injury.	Rehabilitation (subacute or outpatient)	Healthcare Improvement Scotland	SIGN (Grades A, B, C, D and Good practice points)	Electronic book

Clinical Practice Guideline for the Rehabilitation of Adults with Moderate to Severe TBI (INESSS-ONF)	2016	Canada	Adults (i.e. 18 to 65 years old who have sustained a moderate to severe TBI)	Acute settings and rehabilitation facilities	INESSS-ONF	INESSS-ONF Level of Evidence (Level A, Level B, Level C)	Website available for desktop, mobile device, and PDF for printing
Care management of the agitation or aggressiveness crisis in patients with TBI. Systematic review of the literature and practice recommendations (SOFMER)	2016	France	Adults with TBI	Awakening phase of TBI	Association France Traumatisme Cranien	Evidence-based medicine criteria	Peer reviewed journal article
Occupational Therapy Practice Guidelines for Adults with Traumatic Brain Injury	2016	USA	Adults with Traumatic Brain Injury	Not reported	American Occupational Therapy Association, Inc.	Evidence-based medicine criteria	Website article

(AOTA)							
Traumatic Brain Injury Medical Treatment Guidelines (DLE/DWC)	2019	USA	Individuals who qualify as injured workers with TBI under the Colorado Workers' Compensation Act.	Acute care settings, hospitals, rehabilitation hospitals, outpatient settings, residential and behavioural settings, home, and community settings	Colorado Department of Labour and Employment	Colorado Department of Labour and Employment, Division of Workers' Compensation (Some evidence, Good evidence, Strong evidence, Consensus recommendation)	Electronic book
TRIUMPH Traumatic Brain Injury Guidelines. Management of Post Traumatic Brain Injury (TBI): Agitation (TRIUMPH)	2020	USA	Patients with TBI	Not reported	Not reported	Not reported	Online fact sheet

6.3.2 Inter-rater reliability

An excellent degree of inter-rater agreement was found for overall rating scores of AGREE II items between the two reviewers. The overall rating ICC was 0.940 with a 95% confidence interval from 0.914 to 0.956. As described in Table 6.3, a good degree of inter-rater agreement was found for scope and purpose (domain 1); an excellent degree of inter-rater reliability was found for stakeholder involvement (domain 2), rigour of development (domain 3), applicability (domain 5), and editorial independence (domain 6). There was a moderate degree of inter-rater agreement for clarity of presentation (domain 4).

Table 6.3 Inter-rater agreement for rating scores for AGREE II domains

Domain	Intraclass correlation coefficient	95% Confidence Interval
Scope and purpose	0.846	0.617 - 0.939
Stakeholder involvement	0.947	0.885 – 0.975
Rigour of development	0.938	0.890 – 0.965
Clarity of presentation	0.563	-0.23 – 0.819
Applicability	0.938	0.930 – 0.985
Editorial independence	0.985	0.951 – 0.995
Overall rating	0.940	0.914 – 0.956

6.3.3 Quality appraisal of CPGs

Table 6.4 displays the mean domain scores of the AGREE II instrument with a summary of appraisal for each CPG The domains that significantly influence the overall assessment of guideline quality are highlighted in orange in Table 6.4. The overall assessment of quality of included CPGs are displayed in Table 6.5. Overall guideline assessment scores ranged from 21% (TRIUMPH) to 98% (SIGN). SIGN and INESSS-ONF had the highest average with each score above 70% for all six domains and therefore were recommended without any modification. SOFMER and AOTA were recommended with modification to applicability to relevant stakeholders and clinical contexts. TRIUMPH, NGWG and DLE/DWC CPGs had the lowest mean domain scores across the six domains and subsequently the lowest overall guideline assessment at 21%,

41%, and 52% respectively. CPGs were classified as high-quality with mean domain scores of or over 50% for rigour of development (domain 3), clarity of presentation (domain 4), applicability (domain 5) and editorial independence (domain 6). SIGN and INESSS-ONF met these criteria, hence were deemed ‘high-quality’.

Table 6.4 Agree II Mean Domain Scores and summary of appraisal for included CPGs

Guideline	Domain 1. Scope and Purpose	Domain 2. Stakeholder Involvement	Domain 3. Rigour of Development	Domain 4. Clarity of Presentation	Domain 5. Applicability	Domain 6. Editorial Independence	Summary of appraisal using AGREE II instrument
NGWG	83%	17%	65%	56%	2%	25%	Well defined scope and purpose. Professional representation group involved, however lacked description of comprehensive stakeholder representation including target users and consumer input. Some rigour in development, however lacked detail in formulating recommendations, linking evidence to recommendations and lacked procedure for updating. Presented recommendations with unambiguous clarity. Lack of implementation strategies and auditing criteria. Lack of detail on views of funding bodies, no disclosure of conflicts/competing interests provided.
SIGN	100%	89%	99%	100%	100%	100%	Well defined scope and purpose with clear objectives and population group. Clearly described stakeholder groups with consumer views and clearly defined target

							users. Flawless rigour of development whereby the systematic method of literature search, selection of evidence and formulation of recommendations was robust with clear links to the evidence, benefits and risks, with peer review and a procedure for update. Presented recommendations with unambiguous clarity with different treatment options. Comprehensive description of implementation strategies, including barriers, facilitators, tools and resources for implementation and auditing criteria. Views on funding bodies and disclosure of competing interests provided.
INESSS-ONF	94%	94%	100%	94%	71%	100%	Well defined scope and purpose with clear objectives and population group. Clearly described stakeholder groups with consumer views and clearly defined target users. Flawless rigour of development whereby the systematic method of literature search, selection of evidence and formulation of recommendations was robust with clear links to the evidence, benefits and risks, with peer review and a procedure for update. Presented recommendations with unambiguous clarity with different treatment options. Some implementation strategies provided, including facilitators, barriers and tools, but lacking auditing criteria and resources. Views

							on funding bodies and disclosure of competing interests provided.
SOFMER	83%	75%	67%	78%	6%	71%	Well defined scope and purpose with clear objectives and population group. Clearly described stakeholder groups with consumer views and clearly defined target users. Some rigour in development, however lacked detail in formulating recommendations, linking evidence to recommendations and lacked procedure for updating. Presented recommendations with unambiguous clarity. Lack of implementation strategies and auditing criteria. Provided disclosure of conflict of interest but lacked detail in reporting views of funding bodies.
AOTA	86%	56%	75%	89%	21%	54%	Well defined scope and purpose with clear objectives and population group, however, lacks clinical context. Professional representation group involved, however lacked description of comprehensive stakeholder representation. High scores in rigour of development, however lacked a procedure for update. Presented recommendations with unambiguous clarity. Lack of implementation strategies and auditing criteria.

							Provided disclosure of conflict of interest but lacked detail in reporting views of funding bodies.
DLE/DWC	89%	56%	69%	72%	6%	17%	Well defined scope and purpose. Professional representation group involved, however lacked description of comprehensive stakeholder and consumer representation. Some rigour in development, however lacked detail in formulating recommendations, and linking evidence to recommendations. Presented recommendations with clarity and some different treatment options but did not clearly identify key recommendations. Lack of implementation strategies and auditing criteria. Lack of detail on views of funding bodies, no disclosure of conflicts/competing interests provided.
TRIUMPH	22%	0%	9%	78%	17%	0%	Did not define scope and purpose, objectives, population groups or context. Stakeholder views and target users not described. Lack of consumer input. Low scores in rigour of development with lack of description of systematic search and selection of evidence, formulation of recommendations with explicit link to any evidence, no external review, nor strengths, limitations, benefits described. Presented

							recommendations with unambiguous clarity, providing some different treatment options. Lack of implementation strategies and auditing criteria. No disclosure of funding view, competing interests or editorial independence provided.

Table 6.5 Overall assessment of quality for included CPGs

Guideline	Overall Guideline Assessment	High-quality: ≥50% in domains 3, 4, 5, 6	Recommend this guideline?
NGWG	41%	Not high-quality	No
SIGN	98%	High-quality	Yes
INESSS-ONF	92%	High-quality	Yes
SOFMER	63%	Not high-quality	Yes, with modification
AOTA	64%	Not high-quality	Yes, with modification
DLE/DWC	52%	Not high-quality	No
TRIUMPH	21%	Not high-quality	No

6.3.4 Summary of high-quality CPG recommendations

CPG recommendations from the two high-quality CPGs are outlined in Table 6.6. Behaviour assessment recommendations are supported by expert opinion level evidence and include comprehensive, individualised assessment through diagnostic interviews and direct observations (Bayley et al., 2016). Assessing for differential causes of agitation was also a good practice point (Luauté et al., 2016; Scottish Intercollegiate Guidelines Network, 2013).

Non-pharmacological management recommendations with strong supporting evidence include behaviour management plans with positive behaviour interventions (Bayley et al., 2016; Wheeler & Acord-Vira, 2016). Sequential approach from non-pharmacological to pharmacological approaches may be required for those with significant challenging behaviours (Bayley et al., 2016).

Pharmacological management recommendations were predominantly relevant in the management of agitation, aggression and impaired attention/arousal. High-quality CPG pharmacological recommendations with highest supporting evidence include beta-blockers for aggression (Bayley et al., 2016; Luauté et al., 2016; Scottish Intercollegiate Guidelines Network, 2013); selective serotonin reuptake inhibitors (SSRIs) for moderate agitation and irritability, and adamantanes or central nervous system (CNS) stimulants for impaired arousal/attention (Bayley et al., 2016). Expert opinion/good practice recommendations are provided for pharmacological treatment of

severe acute agitation and severe agitation that threatens staff or patient safety, and general pharmacological recommendations (Bayley et al., 2016; Luauté et al., 2016; Scottish Intercollegiate Guidelines Network, 2013).

Model of care is described as the services provided to people with TBI for acute or rehabilitative care. There was strong supporting evidence for specialised TBI behaviour management using multi-disciplinary services (Scottish Intercollegiate Guidelines Network, 2013), with expert opinion recommending an integrated, coordinated team approach (Bayley et al., 2016; Luauté et al., 2016). There were expert opinion/good practice recommendations for education and training to health care professionals, and education and contribution to feedback on behavioural data for individuals with TBI and their family members/caregivers (Bayley et al., 2016; Scottish Intercollegiate Guidelines Network, 2013; Wheeler & Acord-Vira, 2016).

Table 6.6 High-quality GPG recommendations

CPG Recommendations	SIGN	INESSS-ONF
Assessment		
Comprehensive, individualised neurobehavioural assessment		Level C Recommendation
Clinicians should carefully define and characterise neurobehavioural issues through diagnostic interviews and direct observations		Level C Recommendation
Assess for differential causes of agitation prior to treatment	Good Practice Point	
Non-Pharmacological	Not Reported	
Behaviour management plan considering precipitating factors, triggers or antecedents possibly contributing to behaviour and reinforcing events		Level B Recommendation
A person with TBI with significant challenging behaviours may require a combination of both non-pharmacological and pharmacological approaches for optimal treatment. Ideally, a sequenced approached should be used to determine effective components		Level C Recommendation
Pharmacological		
Severe acute agitation that threatens staff or patient safety:		
Neuroleptic medications or intramuscular benzodiazepine		Level C Recommendation
Severe agitation and aggression that threatens staff or patient safety:		
Second generation atypical oral neuroleptic medication		Level C Recommendation
Moderate agitation and irritability:		

Selective serotonin reuptake inhibitors (SSRIs) (sertraline considered as first SSRI option)		Level B Recommendation
Tricyclic antidepressants (nortriptyline or desipramine are preferable)		Level C Recommendation
Aggression:		
Beta-blockers (propranolol or pindolol preferable)	Grade B Recommendation	Level A Recommendation
Anti-epileptics (valproate preferable particularly for those with concomitant seizure disorder)		Level C Recommendation
Impaired arousal or attention in agitation:		
Adamantanes (Amantadine) or CNS stimulants (methylphenidate)		Level B Recommendation
General pharmacological recommendations:		
Use pharmacological treatment with caution, as neuroleptics, anxiolytics, and anticonvulsants are associated with slowed recovery after TBI		Level C Recommendation
First generation neuroleptics and benzodiazepines to treat agitation and aggression after TBI should be minimised as these medications may slow recovery after brain injury. Second generation neuroleptics are preferred		Level C Recommendation
Careful drug selection and monitoring when initiating pharmacological interventions to minimise potentially adverse effects		Level C Recommendation
Pharmacological treatment of neurobehavioural symptoms should be based on individual factors, symptom severity, comorbidity; and will often represent only one component of multimodal treatment		Level C Recommendation

Individuals with traumatic brain injury and their surrogate decision makers should be made aware when use of medication is "off label" and the consent-to-treatment process should be modified accordingly		Level C Recommendation
Introduction of medications should be tailored using the lowest effective dose and titrated slowly upwards, based on tolerability, clinical response and situational urgency. Therapeutic goals for medication treatment should be clearly established.	Good practice point	Level C Recommendation
Avoid adding or making more than one medication change at a time		Level C Recommendation
Specific target behaviours should be clearly defined and monitored during pharmacological treatment with the use of validated rating scales and other methods of objective assessment	Good practice point	Level C Recommendation
Collaboration with family and/or significant others may be useful to monitor efficacy and side effects of medications		Level C Recommendation
Model of Care		
Access to specialised TBI behaviour management services and interventions by multi-disciplinary team to assist in the management of behavioural difficulties	Grade B Recommendation	Level C Recommendation
Interdisciplinary care should develop an integrated approach to manage behaviour and refer to specialist behaviour management services when necessary and when available		Level C Recommendation
Education and Training		
Health care professionals working with individuals with TBI should be trained in behaviour disorders specific to TBI and apply consistent neurobehavioural change strategies		Level C Recommendation
Education/information on behavioural consequences of TBI, including antecedents, triggers, appropriate management strategies, and possible side effects of medications provided to	Good practice point	Level C Recommendation

individuals with TBI and their family/carers. The family should receive written information on managing behaviour and emotions and should be invited to provide feedback on behavioural data		

SIGN Grades of Recommendation – Grade A: High quality meta-analysis, systematic review, or RCT directly applicable to target population, and demonstrating overall consistency of results; Grade B: High quality systematic reviews, case control or cohort studies directly applicable to the target population, and demonstrating overall consistency of results; Grade C: Case control or cohort studies directly applicable to the target population, and demonstrated consistency of results; Grade D: Non-analytic studies or expert opinion; Good Practice Point: Recommended best-practice based on clinical experience of the guideline development group.

INESSS-ONF Grades of Recommendation – Level A: Meta-analysis, systematic review, or RCT of appropriate size with relevant control group; Level B: Cohort studies with comparison group, well-designed single subject experimental designs, or small sample size randomised controlled trials; Grade C – Expert opinion based on their experience, through uncontrolled case series without comparison groups.

6.4 Discussion

This systematic review identified and appraised CPGs relevant to the assessment and management of challenging behaviours after TBI in acute hospital and inpatient rehabilitation settings. CPGs to inform clinical practice on the assessment and management of challenging behaviours after TBI were sparse, with seven CPGs identified that met inclusion criteria and subsequently appraised using the AGREE II instrument. Two of the included seven CPGs (SIGN and INESSS-ONF) met the criteria of high-quality, with recommendations for practice summarised in this systematic review (Bayley et al., 2016; Scottish Intercollegiate Guidelines Network, 2013).

SIGN and INESSS-ONF CPGs were deemed high-quality and were recommended for practice without modification. CPGs deemed high-quality in this systematic review are reflective of the AGREE II quality scoring. One should remember that the AGREE II scoring relates to the quality and reporting of the CPG rather than the evidence underlying the recommendation (Hatakeyama et al., 2019). Recommendations summarised from the two high-quality CPGs were categorised into: behaviour assessment; non-pharmacological management; pharmacological management; model of care; and education and training. No recommendations were identified outlining validated screening tools to identify behaviour change, suggesting further research is required to recommend to clinicians the most appropriate and validated behaviour identification approach for challenging behaviours after TBI in acute and rehabilitation settings. Pharmacological management CPG recommendations were predominantly related to agitation and aggression. Predominantly, CPG pharmacological recommendations, such as neuroleptics, anti-epileptics, SSRIs, tricyclic antidepressants were based on expert opinion level of evidence. Further rigorous clinical research is required to determine the efficacy of these pharmacological treatments on TBI agitation and aggression.

Five CPGs did not meet criteria to be deemed high-quality. CPGs that were not deemed high-quality based on AGREE II domain scores lacked detail of guideline scope, purpose, context, stakeholder involvement, lacked detail in the quality of rigour of development, lacked detail for implementation strategies and auditing criteria, and lacked detail on transparent editorial independence (Department of Labor and Employment & Division of Workers Compensation, 2019; Luauté et al., 2016; University of Arkansas Medical Sciences, 2020; Warden et al., 2006; Wheeler & Acord-Vira, 2016). The reviewers felt two CPGs (Luauté et al., 2016; Wheeler & Acord-Vira, 2016) could be modified for improvement in quality by adequately addressing applicability (domain 5). There is a need for CPGs to explicitly describe implementation and applicability of their recommendations into clinical practice. Guideline recommendations do not implement themselves (Grol, 2001). To close evidence-practice gaps in health care settings and improve adherence to CPGs, the explicit description of application and implementation strategies of new and updated

versions of CPGs is needed (Grol, 2001). Therefore, there is a need for CPGs to be updated and amended with rigour and quality with a specific focus on application to clinical practice.

This systematic review has several strengths, and to our knowledge is the first systematic review appraising CPGs and summarising high-quality CPG recommendations for management of challenging behaviours after TBI in acute hospital and inpatient rehabilitation settings. This systematic review was conducted with methodological rigour with an extensive search strategy and well-defined inclusion criteria to identify relevant CPGs published in literature databases, grey literature and websites. This systematic review was not initially registered but was subsequently registered with PROSPERO prior to updated literature search and final reporting of review. Quality appraisal of CPGs was conducted using the validated AGREE II instrument. Two reviewers rated the quality of CPGs with ICC demonstrating an excellent degree of reliability between the two reviewers. CPG recommendations are synthesised from broad rehabilitation CPGs with three included CPGs specifically dedicated to the topic of TBI challenging behaviours (Luauté et al., 2016; University of Arkansas Medical Sciences, 2020; Warden et al., 2006).

There is a limitation in the differentiation of high-quality CPGs. The AGREE II instrument does not provide validated guidance for differentiating guidelines as high-quality or low-quality based on domain scores (Brouwers, Kho, Browman, Burgers, Cluzeau, Feder, Fervers, Graham, Grimshaw, et al., 2010). The reviewers elected to differentiate ‘high-quality’ based on previous studies which have identified the AGREE II domains to significantly influence overall assessment of quality (Dijkers et al., 2021; Hatakeyama et al., 2019). However, the reviewers concede that there was insufficient objective guidance in previously studies or published appraisals of CPGs to further classify CPGs as ‘moderate’ or ‘low’ quality without subjective interpretation.

The summarised high-quality CPG recommendations provides clinicians with a pragmatic list of useful treatments for practice. The CPGs that were not deemed ‘high-quality’ will be relevant for guideline developers to update and modify their CPGs to adequately address the AGREE II domains contributing to an improved quality to enable inclusion in future reviews.

6.5 Conclusion

This systematic review identified and appraised the quality of CPGs relating to the management of challenging behaviours after TBI in acute and inpatient rehabilitation settings. Two CPGs were deemed ‘high-quality’ indicating a need for CPG developers to update and modify CPGs to improve overall quality. High-quality CPG recommendations with the strongest supporting evidence include behaviour management plans; beta-blockers for treatment of aggression; selective serotonin reuptake inhibitors for moderate agitation; adamantanes or CNS stimulants for impaired

arousal/attention in agitation; specialised, multi-disciplinary TBI behaviour management services. Many CPG recommendations were based on low level evidence, graded as expert opinion, or good practice points. The lack of comprehensive implementation strategies in most CPGs included in this review limits the adoption of CPG recommendations into practice. Further investigation of evidence-practice gaps of guideline recommendations, and investigation to elucidate the barriers/facilitators to evidence-practice gaps and implementation strategies of guideline recommendations is needed.

6.6 Chapter summary

This systematic review identified and appraised CPGs for assessment and management of challenging behaviours after TBI relevant in acute hospital and inpatient rehabilitation settings. Two clinical practice guidelines were deemed high-quality, with recommendations summarised for relevance to clinical practice. Few guidelines provide comprehensive detail on the implementation of recommendations into clinical care which may limit adoption of knowledge into practice.

Further understanding of the contextual factors related to the implementation management of challenging behaviours after TBI in the acute hospital setting is warranted. Gaining the perspectives of clinical staff who work with patients with TBI in the acute hospital and inpatient rehabilitation settings, and family members of people with TBI can elucidate contextual factors, barriers and enablers to implementing evidence-informed behaviour management after TBI in the acute hospital setting. For this reason, a qualitative focus group study was conducted with clinical staff experienced in working with patients with TBI, to understand the perspectives of staff on the barriers and enablers to the implementation of evidence-informed practice for the management of challenging behaviours following traumatic brain injury in the acute setting. This qualitative study is presented in Chapter Seven, followed by the perspectives of families on the management of challenging behaviours after TBI in the acute hospital setting in Chapter Eight.

CHAPTER 7 BARRIERS AND ENABLERS TO MANAGING CHALLENGING BEHAVIOUR AFTER TRAUMATIC BRAIN INJURY IN THE ACUTE HOSPITAL SETTING: THE PERSPECTIVES OF STAFF

This chapter addresses Aim 3 of the thesis: To explore barriers, enablers and contextual factors to the implementation of evidence-informed practice to inform strategies to improve TBI behaviour management in the acute hospital setting. This chapter describes a qualitative study conducted and is presented with minor changes for thesis formatting from the manuscript: “Barriers and enablers to managing challenging behaviours after traumatic brain injury in the acute hospital setting: A qualitative study”. This manuscript has been peer reviewed with BMC Health Services Research, with a revised manuscript submitted.

Chapter Four of this thesis described the pilot study which collaboratively developed and implemented a consistent, clinically pragmatic TBI behaviour management approach for use within hospital settings, with results demonstrating high fidelity of use by hospital staff. Further understanding of the evidence and quality of clinical practice guidelines have been reviewed in Chapters Five and Six. There is a need to further understand contextual factors that may influence evidence-based, evidence-informed, and innovative improvements in behaviour management to patients with TBI in the acute hospital context. This chapter will describe a qualitative study incorporating an implementation framework to understand the contextual factors from the perspectives of staff regarding the barriers and enablers to evidence-informed management challenging behaviours after TBI in the acute hospital settings.

As the lead author of this manuscript, the candidate’s contribution was 80% of this chapter. The candidate conceived the idea and conceptualisation of this qualitative study with co-authors guidance in the study design; facilitated focus groups for data collection; analysed data in collaboration with co-authors; and was the major contributor to the write up and editing of this publication. Co-author approval was obtained for permission to include this publication in the thesis.

7.1 Introduction

Findings from previous chapters emphasise the evidence for non-pharmacological and pharmacological treatments for challenging behaviours after acute TBI is equivocal, requiring more research to provide evidence-based treatment recommendations to improve care (Block et al., 2021; Carrier, Ponsford, Phyland, et al., 2022; Hicks et al., 2018). In the absence of high-quality evidence for the efficacy of TBI behaviour interventions, clinicians are guided by CPGs and expert

opinion for evidence-informed TBI behaviour management (Bayley et al., 2016; Luauté et al., 2016; Scottish Intercollegiate Guidelines Network, 2013; Wiart et al., 2016). Chapter Six highlighted that high-quality CPGs for management of challenging behaviours in TBI in the acute setting are sparse, lacking detail on the implementation of recommendations, thereby limiting adoption of evidence into practice (Block et al., 2023).

Chapter Two outlined a range of interventions for the management of challenging behaviours. However, many clinicians lack the sufficient training, resources, guidelines and support to feel confident and satisfied in how they and their services manage agitation (Carrier et al., 2021). Furthermore, staff working with patients with TBI must anticipate, de-escalate, and cope effectively with aggressive and agitated behaviours (Becker, 2012). Lack of rigorous research on TBI behaviour management interventions in the acute setting, insufficient training for clinicians and lack of resources in the acute setting highlights the challenges in delivering consistent, quality and evidence-informed care to people with TBI.

As discussed in Chapter Two, implementation frameworks help us robustly understand the multiple factors influencing implementation of evidence-informed practice within complex environments, systems, and teams (Rye & Kimberly, 2007). Management of challenging behaviours is complex, requiring multi-disciplinary team approaches with skills, experience and flexibility to identify, adapt and treat a range of behaviour changes within the hospital context (Carrier, Ponsford, & McKay, 2022; Skivington et al., 2021). Implementation of evidence-informed care in hospital settings can be influenced by factors such as clinicians lack of knowledge, time and resources to successfully contribute to evidence into practice (Tucker et al., 2021). Staff perspectives gained through qualitative studies provide valuable insights into the experiences of clinicians within health services and can thus inform service development and adaptions to improve evidence in healthcare settings (Al-Busaidi, 2008). Within specialised brain injury rehabilitation settings, staff have specialised skills in the physical, cognitive, behavioural and emotional needs of patients recovering from TBI (Becker, 2012) with adequate resources and environment for optimal TBI recovery. In contrast, patients in the early recovery stage of TBI are often cared for in acute neurosurgical or trauma units in hospitals with transient staffing, varied experience, knowledge, and resources relevant to TBI recovery. The perspectives of staff from both acute care and specialised TBI rehabilitation are necessary to elucidate the contextual factors influencing evidence-informed management of challenging behaviours after TBI for patients who will often commence their recovery in acute care then transition to rehabilitation.

Perspectives on challenging behaviours have been described by staff across acute care for dementia (Dunkle et al., 2022); disability (Rose & Cleary, 2007); mental health services (Muir-Cochrane et al., 2018); emergency departments (A. H. Wong et al., 2017); and general hospital

wards (Winstanley & Whittington, 2002). However, there are few qualitative studies identifying staff perspectives of managing challenging behaviours after TBI in acute hospital settings. Although Oyesanya et al. (2018) describe nurses concerns and barriers to caring for acute TBI patients, few studies identify multi-disciplinary staff perspectives specifically relating to acute TBI challenging behaviour management. Carrier, Ponsford and McKay (2022) interviewed 33 clinicians from 16 countries and found effective agitation management during acute TBI continues to pose a significant challenge to clinicians worldwide. Themes highlighted the broad approaches to effective agitation management involved: managing safety; managing triggers of agitation; managing behaviour; clinician influences; and systemic influences (Carrier, Ponsford, & McKay, 2022). There is a lack of research that has systematically applied implementation frameworks to robustly investigate barriers and enablers to the evidence-informed management of challenging behaviours after TBI relevant to the acute setting.

Investigation of clinician's experiences, knowledge, and confidence in managing challenging behaviours after TBI is required for pre-implementation planning to guide strategies to sustainably address contextual factors, barriers and enablers in the delivery of comprehensive and safe TBI behaviour management in the acute setting. This current study addresses this gap in the literature with a qualitative investigation of staff perspectives of TBI behaviour management in the acute setting. The aims of this study were to:

- Investigate acute and subacute staff perspectives of barriers and enablers to managing challenging behaviours after TBI in acute hospital settings.
- Apply findings to the constructs of the i-PARIHS framework to understand contextual factors to TBI behaviour management in the acute setting.

7.2 Methods

7.2.1 Design

A qualitative study using focus groups at a major trauma hospital and a subacute specialised inpatient brain injury rehabilitation unit in Australia was conducted. This study received ethics approval through the Southern Adelaide Clinical Human Research Ethics Committee (ID number 178.20). This study employed a qualitative methodology using reflexive thematic analysis (Braun & Clarke, 2006, 2019) with findings applied to the integrated – Promoting Action on Research Implementation in Healthcare Settings (i-PARIHS) implementation framework (Harvey & Kitson, 2016). The Consolidated criteria for reporting qualitative research (COREQ) checklist (Tong et al., 2007) was used to ensure accurate completion and reporting of this study.

7.2.2 Implementation framework for this qualitative study

Implementation science and implementation frameworks were defined in Chapter Two. To robustly understand implementation factors relating to TBI behaviour management in acute settings, this study utilised the i-PARIHS implementation framework. Described in detail in Chapter Three, the i-PARIHS framework portrays successful implementation in healthcare from the facilitation of the innovation with the intended recipients in their contextual setting (Harvey & Kitson, 2016). For this study, the i-PARIHS framework aligned with the complex elements of managing challenging behaviours in acute setting: “Innovation” (evidence-informed TBI behaviour management); “Recipients” (staff providing the care and patients receiving the innovation); and “Context” (ward level and organisational characteristics and factors, and outer state, national policies and priorities). The i-PARIHS framework was adopted for the development of focus group guides, data synthesis and analysis, as depicted in Appendix 5. The use of the i-PARIHS framework is useful to identify barriers and enablers that influence the implementation of evidence-informed TBI behaviour management in acute settings, and to guide planning with implementation strategies for future improvements to the management of challenging behaviours after TBI in acute hospital settings (Harvey & Kitson, 2016; Kirchner et al., 2020; McNett et al., 2019; Nilsen, 2015).

7.2.3 Participants and setting

The acute hospital setting was a major trauma hospital with a 16-bed neurosurgery unit. This setting admits patients with TBI requiring neurosurgery intervention and care within the intensive care unit, high-dependency, and neurosurgery ward. Upon discharge from the acute hospital setting, patients with TBI are commonly transferred to the specialised subacute brain injury rehabilitation unit. The subacute rehabilitation setting was a specialised state-wide brain injury rehabilitation unit with 24 beds. This setting admits patients recovering from TBI with a rehabilitative focus in preparation for discharge to the community setting. Participants included staff from both settings to gain perspectives of TBI behaviour management throughout the continuum of the TBI recovery phase in acute settings with transition to inpatient rehabilitation. Participants from the acute hospital setting provided their perspectives of barriers and enablers to managing challenging behaviours after TBI relevant to the acute setting. Some acute staff participants had been involved in the development and implementation of a TBI behaviour management approach outlined in Chapter Four. Other acute staff participants had not been involved in the study outlined in Chapter Four. The mix of acute staff with variable experience of previous relevant research studies undertaken allowed for a diverse range of staff perspectives on evidence-informed TBI behaviour management. Participants from the subacute brain injury rehabilitation setting have expert knowledge and skills in TBI recovery, particularly behavioural rehabilitation of patients recovering from TBI (Becker, 2012). The perspectives of staff from both acute care and specialised

TBI rehabilitation was necessary to address the study aims to elucidate the barriers, enablers and contextual factors for evidence-informed TBI behaviour management, and for opportunities to inform future recommendations for improvements in acute care. Each focus group consisted of a multi-disciplinary representation with nursing and allied health participants. Focus groups were conducted in 2021 during the COVID-19 pandemic whereby restrictions were frequently changing impacting visitors to hospitals and patients, workforce availability and staffing morale.

7.2.4 Sampling and recruitment

Participants were purposefully recruited at each setting. Purposeful sampling is commonly used in qualitative research for the identification and selection of information-rich cases for the most effective use of limited resources (Palinkas et al., 2015). Purposeful sampling involves identifying and selecting individuals or groups of individuals that are especially knowledgeable about and experienced with a phenomenon of interest (Cresswell & Plano Clark, 2017; Palinkas et al., 2015). The availability and willingness to participate, and the ability to communicate experiences and opinions in an articulate, expressive, and reflective manner are important factors for purposeful sampling (Bernard, 2017; Palinkas et al., 2015). A purposeful sample of relevant multi-disciplinary staff (medical, nursing, pharmacy, and allied health professionals) with experiences of working with patients with TBI in either the acute hospital setting, or specialised inpatient subacute rehabilitation setting were contacted via email, inviting staff to participate in the study. Emails inviting staff with study information were sent by the clinical leads at the acute and subacute settings who had an existing working relationship with the staff. Staff who were unable to speak or understand basic English were excluded. Once individuals had indicated a willingness to participate, they were contacted by the researcher (HB) to schedule the focus group time and place suitable to all participants.

7.2.5 Data collection

Focus groups were scheduled by the study team in collaboration with shift coordinators and clinical leads to suit participant availability within clinical workloads. Due to shift changes and staffing overlap limiting participant availability, focus groups were offered as participant's preferred method to participate. Focus groups are a commonly used qualitative technique, consisting of several participants to discuss their thoughts, experiences or perspectives on a specific topic (Morgan & Spanish, 1984).

Focus groups were conducted from September 2021 to December 2021. Four focus groups were conducted: two at the acute hospital setting and two at the specialised inpatient brain injury rehabilitation setting. Each focus group consisted of 6 – 9 participants, which reflects recommended guidance on focus group sizes commonly consisting of 4 – 12 participants per

group (Carlsen & Glenton, 2011). Previous studies have recommended more focus groups of smaller samples (Carlsen & Glenton, 2011; Fern, 1982), therefore four smaller focus groups were conducted rather than two larger focus groups, allowing for each participant to actively participate in discussions to gain quality and depth of information. Each focus group lasted a duration of 45 – 60 minutes. Focus groups were conducted face to face and facilitated by HB, a PhD student with clinical experience working with patients with brain injuries in the acute setting, and who had received training in qualitative research methods. HB was not known to participants prior to the study and was not part of the clinical team working with participants involved in the focus groups. Written and verbal consent was obtained from all participants following their receipt of participant information about the study. Participants did not receive compensation to participate in focus groups.

Semi-structured question guides were developed to facilitate discussion during the focus groups. The question guides were developed considering the constructs of the i-PARIHS framework to gather data reflecting barriers and enablers in effectively managing challenging behaviour after TBI in the acute hospital setting. The focus group question guides were confirmed by the study team prior to data collection and are available in Appendix 6. During the focus groups, the study rationale was explained, and demographic information was collected. Focus group discussions were audio-recorded and transcribed verbatim by a professional person employed through a transcription service. The researcher made field notes during the focus groups to guide subsequent analysis. Transcripts were not verified by participants, nor did member checking occur due to unavailability of staff participants, limited time and undue burden on staff within periods of changing COVID-19 restrictions at participating hospital sites.

7.2.6 Data analysis

Data were analysed using both inductive and deductive approaches to reflexive thematic analysis (Braun & Clarke, 2006, 2019). Reflexive thematic analysis is well recognised for qualitative analysis of large or small data sets for data collected via interviews or focus groups; used for both inductively and deductively (Braun & Clarke, 2019). Table 7.1 outlines the six steps undertaken by the research team for reflexive thematic analysis of the data (Braun & Clarke, 2006, 2019). Once all focus groups were completed, transcriptions, recordings and notes were then utilised for the analysis which was carried out between May – December 2022.Transcripts and field notes were read and re-read with reflexive key ideas and comments noted. The entire focus group data set were initially inductively coded using an iterative process by first author (HB). All codes were then deductively applied to the i-PARIHS constructs of “Innovation, “Recipients”, and “Context” by two study authors (HB, SG). Coding of data were completed using NVivo (version 12) (QSR International Pty Ltd, 2020). Codes were categorised to i-PARIHS constructs to identify potential

themes by authors (HB, SG, SCH). To organise the codes as they were developed, a project specific codebook was developed with defined codes based on the data and guided by an i-PARIHS codebook (Ritchie et al., 2022). Code definitions were refined and confirmed with the study team. All study authors (HB, SG, MB, SCH) were engaged in an iterative, consensus decision making process discussing the i-PARIHS constructs, codes and quotation mapping to review, define and confirm themes and subthemes. Themes were denoted as barriers or enablers as the key determinants that influence the management of challenging behaviours after TBI in the acute hospital setting. The i-PARIHS framework constructs guided the authors to understand the nuances of how and why the themes and subthemes were considered barriers and enablers. For example, a data excerpt was coded to “ward environment is overstimulating”, then deductively coded to the “Context” construct of i-PARIHS. The code was then categorised to “environmental resources” characteristics based on the codebook, and subsequently themed to “Overstimulating and unsecured hospital environment” as a barrier to managing challenging behaviour after TBI in acute settings.

All authors were involved in interpretation and write up of the results. Participants did not provide feedback on the findings during the data analysis, however a summary of results was shared with participants on completion of the study. The reflexive thematic analysis involved interpretive engagement for deep empirical exploration of the data, making data saturation difficult to align, and was not the intention of the reflexive thematic analysis methods (Braun & Clarke, 2021). For this reason, data saturation was not examined, and findings not intended for generalisability.

7.2.7 Researcher perspective

The research team involved in data analysis consisted of multidisciplinary practitioners in occupational therapy (HB, SG), disability studies (MB), and psychology (SCH). Members of the research team have a broad range of knowledge and experience in clinical rehabilitation for TBI, and implementation science. All members of the research team have knowledge and experience in qualitative research methodology, undertaking a reflexive approach to openness and sensitivity to the topic to minimise personal opinions (Finlay, 2014). All authors (HB, SG, MB, SCH) ensured a consensus-based agreement to ensure any emergent themes were accurately supported by the data with minimal influence of researcher bias. The clinical, content and methodological experience of our research team enabled identification data-driven themes of barriers and enablers impacting on the management of challenging behaviours after TBI in acute hospital settings from the perspectives of staff participating in the focus groups.

Table 7.1 The six steps of reflexive thematic analysis undertaken by the authors

Steps	Description
Familiarisation with the data	HB facilitated all focus groups face to face. HB then read and re-read transcripts for a thorough overview of the data, noting down general and reflexive comments.
Generating initial codes	The data was systematically organised into initial inductive codes in an iterative, data-driven process by HB. Codes were assigned to sections of text relating to the management of challenging behaviours after TBI; and the factors that influencing staff providing care to patients with challenging behaviours after TBI in acute settings. The codes were then explored deductively in terms of Innovations, Recipients, and Context constructs of the i-PARIHS implementation framework. (HB, SG).
Generating themes	Codes were then amalgamated into categories mapped to the constructs of the i-PARIHS framework based on a codebook. Codes and categories were then reviewed by HB, SG and SCH to identify patterns and potential themes.
Reviewing themes	Once all coding, categorising and theming had been undertaken, all authors (HB, SG, SCH, MB) met as a group to discuss and review the themes. The authors reviewed the coding, categorising, and theming using an iterative, consensus decision making process. Themes were confirmed iteratively against the coded extracts (quotes) and the entire focus group data set in relation to the research question.
Defining and naming themes	All authors (HB, SG, SCH, MB) met as a group to define and name each theme, refining how the themes aid the understanding of the data. All authors reviewed the themes and subthemes, confirming the themes were accurately applied to the constructs of the i-PARIHS framework. All authors then confirmed the defined themes reflected the perspectives of staff of the management of

	challenging behaviours after TBI in acute settings and the findings appropriately highlighted the barriers and enablers.
Writing up	All authors (HB, SG, SCH, MB) helped with the interpretation of the results with selection of exemplar extracts for final analysis, relating the findings back to the research question. Participants did not provide feedback on the findings.

7.3 Results

A total of 28 participants (17 from acute setting and 11 from subacute setting) participated in four focus groups (FG). The professional disciplines included nursing (n= 17), allied health (n= 10), and one rehabilitation physician. Acute participants had predominantly less than 10 years of experience working with patients with TBI. In contrast, a greater proportion of subacute participants were experienced with 20 or more years working with patients with TBI. Professional and experience characteristics of participants are displayed in Table 7.2.

Table 7.2 Characteristics of focus group participants from acute hospital and subacute rehabilitation settings

Acute hospital participants		**Subacute brain injury rehabilitation participants**	
Years of experience working with patients with TBI	N = 17	Years of experience working with patients with TBI	N = 11
0 – 5	3	0 – 5	1
6 – 10	8	6 – 10	4
11 – 15	4	11 – 15	1
16 – 20	1	16 – 20	0
21+	1	21+	5
Acute hospital participants		**Subacute brain injury rehabilitation participants**	
Professional Discipline	N = 17	Professional Discipline	N = 11
Nursing	13	Nursing	4
Allied Health Professional (Physiotherapist, occupational therapist, speech pathologist)	3	Allied Health Professional (Physiotherapist, occupational therapist, speech pathologist, social worker)	6
Pharmacist	1	Rehabilitation physician	1

Table 7.3 presents the themes and subthemes for barriers and enablers staff identified to effectively managing challenging behaviours after TBI in acute hospital settings. Barriers included (1) lack of evidence to inform clinical decision making, (2) lack of experienced staff with practical skills, and (3) hospital systems and resources. Enablers were (4) consistent person-centred care

and (5) supportive teams. Each participant has been assigned a number according to their focus group, and quotes indicate if they are from an acute or subacute setting.

Table 7.3 Themes and subthemes for barriers and enablers with exemplar quotes

	i-PARIHS construct	Themes	Exemplar quotes
Barriers	Innovation	Theme 1: Limited evidence to inform clinical decision making	"And the pressure you feel about managing or following maybe what the best-practice might say versus what helps manage their behaviour, can sometimes be conflicting." (FG2 acute).
	Recipients	Theme 2: Lack of experienced multidisciplinary staff with practical skills	"Education is one thing, but you need to experience it … you need to experience it with someone else and that's where the problem, because you don't have time." (FG1 acute).
	Context	Theme 2: Hospital systems and resources Subthemes: - Overstimulating and unsecured hospital environment - Hospital structure, staffing shortages, and lack of resources	"It's probably our biggest issue is that we can't find that quiet isolated area where it's recommended for patients to have that low stimulus … and it's noisy, lots of staff, lots of teams coming in and out, telephone ringing all the time, visitors in and out, patients being admitted all day and night, so it's very difficult to be quiet calm time." (FG2 acute) "With the acute setting they have to think of the acute issues … we [rehab] have the capacity to do those more

			proactive approaches, whereas the acute is very much reactive.” (FG3 subacute).
Enablers	Recipients and Context	Theme 3: Consistent person-centred care Subthemes: - Understanding person related factors - Consistent, structured care	“People are scared, they’re in this bed, their life’s been taken away from them, they’re scared, their families are scared, so they behave differently and there is agitation and this fear.” (FG3 subacute). “Nursing staff that can be key nursing staff for those people with difficult behaviours and provide some consistency for those people so they can get to know those people, build that rapport, figure out what some of the triggers are with that team.” (FG3 subacute).
	Recipients	Theme 4: Supportive teams Subthemes: - Teamwork - Feeling valued promotes resilience	“You really can't manage behaviour effectively without the input from the whole team” (FG3 subacute). “Even just having someone acknowledge what we do, I know that sounds bizarre, that makes me feel better too”. (FG4 subacute).

FG = Focus Group

7.3.1 Barriers – Lack of evidence to inform clinical decision making

Staff identified barriers related to of the lack of evidence to guide their clinical decision making for evidence-informed TBI behaviour management in the acute setting. Staff perceived some components of TBI behaviour management (such as identifying behaviours, and medication management) as "trial and error" due to the unpredictability of a patient's agitated and aggressive behaviours.

> "We know how to deal with someone and look at escalation, but it can then just, something like that can happen, like they're fine … and then they're not." (FG1 acute).

Many staff felt the medications for settling agitated and aggressive patients with TBI in the acute ward do not work effectively, as described by on staff member: "It doesn't seem like the medication works sometimes." (FG2 acute). Staff described a fine line in balancing aggressive behaviours, patient sedation levels, and staff safety. Staff regarded multiple factors (such as pain, hypertension, tachycardia) when considering medications for TBI behaviour management, but there was not always clarity in the decision for medications, for example,

> "I think sometimes with the medications, I never quite know at what point do you give the TBI meds because you don't want to just willy-nilly give them out because their behaviour isn't that bad. To then it just escalates, and you probably should have given them … sometimes it can be really difficult to work out what to do." (FG2 acute).

Staff described the lack of evidence to inform their clinical decision making could result in consequences of restraint use, and risk of injuries. Weighing up the perceived risk versus the benefit of TBI behaviour management interventions was described as a challenge. Staff recognised that physical restraints (including mittens or shackles) should be used as a last resort option but described concerns for their personal safety when extreme agitation and aggression was present with patients following TBI. Staff described their clinical experience as an important factor in identifying forms of restraint and justification for use of restraints. Some staff felt the reduced use of physical restraints had increased staffs' risk of injury.

> "The fact that if they're getting agitated and you've used chemical restraints and nothing's working, the reluctance to use physical restraints is still, puts staff at risk I think ... I understand they've gone this way, but I think they just need to pull it back a little bit." (FG1 acute).

Staff described they work in an environment to care for others and if they put themselves at risk, they can get seriously hurt by aggressive patients. Some staff reflected on how they can be distracted in thinking about their safety when treating patients with TBI, which influences the quality of care they provide.

> "Sometimes when we have TBI patients, I wouldn't be surprised if I got hurt at work … you come to work, and you do your job. It doesn't change how you treat them. But I just know some days I wouldn't be surprised if I got injured at work." (FG1 acute).

Many staff also expressed concerns for other patients on the ward who felt frightened by agitated and aggressive patients with TBI. Although staff try to reassure patients, other patients on the ward are vulnerable and often are fearful of the noise outside their room.

> "It's also other patients because sometimes they're screaming, they're breaking, they're throwing things and we've got patients with spinal injuries that can't move. And it's terrifying for them." (FG2 acute).

This theme highlights the difficulties staff face due to the lack of evidence to inform clinical decision making, and thereby their justification of their clinical decisions, with consequences of clinical decisions sometimes resulting in use of restraints and risk of injuries.

7.3.2 Barriers – Lack of experienced multi-disciplinary staff with practical skills

The lack of consistently experienced staff across the entire team of multi-disciplinary clinicians, specialists, non-clinical and security staff was identified as a significant barrier to effective TBI behaviour management in the acute setting. Many staff expressed their practical experience had built their skills and knowledge of effective TBI behaviour management. There were enablers to develop theoretical knowledge through education sessions and online training modules, but identified the years of on-the-job practical learning, with support from peers, as critical to developing confidence to know how to manage challenging behaviours in this setting.

> "Experience is what you need, really. You can teach people all the things to do with some of the challenging behaviours, but you've got to be confident enough to be able to apply that when you're with a patient." (FG1 acute).

Security guards will often be involved with patients with TBI with challenging behaviours to provide patient supervision or support staff to provide clinical care. The variability in security guards' skills in de-escalation and lack of understanding of TBI was reported as a barrier in managing challenging behaviours. Staff described how some security guards were helpful and experienced, whilst the demeanour of other security guards could trigger agitation and aggression.

> "Some that have the experience, they just know and then others actually escalate the problem because they don't know how to deal appropriately with them. They just wind them up more." (FG1 acute).

This theme highlights barriers to managing challenging behaviours after TBI due to the lack of experienced, multi-disciplinary staff with practical skills to confidently and consistently deliver TBI behaviour management approaches within the acute setting

7.3.3 Barriers – Hospital systems and resources

7.3.3.1 Overstimulating and unsecured hospital environment

Participants identified factors relating to the hospital context which impede effective TBI behaviour management. Hospital environments, infrastructure, medically focussed systems, staffing

shortages and lack of required resources were clearly articulated barriers to providing evidence-informed TBI behaviour management in the acute setting.

Adapting hospital wards or rooms to a low stimulus environment with reduced noise, low lighting, television off, limited number of visitors, and close proximity to nurses' station enabled effective behaviour management by minimising triggers for agitation. However, the hospital environment was not always well suited to low stimulation.

> "You've got bells going, you've got many teams coming in and out, lots of nurses … it's very difficult to control that environment for those patients as well. And they pick up on noises and get distracted and that spins their behaviour then as well." (FG2 acute).

The hospital ward where TBI patients were admitted was unsecured without a lockable door to prevent patients from absconding: "they can wander off to other wards, run out the hospital if they want to" (FG1 acute). For acute TBI patients with post-traumatic amnesia, who often experience confusion and disorientation, wandering and absconding from the hospital can pose a risk of injury to TBI patients. Staff voiced concerns of the unsecured ward, and made suggestions for a locked ward, or section of the ward. Some staff suggested recommendations for hospital rooms specifically designed for TBI patients with low stimulation and padded walls to minimise the risk of patients hurting themselves.

> "It's keeping us safe but it's also they're at high risk of hurting themselves when they have a brain injury and they're not in a protective room for themselves." (FG1 acute).

Staff describe how the hospital environment is a contextual barrier to effectively managing patients with challenging behaviours after TBI.

7.3.3.2 Hospital structure, staffing shortages and lack of resources

The hospital structure was described as medically focussed with the goal to keep patients alive rather than oriented towards facilitating rehabilitative effective behaviour management approaches. In moments of patients' escalating behaviours, staff describe how many staff are required to intervene and settle that patient during the crisis, and often the resources are not readily available.

> "They might escalate again and literally have four more people assisting. So, it takes a lot of the nursing staff to manage." (FG1 acute).

The Code Black security team can be called to provide security and medical interventions at times of personal threat. Staff expressed their concerns in delays in Code Black teams attending to assist in intervening with an agitated and aggressive TBI patients.

> "We've had a situation where the patient's being really-really aggressive so we've had to call a code black and then we've had a phone call saying they can't come at the moment, they're at other code blacks. What do we do?" (FG1 acute).

Staff expressed difficulties in conducting components of effective TBI behaviour management in the acute setting due to lack of required resources. In particular, comprehensive behaviour assessment was difficult due to lack of time and lack of staffing or resources to complete the assessment.

> "I think getting that comprehensive assessment is where it's harder … to start with because if you haven't got that you can't do the next step." (FG3 subacute).

Staff described the lack of resources in the acute setting, including lack of psychology and neuropsychiatry services. The lack of neuropsychiatry services in the acute hospital setting is a barrier to effectively implementing pharmacological and non-pharmacological interventions, thereby limiting the proactive and preventative evidence-informed approaches for acute TBI behaviour management. Staff described the lack of access to neuropsychiatry due to difficulties recruiting to these specialised positions, and therefore higher management approvals were required to fund private neuropsychiatrists with a waiting time in being able to attend to TBI patients at the hospital.

> "That could be because [this hospital] doesn't have their own neuropsychiatrist … we have to get it from [another hospital] and we have to get funding and it has to be approved …Seems a bit strange, doesn't it? Like you said, it's a major hospital." (FG1 acute).

> "If we want it [neuropsychiatry] we can ask, and I think sometimes source it privately but it's difficult to get hold of and sometimes there's a wait." (FG2 acute).

Staff expressed they would usually allocate a staff member with experienced skills in behaviour management to TBI patients, however this was difficult to sustain. Staff described how continuity of staffing with the same patient throughout the admission can be difficult due to availability of staffing, but also the emotional toll of continuously working with TBI patients with challenging behaviours day after day.

> "Continuation of care as well, sometimes it just goes the other way because staff will say, I can't do another shift looking after that patient. I can't, I've done two shifts and it's just not going." (FG2 acute).

Staff expressed difficulty in finding casual or agency staff to work on the ward due to COVID-19 depleting the nursing casual pool. Some staff would often work extra shifts therefore resulting in less staff then available to the ward for the next day. Some casual or agency staff refused offers of shifts on the ward, not wanting to work with aggressive and agitated TBI patients.

> "Before COVID and stuff when we used to get agency and stuff like that, they would refuse to come to [this ward] because being on this ward is like spinal patients and it's really heavy and then they see these behaviours." (FG1 acute).

Not only did staff report staffing shortages but when a patient required one-on-one (1:1) specialled nursing care, this came from within the ward's allocated staffing ratio.

> "Yeah, we'll get the one-on-one but that means it's one less staff member for the rest of the ward." (FG1 acute)

> "If you want us to use less medications, less restraints all the rest of it, we need the funding to have the increased staffing that needs to come to use those strategies." (FG3 subacute).

Evidence-informed TBI behaviour management is resource intensive requiring time and staffing. Many staff described the paradox of valuing good quality TBI behaviour management but lacked the funding and staffing resources to achieve it.

7.3.4 Enablers – Consistent, person-centred care

7.3.4.1 Understanding person-centred factors

Factors such as opportunities for communication, responding to emotions, and responding to patient preferences in their own care are central to providing person-centred care. In individualised assessment and management of challenging behaviours after TBI, understanding the emotional factors (such as fear, anxiety, confusion) that patients may be experiencing in the acute phase of TBI can help staff understand the context of the behaviour change.

> "Once I understood and framed everything around behaviour in the context of confusion and fear it makes everything more predictable, it actually becomes predictable; of course, they're behaving like that because they don't know what's going on and they're scared." (FG3 subacute).

Staff expressed challenging behaviour can be a form of communication difficulty and recommended all TBI patients with challenging behaviours should have a communication assessment.

> "Just giving the person the means to communicate effectively or understanding how to communicate with them can be what manages the behaviour." (FG3 subacute).

Building rapport, trust and respect with patients and families was described as an enabler for promoting a harmonious recovery. Flexibility in how and when care is provided based on when the patient is ready to be seen was identified as promoting patient engagement in their care and therapy.

> "We'll just go: 'The person wants to wash now' and then you can see everyone just sort of grabbing towels as they're running and get them into the shower because that's when they want to do it." (FG4 subacute).

> "You might have a priority for the day of what I'm going to do that day, but I know that that patient is going to be seen when they're ready to be seen … it's very much patient-led, and more so than other conditions I think." (FG1 acute).

Staff described how understanding and responding to person-centred factors were effective approaches to managing individualised behaviour with patients with TBI.

7.3.4.2 Consistent and structured care

Staff expressed how consistency in nursing staff allocated to the patient can be pivotal in building trust, consistent care, identification of triggers to challenging behaviours, and effective handover of what works well, for example, "find what works best and then communicate that to the other staff." (FG2 acute).

> "Nursing staff that can be key nursing staff for those people with difficult behaviours and provide some consistency for those people so they can get to know those people, build that rapport, figure out what some of the triggers are with that team." (FG3 subacute).

Staff described "clustering" the nursing care, rather than frequent interventions, would support patients in sleeping and minimise agitation triggers.

> "Minimising the nursing interventions sometimes. If the patient is sleeping and they're fine, they're fine. Just leave them alone …. cluster care." (FG1 acute).

Additionally, staff reported a structured timetable for therapy was an effective way to ensure patients had enough rest, minimising overstimulation.

> "We do use these timetables when we have the right patient and we do schedule it in there, like rest and block different therapy…so then they can see a bit of structure and that can help visitors plan good times to come as well." (FG2 acute).

These findings highlight enablers for effective TBI behaviour management with consistent staffing and approaches to personalised care scheduled to suit the patient's schedule.

7.3.5 Enablers – Supportive teams

7.3.5.1 Teamwork

Staff described a cohesive, supportive team as an enabler to support skills and knowledge. More experienced staff provided peer-support to their less experienced colleagues when the context and time allowed. Staff described effective TBI behaviour management as a whole team approach. When staff reported feeling overwhelmed for their patients and constant challenging behaviours, regular rest breaks and debriefing with peers were described as strategies to maintain resilience.

> "You really can't manage behaviour effectively without the input from the whole team because there's so many things that can impact what's going on with a person's behaviour." (FG3 subacute).

Ensuring the "right-fit" when allocating staff to patients to minimise personality clashes and ensure there is a positive match between staff and patient's needs was identified as an enabler to positive engagement in behaviour management.

> "Some people just react with people differently. It's not even just challenging, just generally really, isn't it? Just personality clashes. You've got to find that right fit." (FG1 acute).

Although the lack of neuropsychiatry services in the acute hospital was described as a barrier, on the occasions when neuropsychiatrists were able to consult on the acute ward, staff described how their recommendations made a prompt and positive impact on the challenging behaviours.

> "What we've found is the sooner neuropsychiatry come in and change different medications actually some of the agitation calms right down." (FG1 acute).

Staff also expressed they had learned a lot when specialist services consult with the team.

> "We've had the psychiatrists, psychiatry and psychology sit down and explain what part of the brain's been damaged and how this effects behaviour and what's happening." (FG3 subacute).

7.3.5.2 Feeling valued promotes staff resilience

Staff expressed how important it was to feel supported by leadership. As a team, staff felt their peers had a good understanding of the emotional and physical toll of working with patients with TBI.

> "You've got to have a strong team who understand this and know when to step in and step out; it does help. It helps when your manager says how are you feeling, are you okay?" (FG3 subacute).

Feeling supported for their roles from the leadership staff was an important factor in feeling valued, cared for and in promoting resilience. Additionally, staff felt appreciated by families and patients.

> "Recent families that we've had, have had like 'thank you's' and appreciation from the patient's families – I guess that's most recently how I feel that that has been valued because they've been very thankful of our input/education and providing resources/reassurance." (FG2 acute).

A cohesive team, working together and feeling supported by leaders was an enabler for opportunities to deliver effective TBI behaviour management in the acute setting.

7.4 Discussion

Staff expressed several barriers and enablers to evidence-informed management of challenging behaviours after TBI in the acute setting. By adopting the i-PARIHS framework, staff perspectives of the innovation, recipient and context related barriers and enablers to managing challenging behaviours after TBI in the acute hospital setting were examined.

The barrier of lack of evidence to inform clinical decision making relating to TBI behaviour management relevant to the acute setting was illustrated by staff, describing uncertainty and unpredictability in decisions for clinical interventions, or "trial and error" approaches to behaviour management. Staff faced challenges in justifying the perceived benefits and consequences of behaviour management interventions (for example, reducing physical restraints and risk of

injuries). These findings support the need for more evidence to support the management interventions for TBI challenging behaviours in acute settings (Block et al., 2021; Carrier, Ponsford, Phyland, et al., 2022; Hicks et al., 2018). Furthermore, gaps in CPG recommendations implemented in practice limits clinical decision making for staff, contributing to variability in care to TBI patients with challenging behaviours (Block et al., 2023; Pereira et al., 2022; Shafi et al., 2014).

Insufficient skills of staff impeded the provision of comprehensive, consistent and evidence-informed management of challenging behaviours after acute TBI, with staff describing prolonged practical experience as integral to skill development. Insufficient training of clinicians working with patients with agitated behaviours after the acute phase of TBI has been highlighted in our findings and previous research (Carrier et al., 2021). Consequently, clinical staff often learn skills for managing challenging behaviours through “on-the-job” self-taught learning (Carrier et al., 2021). There is a need for more frequent and formal training programs to develop and maintain staffs’ skills in managing challenging behaviours after TBI within the acute hospital setting (Carrier et al., 2021; Carrier, Ponsford, & McKay, 2022; Oyesanya et al., 2018).

Staff voiced concerns about the hospital environment as overstimulating and unsecure, thereby increasing triggers for agitation. The hospital system is designed to be medically focussed on recovery, which staff described limits resources for rehabilitative, proactive, and effective behaviour management approaches, including specialised services to deliver evidence-based behaviour approaches. Staffing shortages, a lack of consistent staffing and reduced staffing ratios were emphasised by staff as a barrier to the required resources required for effective and quality TBI behaviour management in the acute setting. The findings of this study, align with previous research, emphasising the limited staffing, and inadequate resources are barriers in providing care to patients with TBI in the acute setting (Carrier et al., 2021; Carrier, Ponsford, & McKay, 2022; Oyesanya et al., 2018),

Despite the significant contextual barriers present in acute hospital settings, results from this study identified enablers to effective TBI behaviour management in the acute setting. Providing consistent care, with an understanding of communication, emotional and personal factors were enablers, and are key components of pro-active, individualised, person-centred care for positive behaviour principles for people with challenging behaviours after TBI in community settings (Feeney, 2010; Ylvisaker et al., 2003). Staff also expressed the value of supportive, cohesive teams, who were valued by their leaders, as positive enablers in effective TBI behaviour management.

There are few studies that have identified barriers and enablers relating to the evidence-informed management of challenging behaviours after TBI in acute settings from the perspectives of multi-disciplinary staff. This study has highlighted novel findings, emphasising enablers to effectively managing challenging behaviours after TBI in the acute hospital setting. Furthermore, with a lack of studies investigating the management of challenging behaviours after TBI in acute settings incorporating implementation frameworks, this study adds new knowledge. The findings of this study have been imperative in providing novel, pre-implementation planning for future improvement in this area of clinical practice.

To address barriers and leverage enablers in this area of practice requires robust implementation strategies facilitated in practice to embed evidence-informed TBI behaviour management in the acute hospital setting. By understanding the contextual factors relating to the “innovation”, “recipient” and “context” constructs of the i-PARIHS framework, future implementation strategies operationalised through tailored facilitation can adapt and sustain change for improvements in care for people with challenging behaviours after TBI relevant to the acute context (Harvey & Kitson, 2016; Hunter et al., 2020).

This study utilised a robust qualitative methodology underpinned by an implementation science framework, thus demonstrating several strengths. However, some limitations need to be acknowledged. There were differing number of participants and mix of professionals within the acute and subacute focus groups, however all participants contributed to discussions. No acute medical physicians participated in the focus groups, despite invitation to participate. Within one focus group, a ward-based manager was present which could have influenced other staff disclosing concerns and barriers relating to workforce, workload and leadership support. Data saturation was not examined as the goal of this study was to gain deep interpretive and exploratory perspectives of staff (Braun & Clarke, 2021). This study was conducted during COVID-19 pandemic, whereby the impact of reduced workforce and hospital demand could have influenced participant’s perspective on barriers and difficulties in delivery of care.

7.5 Conclusion

This qualitative study identified the barriers to managing challenging behaviours after TBI in acute hospital settings relate to the lack of: evidence informing clinical decision making, staffing experience and skills; staffing workforce and resources; and challenges within the hospital environment. Improvements to TBI behaviour management in acute care will require developed, trialled and tailored implementation strategies for multifaceted system wide changes to address barriers, and leverage individualised, person-centred care from a multi-disciplinary, whole team approach.

7.6 Chapter summary

This chapter described a qualitative study incorporating the i-PARIHS implementation framework to understand the barriers and enablers to managing challenging behaviours after TBI in acute hospital settings from the perspectives of staff. Themes identified the lack of evidence informing clinical decision making, lack of experienced multi-disciplinary staff with practical skills, and hospital systems and resources as barriers. Enablers were consistent, person-centred care and supportive teams. Findings from this study highlight the service-related implementation factors that can influence evidence or improvements into practice. In addition to understanding the service-related implementation factors, further understanding of the family-related implementation factors on the management of challenging behaviours after TBI in the hospital setting from the perspectives of families is warranted. Chapter Eight presents a qualitative study to understand the perspectives of family members of people with TBI on their experience of the management of challenging behaviours after TBI in the hospital setting.

CHAPTER 8 THE MANAGEMENT OF CHALLENGING BEHAVIOURS AFTER TRAUMATIC BRAIN INJURY IN THE HOSPITAL SETTING: THE PERSPECTIVES OF FAMILIES

This chapter addresses Aim 3 of the thesis: To explore barriers, enablers and contextual factors to the implementation of evidence-informed practice to inform strategies to improve TBI behaviour management in the acute hospital setting. This chapter is presented with minor changes for thesis formatting from the manuscript: “Family experiences of the management of challenging behaviours after traumatic brain injury in the acute hospital setting” peer reviewed with a revised manuscript submitted with the Journal of Disability and Rehabilitation.

This chapter will provide the family perspectives of barriers, enablers and contextual factors relating to TBI behaviour management in the acute hospital context. In addition to the prior studies conducted, this study provides further understanding of the family-related implementation factors on the management of challenging behaviours after TBI in the hospital setting from the perspectives of families.

As the lead author of this manuscript, the candidate’s contribution was 80% of this chapter. The candidate conceived the idea and conceptualisation of this qualitative study with co-authors guidance in the study design; facilitated interview data collection; analysed data in collaboration with co-authors; and was the major contributor to the write up and editing of this publication. Co-author approval was obtained for permission to include this publication in the thesis.

8.1 Introduction

As outlined in Chapter Two, challenging behaviours after TBI are associated with risks of harm to the patient and staff (Bogner et al., 2001; Lequerica et al., 2007; McNett et al., 2012; Sandel & Mysiw, 1996). Challenging behaviours can also cause increased burden, emotional strain and distress, and lower quality of life and mood for family members of patients with TBI (Brooks et al., 1986; Norup et al., 2010). Challenging behaviours can persist beyond the early recovery and rehabilitative phases (Ponsford, Downing, et al., 2014), impacting community integration and ongoing family challenges (Anderson et al., 2002; Braine, 2011; Fisher et al., 2020; Murray et al., 2006). Consequently, families and caregivers of people with TBI are faced with a broad range of psychological, financial, familial and social difficulties (Johnson & Griswold, 2017; Kratz et al., 2017; T. Page et al., 2021).

Previous studies have explored family and caregivers’ perspectives of distress and challenges faced with survivors of TBI (Anderson et al., 2002; Anderson et al., 2009; Holloway et al., 2019;

Holloway & Tasker, 2019; Kratz et al., 2017; T. Page et al., 2021; Whiffin et al., 2015). Findings have identified physical, cognitive and behavioural changes following TBI were associated with an increased subjective burden and reduced quality of life in caregivers, with disruption of family functioning (Anderson et al., 2009; Fisher et al., 2020; Holloway et al., 2019; Norup et al., 2010; T. Page et al., 2021). Families are impacted by the enduring and complex changes by TBI upon their relatives, which influences relationships and roles of family members (Holloway et al., 2019; Holloway & Tasker, 2019). The first-year post TBI, from acute to rehabilitation phases, are turbulent for families, with poor support exacerbating difficulties and isolation of family members (Holloway et al., 2019; Whiffin et al., 2015).

Qualitative exploration of the experiences of challenging behaviours after TBI from families and people with TBI within the community setting has previously been conducted (Braine, 2011; Gould, Hicks, et al., 2019; Tam et al., 2015). Previous findings have emphasised the need for increased support models, education and information to families (Anderson et al., 2002; Braine, 2011; Fisher et al., 2020; Kivunja et al., 2018; T. Page et al., 2021). There is a need to understand the impact of challenging behaviours from the perspectives of families to inform effective services, support and interventions to improve quality of life for people with TBI and their families (Braine, 2011; Fisher et al., 2015; Gould, Hicks, et al., 2019; Holloway et al., 2019; Tam et al., 2015).

Few studies have investigated the experiences of family members of patients of TBI in acute hospital settings. An integrative review exploring the experiences of nursing staff giving care, and patients and family members receiving care for people with TBI in hospital and rehabilitation settings highlighted the altered relationship dynamics within families, with recommendations for people with brain injury and their families to be formally included in care planning (Kivunja et al., 2018). Furthermore, a previous review investigating approaches to empowering support for families of brain injury patients in acute hospital care found families wanted involvement in comprehensive treatment planning; participation in their relative's care; and competent interprofessional staff who support families and patients with trustful communication, which promoted the process of family empowerment (Lindlöf et al., 2023).

However, family member's descriptions of their experiences of the management of challenging behaviours in the acute hospital setting have not been detailed. There is a need to further understand the experience of the management of challenging behaviours after TBI in acute hospital settings from the perspectives of families to inform improvements in services and care.

Furthermore, the experience of consumers (patients and families) in healthcare can identify issues in health service research-practice gaps between what is known in evidence and what is provided in clinical services (Proctor et al., 2009). The perspectives of family are pivotal to provide a greater

understanding of recovery from an insider perspective, as they have knowledge of the preinjury person, and can assist services to better meet the needs of people with TBI (Fleming et al., 2012), Therefore, it is necessary to gain the family perspectives of current acute hospital practice of the management of challenging behaviours after TBI, to inform future recommendations and opportunities for implementing improvements. Gaining family insights, in addition to staff perspectives is critical to inform implementation strategies for future improvements to patients with challenging behaviours after TBI within the acute hospital context.

Using a qualitative methodology, this study addressed a gap in the literature and gained deep perspectives and insights from families of acute management of challenging behaviours after TBI. The aim of the current study was to examine the experiences of the management of challenging behaviours after TBI in the hospital setting from the perspectives of family members.

8.2 Methods

8.2.1 Study design

This study used a qualitative interpretive phenomenological approach (IPA), allowing an in-depth understanding of the perspectives of family members of people with TBI of the management of challenging behaviours in the acute hospital setting (Saldana, 2011). IPA is a commonly used approach to explore perspectives and meaning from people's lived experience (Charmaz & McMullen, 2011; Kim et al., 2017; Matua, 2015; Smith & Osborn, 2021), relevant to healthcare contexts (Cassidy et al., 2011; Norlyk & Harder, 2010; Pietkiewicz & Smith, 2014). IPA is useful in examining contextual features of experience that might have direct relevance to healthcare practice (Lopez & Willis, 2004). IPA findings can be linked to theoretical frameworks to explain concepts, ideas and beliefs. The Ecological Systems Theory (EST) (Bronfenbrenner, 1979) provided a guiding theoretical framework in this study, and was used to discuss the emerging themes. The consolidated criteria for reporting qualitative research (COREQ) checklist (Tong et al., 2007) was used to ensure accurate completion and reporting of this study. Ethics approval was provided by the Southern Adelaide Clinical Human Research Ethics Committee (application no: 178.20), and informed consent was obtained from all participants.

8.2.2 Ecological Systems Theory

As outlined in Chapter Three, the EST framework has been widely used to understand structural barriers relevant to complex interventions in healthcare (Coetzee et al., 2011; Pask et al., 2018; Phelan & Kirwan, 2020). Furthermore, EST has been used to identify ecological factors such as social and physical environments that influence systems, services and policies for recovery and participation after brain injury (Diener et al., 2022; A. Wong et al., 2017). The EST was applied as a guiding framework in this research by considering how the ecological levels influence the

management of challenging behaviours following TBI in an acute hospital setting. Themes presented in the results and consideration of the wider literature are examined within the discussion using EST.

8.2.3 Participants and setting

Inclusion criteria required that participants were over 18 years of age, able to communicate in English, and had an adult family member who exhibited challenging behaviours during their acute hospital admission following TBI during their early recovery phase (first 0-6 months). Challenging behaviour exhibited during the acute hospital admission included behaviour changes such as agitation, verbal and physical aggression, irritability, disinhibition, perseveration, impulsivity, wandering and absconding (Kelly et al., 2006). Patients with TBI had been admitted to one of two major trauma hospitals in South Australia following the acute injury. Upon discharge from the acute hospital setting, patients with TBI were transferred to the state-wide specialised subacute brain injury rehabilitation unit.

Seven interviews were conducted with 10 participants whose family member experienced challenging behaviours following TBI in the acute hospital setting. Interpretive phenomenological approach (IPA) is typically an approach that uses small samples sizes of 5-10 participants as a depth of meaning from lived experience is gained, thus our sample size was consistent with other IPA studies (Smith, 2004).

8.2.4 Sampling and recruitment

Participants were recruited purposively from a South Australian subacute brain injury rehabilitation service. A clinician external to the research team identified potential participants who met the inclusion criteria. The clinician provided family members of current and recently discharged TBI patients an information pack including an information sheet and consent form and invited them to participate in the study. Participants were approached following or during their relative's subacute rehabilitation stage to allow time/consideration for emotional responses to the acute trauma and recovery in the acute hospital setting, and to allow retrospective perspectives rather than reflection on the current situation. Patients and families were not admitted to hospital sites during previous research studies undertaken, including the pilot implementation study outlined in Chapter Four. The clinician then informed the researcher of family members who were interested in participating, who were then contacted by the researcher. All participants provided informed written consent to participate following their receipt of participant information about the study.

8.2.5 Data collection

Semi-structured interviews were conducted to gain rich descriptions, perspectives, and experiences of participants (Smith et al., 2009). An interview guide was developed by the research

team based on their content and method expertise and confirmed prior to data collection. The interview guide is available in Appendix 7. During the interview, the study rationale was explained, and demographic information collected. Interviews lasted on average 60 minutes. The interview format allowed for each interview to unfold to capture participants' experiences and reflections of their relative's challenging behaviour in the hospital setting. The researcher conducting the interviews defined challenging behaviours to participants as a preamble to the interview. Participants were asked what strategies worked well, and what was difficult for managing challenging behaviours following TBI in the acute hospital setting. The interview questions were open-ended with specific prompts used as needed to elicit more detailed responses. The researcher made reflexive notes throughout the interviews. No participants withdrew after consenting to participate.

Interviews were conducted between December 2021 – April 2022. Interviews were conducted at a time convenient to the participants. Interviews were either one-to-one or two-to-one if more than one family member was present. All interviews were conducted by HB, a PhD student and occupational therapist with clinical experience working with patients with brain injuries in the acute setting, and who had received training in qualitative research methods. HB was not previously known to any of the participants.

8.2.6 Data analysis

All interviews were audio-recorded and transcribed by a professional transcription service. All transcripts were de-identified using participant IDs and uploaded to NVivo (version 12) (QSR International Pty Ltd, 2020) for analysis. Participants did not verify transcripts but were sent a summary of results. For familiarity with the data (Braun & Clarke, 2006, 2019), transcripts were thoroughly read and re-read by two researchers separately (MB, HB). Both researchers then independently coded the data inductively then categorised the data according to key terms (Braun & Clarke, 2006, 2019; Nowell et al., 2017). Coding analysis was conducted on a case-by-case basis with an iterative focus on descriptive content of participants' reported experiences. Codes were then inductively collated to broader categories to highlight participants' experiences relative to the research objective (Nowell et al., 2017). Categories captured participant's reported experiences of challenges and strategies that worked well for managing challenging behaviours after TBI in the hospital setting. All members of the research team (HB, MB, SCH, SG) then used an inductive analytical and data-driven approach to generate, review and confirm the final themes, content, titles and quotes (Braun & Clarke, 2019; Nowell et al., 2017). Themes were summarised and presented as results, using quotes as data extracts to explain the themes (Nowell et al., 2017). For example, an excerpt was inductively coded as "agitation and aggression can be unpredictable",

then categorised to “difficulties identifying triggers” and subsequently included in the theme of “identifying and preventing triggers”.

The research team involved in data analysis consisted of multi-disciplinary practitioners in occupational therapy (HB, SG), disability studies (MB), and psychology (SCH). Members of the research team have a broad range of knowledge and experience in clinical rehabilitation for TBI, and implementation science. All members of the research team have knowledge and experience in qualitative research methodology, undertaking a reflexive approach to openness and sensitivity to the topic to minimise personal opinions (Finlay, 2014). The clinical, content and methodological experience of our research team enabled identification of factors impacting on TBI behaviour management in hospital settings experienced from the perspectives of family members.

8.3 Results

Ten participants shared their perspectives about seven people with TBI regarding to the management of challenging behaviours after TBI in acute settings. Table 8.1 outlines the relationship of participants with the person with TBI and the time since the initial injury resulting in the acute admission. The median time the participants’ family members experienced TBI prior to interviews being conducted was 11 months (range 9 – 17 months).

Table 8.1 Relationship of participants with the person with TBI and time since injury

Participant number	Relationship to family member with TBI	Time since family member’s TBI
1	Sister	11 months
2 and 3	Mother and Aunt	10 months
4	Mother	16 months
5 and 6	Mother and Father	9 months
7	Sister	9 months
8 and 9	Mother and Sister	15 months
10	Father	17 months

Four themes were identified: 1) The hospital environment; 2) Hospital staffing; 3) Identifying and preventing triggers, and 4) Family support and information. Each theme is described narratively below with exemplar quotes. Each participant (P) has been assigned a participant ID number. Where participants used their family members' names in quotes, these have been de-identified with "[family member with TBI]".

8.3.1 The hospital environment

The acute hospital setting was described by participants as a noisy environment, triggering challenging behaviours due to overstimulation and lack of sleep. Hospital environments were described by participants as loud, with constant noises, bright lights, and frequent interruptions for medical or nursing interventions throughout the day and night. Participants described how the noise, overstimulation and interrupted sleep contributed to their family member's agitation, frustration and aggression.

> "The only thing that got him frustrated and agitated sometimes, was the noise levels … he'd be like they're out there in the hall talking and don't they know we're trying to sleep. And then sometimes it was other patients that might disturb him …He just wanted it quiet and … like there's machines going out there and people walking up and down the corridors." (P4).

One participant described how their family member with TBI could move freely throughout the unsecured hospital ward and abscond via the stairwell: "he could freely run, and he knew where the stairs were. I guess like he would run down four flights of stairs with ease to try and escape" (P1).

Environmental strategies described by participants included turning lights off, closing blinds or curtains, moving rooms away from noise, bringing in familiar items and photos, visitor restrictions, and limiting time for conversations to allow for rest. Despite implementing environmental strategies to reduce triggers for challenging behaviours, participants reflected on how the hospital was a noisy place and limiting the noise was difficult. As described by P10 "I did see that they had the blinds closed to keep the room dark. But the hospital's a noisy place".

8.3.2 Hospital staffing

Family members described the negative impact of hospital staff who lacked experience, confidence, and skills in understanding, anticipating and responding to challenging behaviours following TBI. However, participants deeply valued hospital staff who understood TBI, could build rapport and adopt a compassionate approach to supporting their family member. These are explored in the following sub-themes: 1) The impact of inexperience, and 2) Understanding, compassion and rapport.

8.3.2.1 The impact of inexperience

Participants described they could sense when staff were not confident or skilled in de-escalating or managing TBI challenging behaviours.

> "Some of the staff are really lovely and can manage and some aren't so good and [family member with TBI] can sense that ... I could see that where he was comfortable, and he was more passive and then some would really upset him and then he'd get really angry and call them [profanity] this and that." (P2).

Families discussed times when they noticed hospital staff felt threatened, scared and lacked confidence when confronted with challenging behaviours (particularly aggression) from the person with TBI. At these times, participants described "avoidance of care" where their family members received reduced quality of care, and were left medicated rather than finding someone the person with TBI could engage positively with

> I think the hitting out and the agitation and that, they're a bit scared and they tend to leave them more than try and actually get them to do stuff through the daytime, I guess. They're happy to leave them in bed because that's easier …They get put in the too hard basket." (P7).

Some families noticed inexperienced hospital staff often reverted to reactive approaches, and immediately called for security guards for assistance. Families felt further effort could have been made to de-escalate, distract, and connect with the person with TBI.

> "The treatment from staff that knew versus treatment from staff that didn't know were very, very different …The ones that knew, knew how to calm the situation, knew what was happening, so they wouldn't add to the aggression or the frustration. Whereas the other ones were sort of like ready to code [call for security assistance] rather than try and work out what was happening." (P9).

One father described his concern in leaving his son in hospital when he did not feel confident with the nurse's approach to his challenging behaviours.

> "I thought, if this nurse ain't going to do anything while I'm here, what is she going to do if I'm not here? And how – my kid's got a brain injury, and his leg's bunged up. And he's trying to get out of bed, and all she can do is push a button. I thought that's not right. And I felt like I shouldn't leave, because at least I was there to help if he tried to – if he got angry again." (P10).

The need for further staff training and skill development was identified by some families "The hospital just didn't have brain injury information - there's just, the lack of skill, I think added so much to his agitation and his reactions" (P8). A need for staff with interests in TBI or a specialised practice of nursing for TBI behaviour management, was described by P2: "They need nurses who are interested in brain damage because it is quite unique ... it needs to be specialised type nursing."

Regular staffing shortages were identified as a significant concern. These resulted in casual staff, or staff from other wards and specialities called in to service the ward, or an absence of required

staff for patients with TBI "at that time it was literally staff shortage. They did not have the staff to have one on one, there were days where they didn't have the security rock up on time." (P9).

One participant described the lack of rapport from inconsistent staffing frustrated and agitated their family member with TBI.

> That was another thing that was very vital, was the inconsistency at times on the ward, of staff. You had your regular staff, but then you'd get a lot of temps that would come in to fill those shifts that people couldn't make. He struggled mostly with them … because they didn't know him." (P4).

Security guards were at times required to be involved in both supporting staff working with patients and supervising patients with challenging behaviours. Many participants described how security guards involved with people with TBI in the hospital setting needed more training and knowledge of TBI, challenging behaviours, triggers and de-escalation strategies, as described by P3 "they're there for security, yes. But probably in this environment they need pre-training to better manage and understand patients [with brain injury]." (P3).

Hospital staff lacking the adequate skills and experience to effectively manage challenging behaviour was not the unanimous experience for all participants, or reflections of every hospital staff member by participants. Many participants also described the respect and compassion of hospital staff toward their family member with TBI.

8.3.2.2 Understanding, compassion, and rapport

Participants felt staff who took a caring and compassionate approach were very important for their family member with TBI. When families reflected on those staff who did take a compassionate, calm approach to build rapport with the person with TBI, they expressed gratitude for their dedicated care.

> "There's one guy he should be paid twice as much as anybody else, because no matter whether he was about to go on a break, or whether he was about to end his shift, or whatever, if [family member with TBI] needed something – a bit of attention to calm him down or whatever, he'd spend the time." (P10).

Staff who were able to communicate effectively, build rapport, and recognise emotions with the person with TBI, made them feel comfortable in receiving care and reduced challenging behaviours.

> "There was one male nurse there that was a younger guy and he got along brilliantly with [family member with TBI] as well because they would just chat. They would just banter about stuff, and he was quite candid and open it was really good. [Family member with TBI] felt comfortable with him." (P1).

Some participants highlighted the importance of tailoring the staffing mix to suit relatable personalities between staff and patients and avoid personality “clashes”. As described by P5 “the nurse, it’s more like a personality thing, so he doesn’t like him.”

Staff were highly regarded by participants when compassionately helping family members with TBI in a caring manner, whilst staying calm during stressful situations. Staff who understand challenging behaviours after acute TBI, who can build rapport and use compassion are critical.

8.3.3 Identifying and preventing triggers

Some participants acknowledged identifying their family member’s triggers to challenging behaviours could be difficult due to the unpredictable changes and escalation. When families or staff were unable to identify emotional and communication factors, this would escalate challenging behaviours. Opportunities for family involvement in behaviour management and to support communication were described by participants as effective strategies to identify and prevent triggers.

8.3.3.1 Difficulties identifying triggers

Participants described their family member with TBI would have fluctuating behaviour whereby their challenging behaviour would escalate in an unpredictable manner on a day-to-day basis; for example, “it happens very quickly, he can be like really settled, he can be really good and then it’s like smack, he snaps” (P2). Unpredictable fluctuations of challenging behaviours were difficult when triggers were not identified by hospital staff. Participants described the lack of recognition of emotional factors associated with early TBI recovery contributed to escalating challenging behaviours in the hospital setting. As described by P2 “he’s still got those feelings and understandings and perhaps it’s not being recognised like that.” Many participants described that their family member with TBI would experience frustration, loneliness, anger and grief during their early recovery in the hospital setting. When hospital staff were not able to recognise these emotions, participants felt these emotional factors contributed to frustration and anger, and thereby triggered challenging behaviours.

> “A bit of anger at times which mostly I think comes from frustration in his particular case, he remembers so much of his life prior to the accident and the injury. And some frustrations of that he can’t do the same things.” (P4).

Some participants described times when their family member with TBI was unable to communicate, or was overwhelmed with multiple questions, this would trigger challenging behaviours as a result of frustration.

> “Yeah, and not throwing two or three questions at him at once, which I found some staff would come in and they would be, like, ‘Do you want me to do this or this and that?’ You’d see him, like, that overwhelmed.” (P4).

Participants described hospital staffs' difficulty in recognising triggers to challenging behaviours by not recognising emotional factors, frustration due to difficulty communicating, and the unpredictable nature of behaviour change after TBI.

8.3.3.2 Families involved in preventative strategies

Participants described how they would try strategies to reduce triggers to challenging behaviour for their family member while in hospital. These strategies included avoiding both conversations and arguments.

> "When I visited him as I said earlier it was a lot of you just have to walk on eggshells so there were topics that triggered him. Like, you had to be very careful with what you said to him, and if you disagreed with him that would trigger him. So, you just had to just try and talk to him about generic stuff." (P1).

Some participants brought in activities to reduce boredom for their family member with TBI. These included puzzles, games, craft, watching favourite movies and listening to music. Participants felt it was helpful for staff to know the family member's preferences for hobbies and leisure activities for diversion when challenging behaviours could escalate.

> "Staff, I think just them getting to know us, talking with us and listening to what we had to say that might help soothe [family member with TBI] or little strategies. Like sometimes when he'd get agitated – I'd be like look, just close your eyes and put on some music and just – and he'd be, like, 'As long as it's Eminem, it's okay.'" (P4).

Participants also described sharing photos and familiar items with their family member with TBI. Although aware of avoiding overstimulation, some participants used photos to reminisce and generate conversations for diversion.

> "And his walls were decorated in – just one wall, because we wanted not a busy, busy room. So, he had these walls here that he looked at when he was in his bed, empty. But if he felt like looking at something." (P9).

Some participants felt when strategies to support communication were provided, this reduced aggressive outbursts of frustration from their family member with TBI. One participant brought in picture cards to enable her family member with TBI to communicate, which subsequently hospital staff started using as a communication strategy.

> "…the flash cards and I would show him those. And then they're like [hospital staff], 'oh, we'll get some of those made up for his room', and then they had it up on the wall, and so then they started saying, '[family member with TBI], are you thirsty, are you hungry?'" (P9).

Behaviours could change and escalate quickly, with staff and families having difficulty predicting triggers. Families felt it was helpful to be involved in preventative strategies, and to support the person with TBI to communicate to alleviate potential triggers.

8.3.4 Family support and information

Many participants described the extensive impact TBI has had on the wider family network. Participants reflected on how the TBI happened to one family member, but impacted on all family members including parents, siblings and children of the person with TBI.

> "It's been hard. The accident happened to him, but it also happened to us but in a different – we didn't end up with the injuries. But it's really hard, as a mum, to watch your son be like that and feel so helpless." (P4).

Many participants described there was little or no support for families in the acute setting after a relative had a TBI. Although some participants did state they received support from social work services at one acute hospital and psychology services at inpatient rehabilitation services, many participants suggested more support is needed for families in the early stage after TBI.

> "It took about eight months for them to even offer us any counselling because it's caused a lot of issues. My mum is now on anti-depressants; my sister is depressed …It took a long time for them to get any support. That's been hard and I think that was probably something that was overlooked ... there is a huge hole for support for families and loved ones going through that, and I know there is only so many resources that can be put into some of this stuff, but like I think that's really something that is completely overlooked is for families and loved ones." (P1).

Most participants also described a gap in information and education provided to family members about TBI and behaviour change in the acute stage in hospital settings with "no handouts or anything like that" (P7). Some participants relied on their own online web searching to gain information about TBI and behaviour change as described by P2: "I personally have done googling, but I haven't had any information sheet". One participant found she was "inundated and overloaded with information" (P4). The information was provided in pamphlets, verbal updates and emails, "but sometimes it would just like whoa, no, information overload" (P4).

Overall, participants described the need for more family support in the early stage of TBI recovery in the hospital setting. Additionally, participants felt there was a need for more tailored information about TBI in the acute setting, with the importance of consideration as to how the information was delivered to avoid overwhelming the family members.

8.4 Discussion

This qualitative study has enabled us to gain insight in the experience of the management of challenging behaviours after TBI in the hospital setting from the perspectives of family members. Four themes were identified: 1) The hospital environment; 2) Hospital staffing; 3) Identifying and preventing triggers, and 4) Family support and information.

Family members shared similar perspectives on the challenges of effective TBI behaviour management, including overstimulation and unsecured hospital environments; inexperienced staff; inconsistent and temporary or casual staffing; difficulty identifying triggers due to unpredictability and lack of identification of emotional and communicative needs by patients. Family members shared their perspective of the challenges of care delivered by inexperienced staff, including inconsistent, temporary or casual staffing within the acute hospital setting. This finding reflects commonalities with previous studies exploring acute staff perspectives of effective management of challenging behaviours after TBI and caring for patients with TBI (Carrier, Ponsford, & McKay, 2022; Giles et al., 2013; Oyesanya et al., 2018). Lack of knowledge, training, limited staffing and resources have been found to be barriers for nurses caring for patients with TBI (Carrier et al., 2021; Giles et al., 2013; Kivunja et al., 2018; Oyesanya et al., 2018). Provision of staff training and skill development, provision of information and resources, with ongoing supervision and support to staff are strategies that may improve staffs' agency in effectively managing challenging behaviours (Carrier et al., 2021; Carrier, Ponsford, & McKay, 2022; Holloway & Tasker, 2019; Kivunja et al., 2018).

Family members felt challenging behaviours after TBI can contribute to distress to family members and family relationships. This finding reflects outcomes of previous studies that have explored the emotional distress, reduced quality of life of family members and the impact on psychosocial and family functioning as a result of a family member experiencing a TBI (Braine, 2011; Fisher et al., 2015; Holloway et al., 2019; Holloway & Tasker, 2019; Johnson & Griswold, 2017; Kratz et al., 2017; Norup et al., 2010; T. Page et al., 2021; Whiffin et al., 2015). Family members expressed there is a lack of support and information for family members of people experiencing challenging behaviours after TBI, with more support to families in the acute phase of TBI recovery needed. The lack of support and information correlates with previous findings based in subacute and community settings (Braine, 2011; Fisher et al., 2020; Holloway & Tasker, 2019; Kratz et al., 2017; Murray et al., 2006). This study supports the findings of others for further research to support families and caregivers of people with TBI (Braine, 2011; Fisher et al., 2015; Gould, Hicks, et al., 2019; Holloway et al., 2019; T. Page et al., 2021; Tam et al., 2015). Furthermore, there is an urgent need to develop and provide support and information relating to TBI and challenging behaviours to families during the acute admission after TBI. Tailored adaptation of information and support is required as patients with TBI transition from acute care to subacute rehabilitation and community integration, to minimise distress to families throughout the continuum of care (Lefebvre & Levert, 2012).

Family members described strategies that worked well in the hospital setting to minimise triggers and effectively manage challenging behaviours, including familiar items and low stimulation

environments; staff who provide compassionate and respectful caring approaches; family involvement in preventative strategies, and providing opportunities for communication for the patient with TBI (Lindlöf et al., 2023). To our knowledge, there is a lack of qualitative studies whereby family members have highlighted the difficulties of the hospital environment, management of behaviour triggers with family involvement in TBI behaviour management in the acute setting. However, these findings do support CPG recommendations outlining the importance of modifying the environment, minimising overstimulation, promoting a safe environment, identifying and addressing triggers, and promoting family involvement in care to patients with challenging behaviours in the acute phase of TBI (Luauté et al., 2016; Ponsford, Janzen, et al., 2014; University of Arkansas Medical Sciences, 2020). Opportunities to support improvements in TBI behaviour management in the acute setting should include family involvement, skilled staffing, positive staffing considerations and strategies for communication for people with TBI.

Findings of this study can be considered against the levels of systems within the EST proposed by Bronfenbrenner (1979). In applying the EST to our results, multi-system factors can be identified which influence behaviour management following TBI in the acute hospital setting.

- Influences at the **microsystem** level involve the quality of interactions between the person with TBI, their immediate family and hospital staff within the acute hospital ward. Staff and families directly involved in strategies to identify triggers, engaging directly with the person with TBI in preventative strategies and interactions to promote communication appear at the microsystem level. In our data, the microsystem may be closely associated with the challenges of hospital staffs' inexperience, lack of skills in understanding TBI and managing challenging behaviours, which participants described negatively impacted the family member with TBIs challenging behaviours. Also within the microsystem level, were the interactions participants and their family members had with hospital staff who provided compassionate, care and built rapport with their family member with TBI.
- The **mesosystem** is closely associated with interactions between elements of the microsystem. From our data, the mesosystem relates to the dynamics of interactions between the person with TBI, their families, and the wider networks of hospital staff within the hospital environment. Within an acute hospital setting, the mesosystem influences can include the dynamics of interactions between families and hospital staff to support the person with TBI with challenging behaviours. Based on our data, mesosystem interactions are influenced by family involvement in strategies to identify emotional and communication factors, triggers and preventative strategies of escalating challenging behaviours. Hospital staff collaboratively engaging with families can be helpful to identify and trial personalised preventative strategies to support the person with TBI.

- **Exosystem** influences are the structures within a healthcare organisation, for example hospital environments, procedures and routines. The overstimulation within the acute hospital environment; limited staffing resources, and hospital funding for staffing availability are challenges within the exosystem that influence the management of challenging behaviours following TBI in the acute hospital setting. The lack of support and information provided to families during the acute stage of TBI relate to exosystem routines and procedures within the acute hospital setting.
- Societal, cultural, and political factors can influence at the **macrosystem** level. Although findings from this study are not broadly attributed to the macrosystem, the healthcare policies, standards, CPGs and funding for future research can be applied for future improvements to managing challenging behaviours after TBI in acute settings.

This study utilised a robust qualitative methodology, providing a novel perspective from families about care received in the acute setting after a family member has experience challenging behaviours after TBI. This study highlights the importance of family involvement in person-centred TBI acute care to identify preventative strategies for challenging behaviours. Some limitations should also be addressed. This study was conducted during COVID-19 pandemic whereby the impact of reduced workforce and hospital demand could have influenced participant's perspective on the challenges in the delivery of care during their family members admission with TBI. Interviews were completed with 10 participants in one state in Australia.

8.5 Conclusion

This qualitative study summarises the experience of the management of challenging behaviours after TBI in the acute hospital setting from the perspectives of family members. Findings highlighted the challenges of care including the hospital environment, inexperienced and inconsistent staffing, and difficulty identifying and managing triggers. Strategies that enabled quality of care, as described by families, were modifying the stimulation of the hospital environment, compassionate and caring staff who built rapport with patients, opportunities for communication and family involvement in patient care. Families described a lack of information and support in the acute phase of TBI in the hospital setting.

8.6 Chapter summary

This chapter described a qualitative interpretive phenomenological study to explore the experiences of the management of challenging behaviours after TBI in the acute hospital setting, from the perspectives of family members. The EST was applied to interpret the findings. Themes

identified were related to the hospital environment; hospital staffing; identifying and preventing triggers; and family support and information.

Findings from this study highlight the family-related implementation factors that can influence evidence or improvements into practice. Further understanding of the contextual factors relating to staff knowledge, confidence, and current practice of TBI behaviour management in the acute hospital will be useful to provide pre-implementation data to inform the development of implementation strategies. Chapter Nine will present a survey of acute staffs' confidence in managing challenging behaviours, together with an audit of current practice to understand and explore current evidence-practice gaps.

CHAPTER 9 CURRENT PRACTICE AND KNOWLEDGE OF THE MANAGEMENT OF CHALLENGING BEHAVIOURS AFTER TBI IN THE HOSPITAL SETTING: AN AUDIT OF PRACTICE AND A SURVEY OF STAFF

This chapter addresses Aim 3 of the thesis: To explore barriers, enablers and contextual factors to the implementation of evidence-informed practice to inform strategies to improve TBI behaviour management in the acute hospital setting. This chapter presents:

(1) an audit of current practice and use of TBI behaviour management clinical practice guideline recommendations,

(2) a survey of acute hospital staffs' knowledge and confidence in managing challenging behaviours after TBI.

This chapter will provide an understanding of the contextual factors influencing implementation of evidence-informed practice, including detailing the evidence-practice gap in current practice and staffs' knowledge and confidence in applying CPG recommendations for TBI behaviour management in the acute hospital setting. This study provides pilot, pre-implementation data to inform the development of implementation strategies for future improvements and implementation research trials in this area of practice.

9.1 Introduction

As mentioned in Chapter Two, challenging behaviours have been estimated to be prevalent in 25 – 57% of TBI acute admissions (McNett et al., 2012; Phyland et al., 2021). Care to patients with TBI can be inconsistent and variable (Green et al., 2012; Jolliffe et al., 2019; O'Callaghan et al., 2009) with improvements in practice needed in the acute setting (O'Callaghan et al., 2009).

Variability in the quality and consistency of care can be due to contextual factors such as a lack of knowledge, time, and resources to successfully contribute to the knowledge-to-practice gap when implementing quality and safety innovations in healthcare settings (Tucker et al., 2021). There is also variability in the quality of CPGs relating to TBI behaviour management in the acute setting (Block et al., 2023; Seel et al., 2015; Shafi et al., 2014). Therefore, there is a need to minimise variability in services provided with consistent approaches to the assessment and management of challenging behaviours after TBI in acute hospital settings (Block et al., 2022; Flanagan et al., 2009). Greater implementation of recommended management strategies for challenging behaviours may lead to a reduction in the prevalence of challenging behaviours within the acute hospital setting (Phyland et al., 2021), however prior to the development of implementation

strategies, further understanding of barriers, enabler, and contextual factors within the acute hospital setting are needed (Kirchner et al., 2020; McNett et al., 2019).

This chapter investigates the contextual factors to the implementation of evidence-informed practice to inform strategies to improve TBI behaviour management in the acute hospital setting. Contextual factors relating to the evidence-practice gap in current practice of TBI behaviour management in the acute context, and acute staffs' knowledge and confidence in applying CPG recommendations for TBI behaviour management will be evaluated.

Evidence-practice gap is the gap between what is recommended in CPGs and what occurs in clinical practice (Bennett & Bennett, 2000). To understand evidence-practice gaps, an evaluation of current practice is needed. Audits of medical records is an approach to understand current practice and investigate evidence-practice gaps. Furthermore, understanding staffs' confidence in their knowledge and application of CPG recommendations relating to managing challenging behaviours after TBI, is an important contextual factor for consideration to inform implementation strategies.

The aims of this study were:

- To identify current hospital practices and gaps relating to CPG recommendations for TBI behaviour management.
- To understand acute staffs' knowledge and confidence in applying CPG recommendations for TBI behaviour management in the acute setting

9.2 Methods

9.2.1 Design and setting

This research was conducted at a neurosurgery unit at an acute hospital in Adelaide, Australia. This study involved a retrospective audit of medical records of patients with acute TBI who exhibited challenging behaviours during their acute admission, and an online survey of staff experienced in working with patients with TBI in the acute setting. This study received ethics approval through Southern Adelaide Human Research Ethics Committee (ID number 178.20).

9.2.2 Audit procedure

A retrospective audit was conducted in July 2022 of medical records of patients with acute TBI who exhibited challenging behaviours during their admission to the neurosurgery unit of the acute hospital setting during 2020 and 2021. This audit methodology was informed by evidence, as data was collected based on TBI behaviour assessment and management interventions recommended in CPGs appraised in Chapter Six of this thesis. Data extracted included documented behaviour

assessment; non-pharmacological and pharmacological interventions; restraint use; Code Black security incidents; one-on-one staffing resources (1:1 nursing or guards used); workplace violence incidents; hospital length of stay; discharge destination. An allied health research practitioner working within hospital neurosurgery unit undertook the screening and audit of medical records. Two researchers (HB and LR) undertook the first three audits together to ensure consistency and to minimise bias in the data collection approach. An audit template was used for consistent data collection. Data were analysed using descriptive statistics.

9.2.2.1 Screening retrospective TBI admissions

A list of admissions of patients with TBI admitted to neurosurgery unit at the participating acute hospital was obtained from Casemix activity based funding services (South Australian Department of Health and Wellbeing, 2020) on 27th April 2022. As initially described in Chapter Four, Casemix activity based funding refers to the method of funding hospital services based on the level of activity undertaken, at an agreed price (South Australian Department of Health and Wellbeing, 2020). The inpatient hospital services have a specific classification, including diagnoses based on the International Statistical Classification of Diseases and Health Related Problems, 10th Edition (ICD-10) (World Health Organization, 2019). Classification of inpatient hospital services allows activities provided during the acute admission to be grouped according to clinical need and relative cost (South Australian Department of Health and Wellbeing, 2020).

Admission criteria included:

- Adults admitted to the participating acute hospital from 1st January 2020 – 30th December 2021 admitted under the care of the neurosurgery unit. This included patients who transferred across multiple wards, including intensive care, high dependency ward, and the neurosurgery ward.

- Admission length of stay for 5 days or longer. An admission of 5 or more days is indicative of patients categorised with moderate-severe TBI (Andriessen et al., 2011; Katz & Alexander, 1994; Moore et al., 2020; Schönberger et al., 2009; Williams et al., 2015) receiving the minimum three-days of consecutive assessment for post-traumatic amnesia (Marosszeky et al., 1998).

- Principal diagnoses based on the International Statistical Classification of Diseases and Health Related Problems, 10th Edition (ICD-10) (World Health Organization, 2019) S06 coded diagnoses relating to intracranial injury, as highlighted in Table 9.1 below.

- Exhibited challenging behaviours during the acute admission. This included those admitted with post-traumatic amnesia who exhibited agitation, verbal aggression,

physical aggression, impulsivity, wandering, absconding, perseveration documented in the medical records.

Casemix re-identifiable data received included patient medical record number, date of birth, gender, admission date, discharge date, admission diagnosis (ICD-10 S06 code) (World Health Organization, 2019), ward, clinical unit, length of stay, and discharge destination. The Casemix data received was screened to determine suitable admitted cases for inclusion in the audit based on the eligibility criteria. Further screening of patient admissions was conducted via the medical records to determine if TBI patients exhibited challenging behaviours, and to confirm eligibility.

Screening data were recorded in Microsoft Excel to determine number of admissions searched, number of admissions suitable for inclusion determined from screening, and total number of admissions audited. Reasons for exclusion were documented.

Table 9.1 ICD-10 S06 traumatic brain injury coded diagnoses for inclusion

Code	Description
S06	Intracranial injury
S061	Traumatic cerebral oedema
S062	Diffuse brain injury
S0620	Diffuse cerebral cerebellar brain injury unspecified
S0621	Diffuse cerebral contusions
S0622	Diffuse cerebellar contusions
S0623	Multiple intracerebral cerebellar haematomas
S0628	Other diffuse cerebral and cerebellar injury
S063	Focal brain injury
S0630	Focal cerebral and cerebellar injury unspecified
S0631	Focal cerebral contusion
S0632	Focal cerebellar contusion
S0633	Focal cerebral haematoma
S0634	Focal cerebellar haematoma
S0638	Other focal cerebral and cerebellar injury
S064	Epidural haemorrhage
S065	Traumatic subdural haemorrhage
S066	Traumatic subarachnoid haemorrhage
S068	Other intracranial injuries
S069	Intracranial injury unspecified

9.2.2.2 Audit data extraction

Patient medical records were accessed to audit documented behavioural assessments, non-pharmacological interventions, pharmacological interventions, and service outcomes used throughout the patient's relevant admission. Figure 9.1 displays the evidence-informed audit template that was developed and used for consistent data collection of each patient record audit. The research team confirmed the audit template prior to use. Patient admission characteristics were also collected, including age, gender, date of injury, admission diagnosis (with corresponding ICD-10 S06 code), admission date, discharge date, length of stay, discharge destination. Data were entered into a Microsoft Excel spreadsheet. Data collected included audit criterion and patient characteristics.

9.2.2.3 Audit data analysis

Audit data were analysed using descriptive statistics in Microsoft Excel, to summarise patient characteristics, describe behavioural assessment approaches, and management interventions. Data were reported as means with standard deviations; medians with inter-quartile range; and percentages.

	AUDIT CRITERIA
1	An assessment tool was used to identify challenging behaviours. If yes, name the tool
	a) Behaviour assessment occurred daily
	b) Comprehensive assessment of the individual (premorbid factors, triggers, psychological response) occurred
	c) Assessment involved direct observation
	d) Assessment involved diagnositic interviews with the individual and/or signficiant others
	e) Differential causes of agitation were identified (pain, infection, hunger, thirst, toileting)
2	Non-pharmacological management was used for challenging behaviours
	a) Environmental modification for safety and low stimulus
	b) Supervised wandering/pacing
	c) Family involved and/or familiar items
	d) Reorientation strategies
	e) Sleep-wake cycle was restored
3	A behaviour management plan was documented
	e) The behaviour management plan was reviewed and/or updated during admission
4	Pharmacological management was used for challenging behaviours
	a) Second generation atypical neuroleptics were prescribed
	b) Beta Blockers were prescribed
	c) Selective Serotonin Reuptake Inhibitors (SSRIs) were prescribed
	d) Amantadine or methylphenidate was prescribed for impaired arousal or attention in agitation
	e) First generation neuroleptics were prescribed
	f) Medication side effects and/or sedation was regularly monitored. If yes, what scale or tool was used
5	Neuropsychiatrist provided recommendations on TBI behaviour management during the admission
6	Education on TBI behaviour change was provided to individuals with TBI and/or their significant other
7	The individual with TBI was discharged to a specialised brain injury rehabilitation service
8	1:1 nursing or guard specialing the patient on the ward
9	A Code Black occurred during the admission
10	Physical or mechanical restraints were used due to challenging behaviours
11	An injury occurred to a staff member, visitor or patient due to challenging behaviours

Figure 9.1 TBI behaviour management in acute audit template

9.2.3 Survey procedure

An online survey was conducted in March 2020 to investigate staffs' knowledge and confidence of CPG recommendations for the assessment and management of challenging behaviours with

patients with TBI. Survey questions were developed following review of the literature on the evidence (as outlined in Chapter Five) (Block et al., 2021) and CPGs (Chapter Six) for the management of challenging behaviours during TBI in the acute setting (Block et al., 2023). Survey questions were formulated to gain multi-disciplinary staffs' levels of knowledge and confidence to further understand contextual implementation factors influencing the use of guideline recommendations in clinical practice. Survey questions were developed and confirmed by the research team prior to distribution. The survey included 12 multiple choice questions with Likert responses ranging from Strongly Disagree; Disagree; Neither Agree nor Disagree; Agree; Strongly Agree. Questions focused on staffs' knowledge of, and confidence in using CPG recommendations in practice for assessment, non-pharmacological interventions and pharmacological interventions for the management of challenging behaviours with TBI in the acute setting, which are presented in the results section of this chapter. Survey duration was approximately 15-minutes.

Surveys were distributed via Qualtrics (Qualtrics, 2020) from February to March 2021, targeting multi-disciplinary healthcare professional staff working with patients with TBI in the acute neurosurgery unit. The surveys were anonymous, therefore it was not known if acute staff were involved in previous research studies undertaken, including the pilot implementation study outlined in Chapter Four. Survey participants were recruited via clinical leads and ward managers, with flyers promoting the survey distributed within the ward staff room and nurses' station within the neurosurgery unit. Staff were eligible to participate in the survey if they had worked with adult patients with TBI who exhibited challenging behaviours in the acute hospital setting. Participant information was provided as a preamble, and consent gained prior to commencing the online survey. Survey data responses were quantified and analysed descriptively.

9.2.3.1 Survey data analysis

Survey data were analysed separately using descriptive statistics in Microsoft Excel. Likert responses from the survey questions were quantified and analysed as percentages. Data were reported as means with standard deviations and percentages.

9.3 Results

9.3.1 Audit results

A total of 26 neurosurgery acute admissions from 2020-2021 of adults with TBI with challenging behaviours with medical records available met inclusion for auditing. Figure 9.2 outlines the flow chart for screening admissions for inclusion.

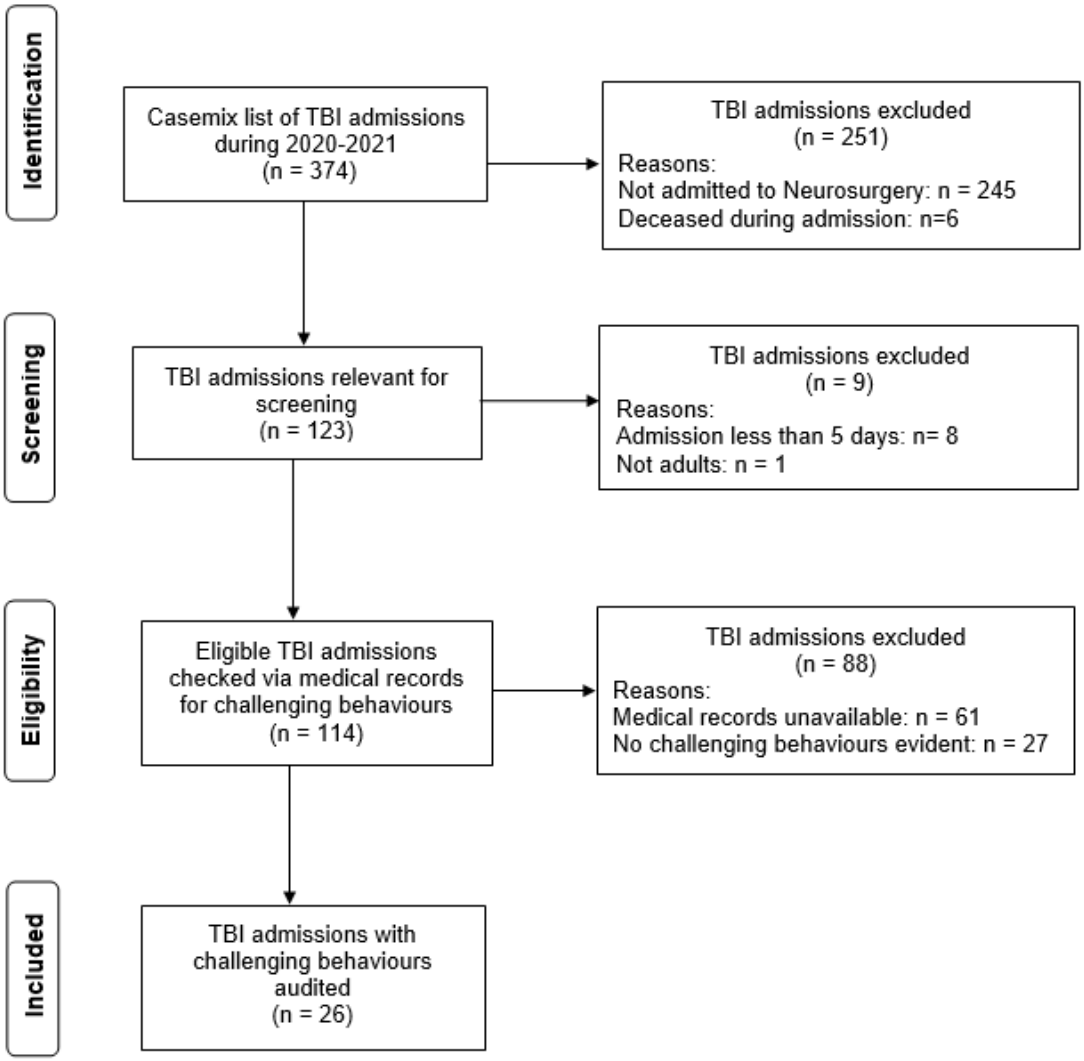


Figure 9.2 Flowchart of screening TBI admissions for inclusion

9.3.1.1 Patient characteristics

Of the included audited medical records, patients were predominantly male (85%), with a median age of 35 years. Median length of acute hospital admission stay was 20 days, and predominant discharge destinations were inpatient brain injury rehabilitation services (69%), with 27% discharged directly home from hospital. The most common ICD-10 S06 coded diagnoses of TBI were traumatic subarachnoid haemorrhage (46%) and traumatic subdural haemorrhage (31%). A summary of patient characteristics is displayed in Table 9.2.

Table 9.2 Summary of audited TBI patient characteristics

Audited patient characteristics	Results
Male (%, n)	85% (n = 22)
Female (%, n)	15% (n = 4)
Age in years (median, IQR)	35, (30)
Length of stay in days (median, IQR)	20, (7)
Discharged to brain injury rehabilitation service (%, n)	69% (n = 18)
Discharged directly home (%, n)	27% (n = 7)
Discharged via intrahospital transfer (%, n)	4% (n = 1)
Traumatic subarachnoid haemorrhage (%, n)	46% (n = 12)
Traumatic subdural haemorrhage (%, n)	31% (n = 8)
Focal cerebral contusion (%, n)	4% (n = 1)
Diffuse cerebral contusions (%, n)	4% (n = 1)
Multiple intracerebral haematomas (%, n)	15% (n = 4)

9.3.1.2 Behaviour Assessment

Audit results are displayed in Table 9.3. Most TBI patients had their behaviours assessed using an assessment tool (88%) and most behaviour assessments occurred daily (85%). Behaviour assessment involved staff directly observing the TBI patient (85%) using an internally developed, non-validated assessment tool. Behaviour assessment did not involve comprehensive assessment (0%) involving diagnostic interviews with patients, families/significant others (0%). All assessments documented included identification of differential factors that contribute to agitation, such as pain, infection, hunger or thirst.

9.3.1.3 Non-pharmacological strategies

All patients (100%) had at least one form of non-pharmacological management strategy documented during their admission. Most used non-pharmacological strategies were family involvement (100%), environmental modification for low stimulation (96%), reorientation strategies

(92%), and supervised wandering/pacing (88%). Fifty-four percent patients had documented their night-time sleeping patterns were restored. Only 23% of patients had a documented behaviour management plan, which was a one-off documented plan with no reviews or updates during the admission.

9.3.1.4 Pharmacological strategies

Most patients (98%) received pharmacological interventions during the acute admission. Most used medications documented were second generation atypical neuroleptics (88%) followed by beta blockers (27%). CPG recommendations advise against the use of first-generation neuroleptics. This audit demonstrated only one patient received a first-generation neuroleptic during the acute admission. Very few patients received selective serotonin reuptake inhibitors (SSRIs) (8%) and no patients received amantadine. All patients who received pharmacological interventions had documentation of their sedation levels monitored using a standardised nursing sedation scale.

Neuropsychiatry services were not routinely available at this acute hospital setting, therefore referral to an external neuropsychiatrist was required as the needs arose. Neuropsychiatry services were received by 23% of patients with TBI in this acute setting. Documentation of education provided to patients and families/significant others was observed in 54% of records, but detail of education provided was not documented. Throughout the acute admission, there were one-on-one (1:1) nursing and/or guards used for 92% of audited patients. A Code Black security threat was observed for 60% of audited patients. Physical or mechanical restraints were used for 35% of audited TBI patients. Documented injury to staff, family or patient due to challenging behaviour occurred in 54% of audited records. Documented injuries included falls, punching, slapping, kicking. Severity and outcomes of injuries were not documented or audited.

Table 9.3 Audit results of included acute TBI admissions with challenging behaviours

Audit Criteria	**Total Yes** **(%, n)**
An assessment tool was used to identify challenging behaviours. If yes, name the tool	88% (n = 23)
a) Behaviour assessment occurred daily	85% (n = 22)
b) Comprehensive assessment of the individual (premorbid factors, triggers, psychological response) occurred	0% (n = 0)
c) Assessment involved direct observation	85% (n = 22)
d) Assessment involved diagnostic interviews with the individual and/or significant others	0% (n = 0)
e) Differential causes of agitation were identified (pain, infection, hunger, thirst, toileting)	100% (n = 26)
Non-pharmacological management was used for challenging behaviours	100% (n = 26)
a) Environmental modification for safety and low stimulus	96% (n = 25)
b) Supervised wandering/pacing	88% (n = 23)
c) Family involved and/or familiar items	100% (n = 26)
d) Reorientation strategies	92% (n = 24)
e) Sleep-wake cycle was restored	54% (n = 14)
A behaviour management plan was documented	23% (n = 6)
a) The behaviour management plan was reviewed and/or updated during admission	0% (n = 0)

Pharmacological management was used for challenging behaviours	92% (n = 24)
a) Second generation atypical neuroleptics were prescribed	88% (n = 23)
b) Beta blockers were prescribed	27% (n = 7)
c) Selective serotonin reuptake inhibitors (SSRIs) were prescribed	8% (n = 2)
d) Amantadine or methylphenidate was prescribed for impaired arousal or attention in agitation	0% (n = 0)
e) First generation neuroleptics were prescribed	4% (n = 1)
f) Medication side effects and/or sedation was regularly monitored. If yes, what scale or tool was used	100% (n = 26)
Neuropsychiatrist provided recommendations on TBI behaviour management during the admission	23% (n = 6)
Education on TBI behaviour change was provided to individuals with TBI and/or their significant other	54% (n= 14)
The individual with TBI was discharged to a specialised brain injury rehabilitation service	69% (n = 18)
1:1 nursing or guard specialling the patient on the ward	92% (n = 24)
A Code Black occurred during the admission	60% (n = 15)
Physical or mechanical restraints were used due to challenging behaviours	35% (n = 9)
An injury occurred to a staff member, visitor or patient due to challenging behaviours	54% (n = 14)

9.3.2 Staff survey results

A total of 21 acute hospital staff completed the online survey. Most staff were from an allied health discipline (67%). Over 42% of respondents had less than 2 years of experience in working with patients with TBI. Table 9.4 displays acute staffs' professional disciplines and years of experience working with TBI patients.

Table 9.4 Acute hospital staff professional disciplines and experience in working with patients with TBI

Professional discipline	**Results**
Medical Officer / Registrar / Intern (%, n)	5% (n = 1)
Registered nurse (%, n)	19% (n = 4)
Enrolled nurse (%, n)	10% (n = 2)
Physiotherapist (%, n)	38% (n =8)
Occupational therapist (%, n)	10% (n = 2)
Social worker (%, n)	5% (n = 1)
Speech pathologist (%, n)	10% (n = 2)
Dietitian (%, n)	5% (n = 1)
Years of experience working with patients with TBI	**Results**
Less than 2 years (%, n)	43% (n = 9)
2 – 4 years (%, n)	10% (n = 2)
5 – 9 years (%, n)	24% (n = 5)
10 – 19 years (%, n)	19% (n = 4)
20 – 29 years (%, n)	5% (n = 1)
30+ years (%, n)	0% (n = 0)

Figure 9.1 displays acute staff survey responses. Most staff survey respondents (62%, n = 13/21) agreed that the assessment and management of TBI challenging behaviours is supported by high quality evidence and outlined in clinical practice guidelines. Staff were predominantly uncertain about their knowledge of guideline recommendations for TBI behaviour assessment (60%, n =12/20), and guideline recommendations for TBI behaviour management (48%, n = 10/21). Despite reporting uncertainty in their knowledge of guideline recommendations, most staff survey respondents agreed or strongly agreed they could easily find clinical practice guidelines (71%, n = 15/21). Staff were predominantly uncertain (50%, n = 10/20) about their confidence in applying guideline recommendations for TBI behaviour assessment. Most staff reported they were uncertain (48%, n = 10/21) or agreed (38%, n = 8/21) they had good confidence in applying non-pharmacological interventions for TBI behaviour management. For a subset of nursing and medical staff involved in providing pharmacological interventions, most reported they agreed or strongly agreed (57%, n = 4/7) they were confident in applying pharmacological treatment for TBI behaviour management.

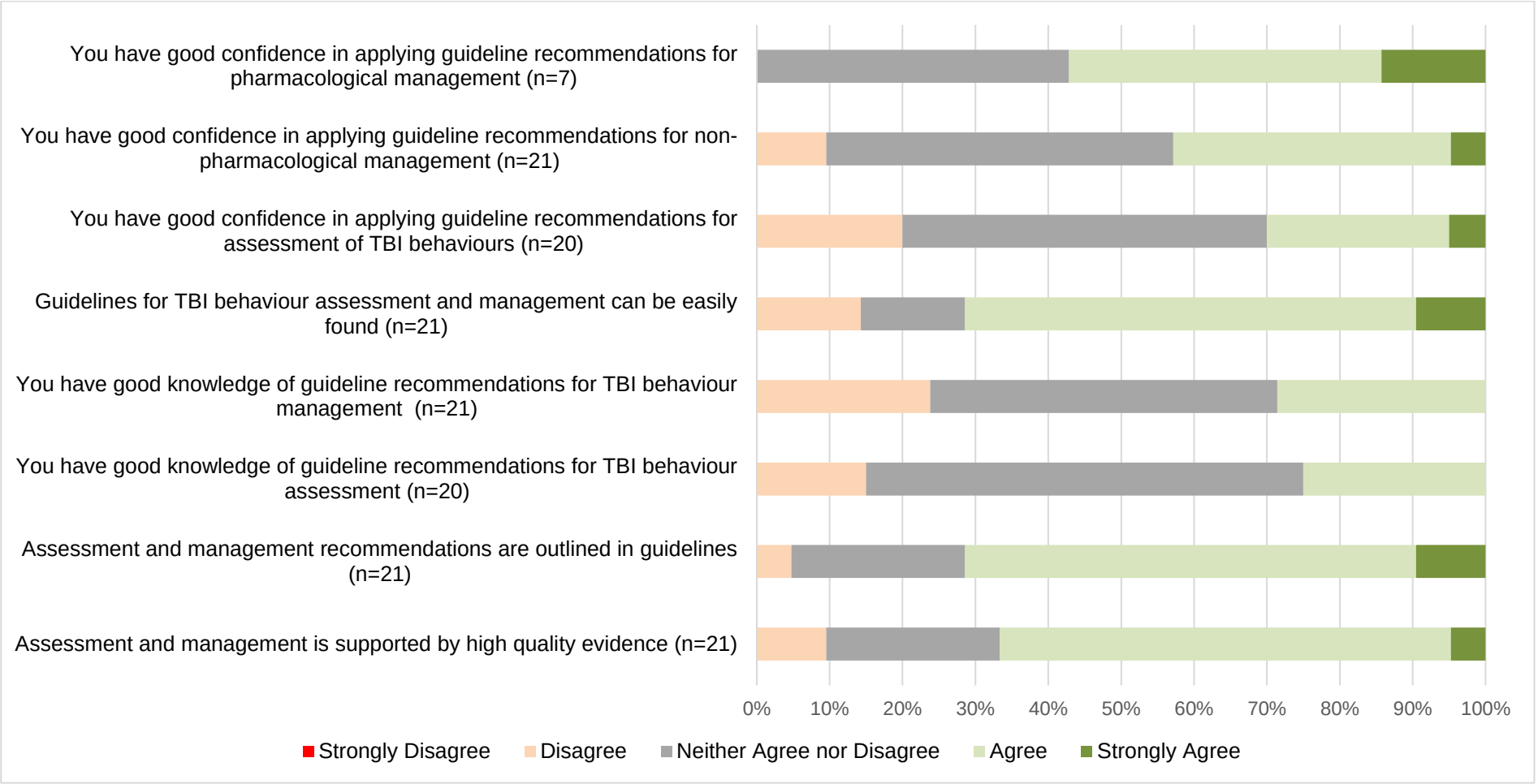


Figure 9.3 Acute staff survey responses

9.4 Discussion

This chapter explored the contextual factors to the implementation of evidence-informed practice for TBI behaviour management in the acute hospital setting. Contextual factors relating to the evidence-practice in current practice of TBI behaviour management in the acute context were audited, and acute staff were surveyed to determine levels of knowledge and confidence in applying CPG recommendations for TBI behaviour management.

The findings of this audit suggest evidence-informed TBI behaviour management is variable. Audit findings that support current evidence-informed practice includes regular observational assessment of challenging behaviours; the use of non-pharmacological strategies (low stimulation environment, reorientation strategies, and family involvement); the use of second-generation neuroleptics rather than first-generation neuroleptics; and consistent monitoring of patient's sedation levels after pharmacological treatment. Although the use of second-generation neuroleptics for TBI challenging behaviours is recommended in some CPGs (Bayley et al., 2016), further investigation of the efficacy of pharmacological interventions is required (Hicks et al., 2018; McKay et al., 2021).

Audit findings that indicate the evidence-practice gaps in current practice include the lack of validated assessment tools used; comprehensive assessment was not completed incorporating pre-morbid history and interviews with families; the lack of behaviour management plans documented and reviewed regularly. Given behaviour management plans were documented in over 20% of cases, but none were reviewed, it is worth considering if documentation of a behaviour management plan was a required process task to be achieved to facilitate discharge for some community services (for example requirement for discharge as requested by an external agency). Beta blockers are currently recommended as the highest level of evidence for managing agitation and aggression after acute TBI (Block et al., 2021; Fleminger et al., 2006; Plantier & Luauté, 2016), however few medical records indicated beta-blockers were used (27%), with second-generation neuroleptics the most used pharmacological treatments (88%). The hospital where the audit was conducted had limited access to specialised neuropsychiatry services, which was reflected in 23% of records documenting a neuropsychiatrist consultation occurred during the acute TBI admission. Although there was documentation of education provided to families in over 50% of cases, there was no record of the extent and approach education provided. Findings from interviews with families in Chapter Eight highlighted the need for more information and support to families in the acute recovery phase of TBI. Therefore, further evaluation of the detail, mode and format of education and information provided to families in the acute setting is needed.

Audit results indicate that most patients with TBI required one-on-one (1:1) nursing or guard supervision on the ward, and many patients with TBI had documentation of a Code Black security incidence, which can be costly resources involving attendance of multiple security and clinical staff. Out of the 26 medical records audited, 54% had documentation of a patient, family member, or staff member being injured because of aggressive challenging behaviours (such as kicking, punching, slapping). This is a substantial finding which verifies the concerns voiced by staff during focus groups in Chapter Seven, whereby staff described concerns for their personal safety when extreme agitation and aggression was present with patients following TBI: “Sometimes when we have TBI patients, I wouldn’t be surprised if I got hurt at work” (FG1 acute).

The audit was conducted after the study outlined in Chapter Four was completed. Despite the intervention study outlined in Chapter Four implementing a consistent approach to assessment and management of challenging behaviours after TBI, evidence-informed TBI behaviour management remains variable. This indicates the need for implementation strategies and further research trialling the implementation strategies for successful and sustained implementation of evidence-informed practice for the management of challenging behaviours after TBI in acute settings. The audit collected data from patient admissions during the COVID-19 pandemic whereby restrictions were frequently changing in South Australia, impacting visitors and service delivery. It is important to note the audited services provided to TBI patients admitted during COVID-19 pandemic may have been influenced by lack of staffing availability, redirection of workforce services, changes in service delivery, and staff morale within the acute setting.

Survey findings indicated that staff know TBI behaviour management recommendations are outlined in evidence and CPGs and they can easily find guidelines. However, staff were predominantly uncertain about their level of knowledge of CPG recommendations for TBI behaviour assessment and management strategies. Staff reported they had good confidence in applying CPG recommendations for pharmacological strategies, however, were uncertain about their level of confidence in applying CPG recommendations for TBI behaviour assessment and non-pharmacological strategies.

These findings highlight the limited applicability and adoption of CPG recommendations into clinical practice. As discussed in Chapter Six, few CPGs appraised provided comprehensive detail on the implementation of recommendations into clinical care, which may limit adoption (Block et al., 2023). Despite staff knowing about CPGs and how to access CPGs, their uncertainty in their knowledge of, and confidence in applying CPG recommendations verifies the lack of adoption of CPG recommendations into practice.

Findings from this survey also verified the findings discussed in Chapter Seven of this thesis regarding the lack of experienced staff with practical skills identified as a barrier to implementing evidence-informed practice for managing challenging behaviours after TBI in the acute setting. Findings from this survey, and findings from Chapter Seven highlight that staffs' lack of knowledge of and confidence impedes effective TBI behaviour management. As highlighted by one acute focus group participant in Chapter Seven, "You can teach people all the things to do with some of the challenging behaviours, but you've got to be confident enough to be able to apply that when you're with a patient" (FG1 acute). These findings are consistent with Oyesanya and Thomas (2019) who conducted a qualitative study about nurses concerns in caring for patients with acute TBI, with findings echoing the need for more education of staff to promote knowledge, and development of guidelines for the management of patients with TBI (Oyesanya et al., 2018).

This study provides pilot pre-implementation data, which can be used to inform implementation strategies for improvements to TBI behaviour management in the acute setting. The audit methodology provides details on actual service provided without the bias prevalent in self-reporting. However, some limitations need to be acknowledged. A large proportion of the survey respondents (38%) were physiotherapists, which may limit the applicability of the results for nursing, medical and other allied health professionals. Audit data collected was limited by what was documented in the medical record, therefore details regarding the content of the services provided may be limited. Audit results relating to the medications provided for pharmacological interventions of challenging behaviours should be interpreted with caution, as the reasons for administering each medication was not documented. Some medications (such as beta-blockers) serve a multi-purpose and may not have been prescribed solely for managing challenging behaviours. These audit and results are from one ward in one hospital in South Australia, therefore limiting the broader understanding and generalisability of results.

9.5 Conclusion

This chapter explored the contextual factors to the implementation of evidence-informed practice for TBI behaviour management in the acute hospital setting. Audit findings suggest evidence-informed TBI behaviour management is variable. Survey findings suggest staff were predominantly uncertain about their level of knowledge and confidence of CPG recommendations for TBI behaviour assessment and management strategies. Implementation strategies are required for adoption of evidence and guideline recommendations into practice, in addition to the need for staff education and training to further develop their knowledge and confidence.

9.6 Chapter summary

This chapter described an audit of current practice and a survey of staff to address the aim of the thesis to explore barriers, enablers and contextual factors to the implementation of evidence-informed practice to inform strategies to improve TBI behaviour management in the acute hospital setting. As the final study conducted for this PhD, results within this chapter verify the findings highlighted in previous chapters of this thesis. This includes the need for detail on applicability and implementation for adoption of CPG recommendations into clinical practice (Chapter Six); the need to build staffs' knowledge and confidence (Chapter Seven); minimise concerns and risk of injury because of challenging behaviours after TBI (Chapter Seven); and the need for education and information to families (Chapter Eight). This chapter provides pre-implementation data that can be used to inform implementation strategies for improvements and evidence-informed practice for the management of challenging behaviours after TBI in the acute setting. Chapter Ten will present a discussion of the thesis findings with considerations for improvements in clinical practice with implementation strategies outlined. Implications for future research and policy will also be discussed.

CHAPTER 10 DISCUSSION AND CONCLUSION

This chapter provides an overview of the main findings of the series of studies conducted in this thesis and highlights the novel contributions to knowledge. In addition, implications for clinical practice, implementation strategies, future research, and policy are presented. Strengths and limitations are identified.

10.1 General summary

This thesis has explored the factors relating to the management of challenging behaviours after TBI in the acute hospital setting. The literature review in Chapter Two introduced TBI, the prevalence and risks associated with challenging behaviours, and current state of knowledge for TBI behaviour management. Implementation science was then introduced, including the rationale for the need for implementation frameworks to understand contextual factors influencing implementing evidence into practice for TBI behaviour management within the acute hospital context. Chapter Three outlined the methodological overarching worldview of pragmatism, and frameworks used to inform design and interpretation of data. Chapter Four described an initial pilot study, which involved the development and implementation of a consistent, clinically pragmatic TBI behaviour management approach in hospital settings. Investigation of the evidence and quality of CPGs for the management of challenging behaviours after TBI was conducted in Chapter Five and Chapter Six.

There was a need to explore the barriers, enablers and contextual factors to inform the implementation of evidence into practice for improvements in TBI behaviour management in the acute hospital setting. Three studies were conducted to explore this aim, guided by implementation frameworks. Focus groups described in Chapter Seven were conducted with staff experienced in working with patients with challenging behaviours after TBI to explore the barriers and enablers to managing challenging behaviours after TBI in acute hospital settings, underpinned by the i-PARIHS implementation framework. The perspectives of family members were gained through interviews to understand the family experiences of the management of challenging behaviours after TBI in the hospital setting (Chapter Eight). Contextual factors to the implementation of evidence-informed practice to inform strategies to improve TBI behaviour management in the acute hospital setting were explored in Chapter Nine through an audit of current practice and a survey of staff.

The studies from this thesis provide original contributions to knowledge. It was feasible to implement a consistent approach to the assessment and management of challenging behaviours after TBI in acute hospital settings, with results demonstrating positive outcomes in lowered use of

restraints and admission costs. The evidence and CPGs for the management of challenging behaviours after TBI in the acute setting have been identified and evaluated, highlighting the need for more evidence and implementation of CPG recommendations. There are multiple barriers, but also enablers and contextual factors to the implementation of evidence-informed TBI behaviour management approaches in the acute hospital setting. Furthermore, implementation strategies to support future implementation in clinical practice have been recommended and are outlined in the subsequent sections of this discussion chapter.

Based on the findings of this thesis, the approaches to improve the management of challenging behaviours after TBI in acute settings need to incorporate strategies that address the complex ecological systems of the acute hospital context, including the hospital environment; improving staffs' knowledge and skills; consistent staffing workforce and resources; person-centred, compassionate care; supportive teamwork; and provision of support and information to families are factors that need to improve over time. Collectively, the studies within this thesis contribute to new knowledge for people with TBI and their families, clinicians, hospital services, organisations, policy makers, and researchers about the implementation factors relating to effective, best-practice interventions for managing challenging behaviours after TBI in the acute hospital setting.

10.2 Synthesis of key findings

Each research study addresses the aims of the thesis and makes an important contribution to research in acute TBI care, challenging behaviour management and implementation science. The key findings of the studies are discussed in the subsequent sections of this chapter. Recommendations for improvements in clinical practice and implementation strategies, along with considerations for future research and policy development are also be outlined.

As outlined in Chapter Two, challenging behaviours are common after TBI with a prevalence estimated at 25-57% in the acute setting (McNett et al., 2012; Phyland et al., 2021). Challenging behaviours after TBI pose many risks to patients and staff (Beaulieu et al., 2008; Bogner et al., 2015; Bogner et al., 2001; Kosch et al., 2010; Lequerica et al., 2007; Luauté et al., 2016; McNett et al., 2012; Nikathil et al., 2017; Ponsford, 2012a; Sandel & Mysiw, 1996) and contributes to emotional strain and distress for family members of patients with TBI (Brooks et al., 1986; Kivunja et al., 2018; Norup et al., 2010; Rao & Lyketsos, 2000; Rao et al., 2009). TBI continues to have a high incidence within Australia and internationally (Dewan et al., 2019; Faul et al., 2010; Helps et al., 2008), therefore the complexities of the management of challenging behaviours after TBI, the ongoing risks to patients, families and staff associated with challenging behaviours, the variability in management strategies provided, and the impact on hospital organisations will not ease over time without future innovations for improvements and robust evaluations of implementation.

10.2.1 Lack of high-quality evidence and guidelines

Findings from studies within this thesis highlight the lack of equivocal evidence of non-pharmacological and pharmacological interventions for the management of challenging behaviours after TBI in acute settings, with a lack of high-quality CPGs to apply best-practice into acute clinical care.

Findings from the umbrella review in Chapter Five confirmed the evidence relating to non-pharmacological interventions was scarce, and the evidence relating to pharmacological interventions was equivocal, with studies lacking quality. Findings from this umbrella review support previous findings of the limited evidence for non-pharmacological interventions (Carrier, Ponsford, Phyland, et al., 2022; McNett et al., 2012) and pharmacological interventions (Fleminger et al., 2006; Hicks et al., 2018; Levy et al., 2005; Luauté et al., 2016; McNett et al., 2012; Phyland et al., 2020) for the management of challenging behaviours after acute TBI. Appraisal of CPGs conducted in Chapter Six found only two CPGs were deemed high-quality. Of the high-quality CPGs, summarised recommendations were predominantly based on expert opinion, which corroborates previous findings emphasising practice recommendations are predominantly based on expert opinion due to a lack of high-quality studies and empirical evidence (Carrier, Ponsford, Phyland, et al., 2022; Luauté et al., 2016; Ponsford et al., 2023). Furthermore, the appraised CPGs lacked explicit detail to describe implementation and applicability of their recommendations into clinical practice, which limits adoption of evidence into practice, and contributes to variability in care in clinical practice (Grol, 2001; Pereira et al., 2022). Furthermore, in Chapter Seven, staff reported the lack of evidence to inform clinical decision making was a barrier to effectively managing challenging behaviours after TBI in acute settings. The lack of evidence impeded clarity in staff decision making, and therefore staff facing uncertainty about the perceived benefits of management strategies and consequences or risks of injury. These findings align with previous research whereby nurses reported concerns in making clinical decisions to identify changes, and minimising physical injury whilst promoting recovery when caring for patients with TBI (Oyesanya et al., 2018). The lack of evidence and high-quality guidelines contributes to staffs' uncertainty and lack of clarity in their clinical decision making, justification, and potential consequences of the clinical decisions.

10.2.2 Variability in care

Findings from studies in this thesis found the management of challenging behaviours for acute TBI patients was variable, and did not encompass a consistent, comprehensive approach (Flanagan et al., 2009).

Although the pilot study in Chapter Four found a high fidelity of the uptake of the implemented consistent behaviour management approach, these results were not sustained. The subsequent

study in Chapter Nine involved an audit of current practice, with findings confirming that evidence-informed practice for TBI behaviour management in the acute hospital setting was variable, supporting the need to consider implementation factors for sustainability. Survey findings outlined in Chapter Nine also indicated staff were predominantly uncertain about their level of knowledge and confidence in applying CPG recommendations for TBI behaviour assessment and management strategies, despite good knowledge of evidence, and knowledge of guidelines and access to guidelines. These findings highlight the gap in knowledge and confidence in adopting CPG recommendations into practice, emphasising the need for CPGs to provide explicit detail on applicability and implementation of recommendations into clinical settings to minimise variability in care (Block et al., 2023; Shafi et al., 2014). The synthesis of high-quality CPG recommendations provided in Chapter Six and published by Block et al. (2023) provides a novel guide for staffs' clinical decision making when working with patients with challenging behaviours after TBI in hospital and inpatient rehabilitation settings. However, to close evidence-practice gaps and improve adherence to CPGs, the explicit description of application and implementation strategies of new and updated versions of CPGs is needed (Grol, 2001; Pereira et al., 2022) to minimise variability in care to patients with TBI (Shafi et al., 2014).

The variability of staffs' knowledge, confidence and experience are barriers to the implementation of consistent, quality care within the hospital context (Geerligs et al., 2018). This thesis highlights that a lack of staffs' skills, knowledge and confidence can impede on the consistent delivery of evidence-informed care for TBI behaviour management in acute hospital settings (Carrier et al., 2021; Giles et al., 2013; Kivunja et al., 2018; Oyesanya et al., 2018). Furthermore, the audit findings in Chapter Nine highlighted a substantial frequency of injuries occurred to patients, family members and staff during the acute admission. It is therefore unsurprising that staff voiced concerns for their risk of injury when working with patients with TBI and challenging behaviours during the focus groups in Chapter Seven. There is a critical need to address the variability in care, lack of knowledge and skills of staff to minimise risk of injuries to patients, families and staff resulting from challenging behaviours after TBI in acute settings. More frequent and formal training programs to develop and maintain staffs' skills in managing challenging behaviours after TBI within the acute hospital setting is warranted (Carrier et al., 2021; Carrier, Ponsford, & McKay, 2022; Oyesanya et al., 2018).

10.2.3 Contextual factors relating to the acute hospital setting

Findings from studies in this thesis highlighted contextual factors relating to the acute hospital setting from the perspectives of staff, and families, and an audit of current practice.

Findings from Chapter Seven highlight the staffing related factors, knowledge, and confidence, contributing to difficulties in effectively managing challenging behaviours after TBI in the acute

setting. This is exacerbated by the lack of a consistent workforce with limited understanding of TBI behavioural symptomology. Families expressed compassionate, person-centred care from staff who built rapport with patients with TBI was an important factor in identifying and managing challenging behaviours. Studies within this thesis emphasise the need for more experienced hospital staff, with adequate skills, confidence and competence to be able to effectively and proactively manage TBI challenging behaviours. These findings confer with previous studies indicating limited staffing, and insufficient knowledge and skills of staff, limit implementation of evidence-informed TBI behaviour management approaches (Carrier, Ponsford, & McKay, 2022; Giles et al., 2013; Oyesanya et al., 2018). Provision of staff training and skill development, provision of information and resources, with ongoing supervision and support to staff are strategies that may improve staff's agency in effectively managing challenging behaviours (Carrier et al., 2021; Carrier, Ponsford, & McKay, 2022; Holloway & Tasker, 2019; Kivunja et al., 2018). Given the inconsistent, casual and rotational workforce of hospital staffing, a simple suite of education modules is not the single solution The hospital context is complex with medically focussed care limiting proactive, patient-centred behaviour management approaches. Therefore, explicit, multifaceted implementation strategies are required that address the contextual barriers of staffs' knowledge and confidence and sustained adoption of evidence-informed practice into acute clinical care.

Families described opportunities for family involvement in behaviour management were effective strategies to identify and prevent triggers. Involving families, who are willing and able to be involved in the care to patients with TBI, can support person-centred care, as families have a personalised understanding of the patient prior to their injury, which can facilitate proactive, individualised behaviour management strategies (Lindlöf et al., 2023). This thesis identified the critical need for more support and information to families during the acute stage of their family member's TBI. The lack of support and information to family members with challenging behaviours after TBI was a novel finding relating to the acute setting, but corroborates previous findings based in subacute and community settings (Braine, 2011; Fisher et al., 2020; Holloway & Tasker, 2019; Kratz et al., 2017; Murray et al., 2006). Acute care should also incorporate the provision of support and information to families during the acute phase of TBI. Further support and information are needed for families due to their risk of emotional distress and burden, and to encourage family involvement in acute TBI care.

Results from studies in this thesis support previous findings and highlight that the hospital environment is not conducive to supporting calm, low stimulation to minimise triggers to escalating challenging behaviours for people with TBI (Carrier, Ponsford, & McKay, 2022; Oyesanya et al., 2018; Ponsford, 2012a; Snow & Ponsford, 2012). The contextual barriers relating to the hospital environment, the lack of resources and staffing shortages to effectively manage challenging

behaviours after TBI in the acute setting will need to be addressed for future improvements. Restrictive devices (such as mechanical restraints) are used at times; Code Blacks occur, and there are injuries to patients, families and staff as a result of challenging behaviours after TBI in the acute setting (Nikathil et al., 2017; A. H. Wong et al., 2017). Hospital funding is lacking to provide the necessary resources and consistent staffing. But without policies, guidelines and standards of clinical care, changes to invest and prioritise in resources for effective, proactive TBI behaviour management will be difficult for hospital organisations and health systems.

Hospital staff are demonstrating a readiness for change in this area of acute care. The positive fidelity findings of Chapter Four confirmed hospital staffs' receptiveness to apply quality improvement interventions to patients with TBI (Block et al., 2022). Findings from Chapter Seven of this thesis also highlight that staff who work together as a team and feel supported by leadership are enablers for effective TBI behaviour management in the acute setting. These findings support the need for a collaborative approach involving the expertise of the multi-disciplinary team to address complex interventions in healthcare (Gagliardi et al., 2016; Skivington et al., 2021). Further collaboration and championing of staffs' readiness for change will be needed to promote broader hospital and organisational congruence for the sustainable implementation of improvements into practice within acute hospital settings (Kirchner et al., 2020).

The management of challenging behaviours after TBI requires input from collaborative expertise of the multi-disciplinary team to address the complex problems in acute care practice (Carrier, Ponsford, & McKay, 2022; Denis et al., 2002; Gagliardi et al., 2016). Complex problems in healthcare require complex solutions with multifaceted, collaborative approaches involving expertise from team members (Skivington et al., 2021). To address complex interventions in healthcare, research needs to understand the influence of the contextual factors within the ecological systems of the hospital context (Bronfenbrenner, 1979; Pfadenhauer et al., 2017; Skivington et al., 2021). The variability of patient presentations; hospital staffing skills, competence and confidence; complex health services and systems; the clinical environment; lack of policies, guidelines, standards and funding are multilevel ecological system barriers to the implementation of improvements in TBI behaviour management within the hospital context (Bronfenbrenner, 1979; Geerligs et al., 2018).

This thesis identified the contextual factors influencing evidence-informed TBI behaviour management in the acute hospital setting. Identification of contextual factors are imperative for pre-implementation planning for tailored implementation strategies. Implementation strategies can be selected and trialled to facilitate successful adoption of evidence into practice (Eccles & Mittman, 2006; Kirchner et al., 2020; McNett et al., 2019; Squires et al., 2019; Tucker et al., 2021), taking

into account the barriers, enablers and contextual factors within the acute hospital setting with facilitation the key ingredient for successful implementation (Harvey & Kitson, 2016).

In summary, this thesis has highlighted the pre-implementation contextual factors that need to be considered for future implementation of improvements for the management of challenging behaviours after TBI within the acute hospital context. Further work is required in this area of healthcare, and should incorporate collaboration between researchers, policy makers, clinical and organisational leaders, clinicians, families, and people with TBI.

Future research is needed to investigate the efficacy of behaviour management strategies, but also to evaluate the effectiveness of the implementation of improvements. Further education and training are required to build staff experience, confidence and competence, with support from hospital leaders, and funding for the required resources to adequately manage challenging behaviours after TBI in acute settings. Policies, standards of clinical care, and guidelines that comprehensively detail the implementation of assessment and management strategies for challenging behaviours in the acute setting will be beneficial. Auditing and reporting of practice against policies, standards and guidelines can monitor clinical performance and funding initiatives (Australian Commission on Safety and Quality in Health Care, 2023). Importantly, families want to be actively involved in the care to patients with TBI to enable person-centred care. Family involvement also necessitates more support and information provided to families during the acute phase of TBI. To achieve these future improvements within the complex hospital context, implementation strategies are required with evaluation using implementation frameworks.

The subsequent sections of this chapter will outline the implications for improvements in clinical practice with recommended implementation strategies, and considerations for future and research and policy.

10.3 Implications and recommendations

10.3.1 Implications for practice

Although further research is needed to understand the efficacy of management strategies for TBI challenging behaviours in acute hospital settings (Block et al., 2021; Carrier, Ponsford, Phyland, et al., 2022; Hicks et al., 2018), some pragmatic, tangible strategies from the findings in this thesis can be implemented into clinical practice. This includes strategies which can be pragmatically translated for improved care to patients with challenging behaviours after TBI in acute hospital settings, as outlined in Table 10.1.

Table 10.1 Strategies for improvements in to TBI behaviour management in acute clinical practice

Hospital environments	• Promote a quiet room or ward with reduced noise. • Avoid overstimulation with lights off or dimmed, blinds or curtains closed. • Restrictions on number and duration of visitors. • Secured doors of entry and exit to wards to promote secured wandering and minimise absconding.
Staff training for TBI behaviour management	• Regular and routine provision of education, training, modules, professional development relating to TBI, challenging behaviour symptomology and management strategies. • Orientation including provision of information and resources to new, rotating and relieving staff. • Practical support to build experience, confidence, skills within the acute ward. Practical support could include inexperienced staff observing more experienced staff, peer feedback on interactions with patients and documentation. • Challenging behaviour question and answer (Q&A) at daily huddles for handover of identified triggers and effective management strategies. • Mentorship and supervision. Experienced staff dedicated to supporting new, rotating, inexperienced staff. • In-reach support (visiting in person or virtually) from specialised brain injury rehabilitation services. • Demonstrated competencies achieved for staff working with patients with TBI and challenging behaviours.
Promoting safety to patients, families and staff	• Falls prevention strategies (for example low bed, mats on the floor). • Training for de-escalation and awareness of escalation of aggression. • More detailed documentation and reporting of injuries resulting from challenging behaviours.

Methods to assess and identify triggers and behaviour changes	• Regular assessment every four hours including descriptive documentation with correct terminology of behaviours. • Explicit documentation (found easily in medical records) for behaviour assessments. • Behaviours assessed are described at huddles and handovers. • Ward-based quality improvement indicator to audit and report on frequency of assessment and documentation of challenging behaviours.
Support re-orientation and emergence from PTA	• Provide familiarising items and information to the person. • Allow family to bring in personal possessions or share photos. • Frequent orientation and reassurance. • Structured care, assessments and therapy to minimise fatigue. • Allow for regular rest breaks and facilitate day-night routine.
Promote non-pharmacological strategies as first line of management	• Service or ward-specific guide outlining recommended non-pharmacological strategies. Guide listing non-pharmacological strategies need to be readily accessible within the hospital and ward (for example online and hard copy versions) and provided to staff working with TBI patients with challenging behaviours at each shift. • Explicit documentation of non-pharmacological strategies used with TBI patients with challenging behaviours at each encounter or shift. • Ward-based quality improvement indicator to audit and report on use of non-pharmacological strategies.
Documentation of pharmacological strategies	• Service or ward-specific guide outlining recommended pharmacological strategies. The guide should outline recommended pharmacological agents, preferred route, doses, frequency, and contraindicators of medications. • Explicit documentation of pharmacological strategies used and documented reasoning of use of pharmacological agents.

	• Ward-based quality improvement indicator to audit and report on use and documentation of pharmacological strategies (including medications with dual or multi-purpose).
Minimise use of restrictive devices	• Minimise use of restraints (physical, mechanical, chemical). • When restrictive devices are indicated during crisis situations, third party consent is obtained with transparent reasoning communicated to the family and/or significant other. • Promote awareness within the team of environmental restraints (for example wheelchair lap belts, or an over-way table across a chair blocking a person's ability to move freely around the room).
Opportunities to support patient's communication	• Every TBI patient with challenging behaviour has a communication assessment to determine if limited communication is a trigger. • Provide a range of communication strategies (verbal, written or pictorial). • Documentation, handover and updates to family of effective communication strategies. • Provide instructions in the most simple and reliable means.
Adequate staffing levels	• Consistent staff trained in working with people with TBI • Increase staffing levels/ratios for patients with TBI and challenging behaviours. • Minimise casual and/or relieving staff where possible. • When casual or relieving staff cannot be avoided, have a dedicated, experienced staff member to provide practical support and detailed handover. • training for TBI behaviour management to casual agencies and their staff.
Specialised staffing	• Multi-disciplinary team within the ward providing care to patients with TBI. • Consider psychology involvement specifically for

	management of challenging behaviours in acute settings. • Better access to neuropsychiatry services (including in-reach support) within the acute setting in a timelier manner.
Family involvement in care to patients with TBI	• Conduct initial comprehensive assessments of patients with TBI with family members to understand pre-morbid factors. • Encourage family involvement to promote person-centred care. • Family involvement in providing diversional and preventative strategies.
Education to families	• Routine provision of education to the person with TBI and their family. • Documentation of education that was provided to the person with TBI and their family.
Teamwork	• Cohesive teams who work in a collaborative and supportive. manner to provide comprehensive, person-centred care to patients with TBI. • Opportunities for team members to debrief and seek counselling to promote staff resilience. • Support from leadership by valuing, acknowledging and thanking staff and teams.

Within clinical practice, provision of staff training, supporting competent skill development, practice experience, with ongoing mentoring and supervision are strategies that will support staffs' ability to effectively manage challenging behaviours with patients with TBI (Carrier, Ponsford, & McKay, 2022; Kivunja et al., 2018). Resources that provide structured guides for assessment, recommended management strategies, minimising restrictive devices; supporting re-orientation; documentation and handover processes, and opportunities for communication for patients (Ponsford, 2012a), relevant within the context of the acute hospital setting are strategies that can be used for quality improvement, auditing and reporting. Ideally, increased staffing levels maximising staff trained in working with patients with TBI challenging behaviours, with access to specialised staff within the hospital setting are workforce resources that will require leadership support and funding. There is a need for the routine provision of information to people with TBI and

their families (Bayley et al., 2016; Ponsford, 2012a), and to promote family involvement in care to patients with TBI during the acute admission.

These clinically relevant strategies for improvement will require funding, resources, collaboration, and research evaluation in clinical practice. Hence implementation strategies involving facilitation will be required to promote successful implementation of improvements to clinical practice (Harvey & Kitson, 2015; Kirchner et al., 2020) for TBI behaviour management in acute settings.

10.3.2 Implementation strategies

The management of challenging behaviours after TBI in acute hospital settings is complex, variable and dynamic (Geerligs et al., 2018; Skivington et al., 2021). Implementing innovations or improvements into acute clinical practice for the management of challenging behaviours will require multifaceted, tailored, facilitated implementation strategies (Bauer et al., 2015; Kirchner et al., 2020; McNett et al., 2019; Tucker et al., 2021). Findings from the studies within this thesis have outlined the barriers, enablers and contextual factors influencing implementation of evidence-informed improvements for TBI behaviour management within the acute hospital setting. Future improvements and research will require facilitation of implementation strategies to increase the likelihood of effective and sustainable implementation of evidence-informed TBI behaviour management in acute hospital settings (Geerligs et al., 2018; Harvey & Kitson, 2015; Kirchner et al., 2020; McNett et al., 2019). Based on the barriers, enablers, and contextual factors identified in this pre-implementation planning program of research and with consideration of the Expert Recommendations for Implementing Change (ERIC) compilation (Powell et al., 2015), a range of implementation strategies are recommended. These implementation strategies are outlined in Table 10.2 and are specifically for the implementation of evidence-informed improvements for the management of challenging behaviours after TBI within the acute hospital context.

Table 10.2 Implementation strategies for innovations for improvement to the management of challenging behaviours after TBI in the acute context

Access new funding	Access new or existing funds to facilitate implementation of improved management of challenging behaviours after TBI in acute settings.
Incentives for best-practice	Hospital organisations incentivise the adoption and implementation of improvements to the management of challenging behaviours after TBI in the acute hospital setting.
Audit, feedback, and readjust	Collect and summarise clinical performance of TBI behaviour management over a specified time period. Clinical performance data can be inclusive of the strategies for improvements in clinical practice outlined in Table 10.1. Feedback audit data to clinicians, service leaders and hospital administrators. Adjust clinical practices and implementation strategies to continuously improve the quality of care.
Build a coalition	Recruit and cultivate relationships with clinicians, service leaders and partners motivated to improve acute TBI behaviour management throughout the implementation process.
Identify champions	Identify and prepare individuals who are motivated and dedicated to supporting and driving the implementation of innovations within the acute setting.
Capture and share local knowledge from early adopters	Capture local knowledge from other sites that have adopted and implemented effective TBI behaviour management. Benchmark with other sites on how implementers and clinicians make successful change to the management of challenging behaviours in their setting.
Change clinical care standards for accreditation	Strive to develop a challenging behaviour clinical care standard to encourage clinical improvements for accreditation.
Change the physical environment, structure and equipment	Evaluate current hospital configurations and adapt the physical environment, structure and/or equipment needed to best accommodate targeted improvements to managing challenging behaviours after TBI.

Change documentation or record systems	Change recording systems to allow better documentation of implemented assessment, management strategies, and clinical outcomes for TBI behaviour management.
Conduct small tests of change	Given the complexity of managing challenging behaviours after TBI in acute settings, implement changes using small tests of change prior to translating the changes to broader systems, networks and organisations. Small tests of change can incorporate audit and feedback, quality cycles, and process evaluation.
Collaborate with leaders	Inform and intervene with key opinion leaders (service leaders, administrators, governing executives, consumer representatives) to influence the clinical innovation to colleagues and consumers/patients. Provide updates to leaders with data on implementation processes and outcomes.
Conduct education meetings and visits	Hold meetings, in-services and presentations toward a range of stakeholders (clinicians, service leaders, administrators, patient/consumer representatives, and family members) to teach them about the clinical innovations for improvements to the management of challenging behaviour after TBI in acute settings. Have trained experts provide in-reach support, or have stakeholders attend outreach visits to learn about TBI behaviour management in their clinical practice.
Conduct ongoing training in a dynamic manner	Plan and conduct ongoing training in the clinical innovation of TBI behaviour management in an ongoing basis to ensure training to rotation workforce and clinical competency to staff. Ensure training is dynamic to capture a range of clinicians within their variable work contexts.
Change clinical teams	Add specialised disciplines (for example psychology and neuropsychiatry) to the clinical team providing care to patients with challenging behaviours after TBI. Ensure the clinical team has the essential skills to make it more likely the clinical improvements can be delivered.

Develop academic partnerships	Partner with university or academic units for training and research skills to the implementation process.
Develop and implement a quality toolkit	Develop, test and introduce a toolkit of terminology; training modules; manuals or protocols for best-practice of acute TBI behaviour management in clinical practice; quality monitoring systems; and implementation and consumer outcomes. Toolkits can be used and distributed to make it easier for clinicians to learn how to deliver the clinical innovation and evaluate the quality and implementation of the improvements.
Tailored facilitation	The process of supporting implementation of innovations, in a multifaceted, tailored approach to address barriers and leverage enablers within the acute hospital context. Facilitate ongoing consultation with experts in the strategies used to support implementation.
Involve patients/consumers and families	Involve patients and families to be active in their care, including clinical innovations to improve care. Involve patients and families in providing feedback on the clinical innovation and the implementation effort.
Provide clinical supervision	Provide clinicians with ongoing supervision focusing on improvement innovations in clinical practice. Provide training for clinical supervisors who will support the innovation and can deliver training to others about the clinical innovation.
Remind clinicians	Develop reminder systems designed to help clinicians recall information and prompt them to use the clinical innovation.
Workshop for future scale up and dissemination	Engage stakeholders in a formal workshop to provide input about the clinical innovation, implementation efforts, scale up to broader systems and organisations, and dissemination of implementation outcomes to external organisations.

These recommended implementation strategies can be selected and tailored to address barriers and leverage enablers within acute hospital settings for improvements to the management of challenging behaviours after TBI. In addition to improvements to clinical practice with facilitated

implementation strategies, further research and policy changes are required. The following sections of this chapter will discuss implications for future research and policy changes.

10.3.3 Implications for research

Rigorous studies investigating the efficacy of behaviour management interventions after acute TBI are required (Block et al., 2021; Carrier, Ponsford, Phyland, et al., 2022; Hicks et al., 2018; Luauté et al., 2016; Wiart et al., 2016). The evidence for the management of challenging behaviours after TBI in acute settings is equivocal (Block et al., 2021). Future research should focus and include non-pharmacological and pharmacological behavioural interventions to investigate the most effective behaviour management approaches for the acute patient with TBI. Large-scale, powered, randomised controlled trials evaluating TBI behaviour management programs in acute and inpatient rehabilitation settings are warranted to demonstrate evidence of effectiveness. The lack of evidence relating to the management of challenging behaviours for patients experiencing PTA indicates further primary research is required to investigate effective behaviour management in the early recovery phase of TBI (Block et al., 2021).

Published CPGs should be updated, and new CPGs developed with rigour and quality with a specific focus on the implementation of recommendations to clinical practice to promote adoption of evidence into practice and staffs' uptake of knowledge (Block et al., 2023; Pereira et al., 2022). CPGs appraised in this thesis were relevant to inpatient acute hospital and inpatient rehabilitation settings. Given the complexity of TBI behaviour management in the acute hospital setting, future research could include the development of CPGs specifically relevant to the acute context.

Chapter Four of this thesis involved implementing a consistent behaviour management approach for patients with TBI in the acute hospital setting. The implemented behaviour management approach included a TBI Behaviour Scale and Record form, a behaviour assessment form adapted from the Overt Behaviour Scale (Kelly et al., 2006). The TBI Behaviour Scale and Record form was not evaluated for psychometric properties, including validation and reliability for acute TBI populations. Additionally, CPGs do not provide recommendations for the assessment or identification of challenging behaviours after TBI in acute hospital settings. Therefore, further research is needed for valid, reliable, comprehensive and consistent assessment methods for identification of challenging behaviours after TBI within the acute setting.

Lack of experienced staff was an identified barrier to effectively managing challenging behaviours after TBI in the acute hospital setting. Furthermore, acute hospital staff lack knowledge and confidence in applying guideline recommendations for the assessment and management of challenging behaviours after TBI. Developing staffs' skills, knowledge and confidence are critical in promoting improved TBI behaviour management in acute settings (Carrier et al., 2021; Carrier,

Ponsford, & McKay, 2022; Giles et al., 2013; Kivunja et al., 2018; Oyesanya et al., 2018). There is a need for research to evaluate skills, training and education from university curriculum to clinical practice programs to identify areas for improvements to education and training for clinical staff working with patients with TBI in acute hospital settings. Furthermore, there is a need for research to develop and provide information, education and support to families and patients with challenging behaviours after TBI during their acute admission (Bayley et al., 2016). Co-designed research investigating tailored information to people with TBI and their families, including how much information, mode of delivery, and timing of provision is needed.

The environment of the hospital setting has been identified as a contextual barrier to effectively minimising stimulation triggers in the management of challenging behaviours after TBI (Carrier, Ponsford, & McKay, 2022; Ponsford, 2012a; Snow & Ponsford, 2012). Built environments research considers the building design of healthcare services to best support staff and patients (Bernhardt et al., 2021). Emerging research is exploring the impact of the physical hospital environment on the care of people with dementia, and for people undertaking rehabilitation after stroke (Bernhardt et al., 2021; Waller & Masterson, 2015). Future research contributing to the evidence base of hospital redesign of environments, with collaborative engagement with patients with TBI, families, clinicians and building architects would be beneficial. Future improvements to the environmental design of hospitals, wards, and rooms will be a novel change to be evaluated to minimise overstimulation and support emergence from PTA for patients with TBI experiencing challenging behaviours (Ponsford, 2012a), and many other hospitalised population groups experiencing challenging behaviours.

Studies within this thesis highlighted service and workforce related challenges relating to TBI behaviour management within the hospital context. Service-related outcomes were highlighted in Chapter Four and Chapter Nine, and include the use of restraints, frequency of Code Blacks, length of hospital stay and admission cost. Workforce related challenges were identified in Chapter Seven, Chapter Eight, and Chapter Nine, and include inexperienced and inconsistent staffing, lack of resources to effectively manage TBI challenging behaviours, with a substantial number of injuries to patients, families or staff identified in an audit of current practice. Further investigation of the frequency and impact of injuries to patients, families, and staff as a result of challenging behaviours after TBI in acute settings would be beneficial (A. H. Wong et al., 2017). Research incorporating economic evaluations may elucidate if investing in staffing, skill development and adequate resources to effectively manage challenging behaviours after TBI would result in cost effective reductions of hospital length of stay, admission costs, impact on workforce injuries, and costs of Code Black security incidents. Future research incorporating economic evaluations of TBI behaviour management strategies may be pivotal in changing hospital organisational funding for better care to patients with TBI.

Studies within this thesis identified barriers, enablers and contextual factors that may influence the successful implementation of improvements for evidence-informed practice for the management of challenging behaviours after TBI in acute hospital settings. This provides pre-implementation planning information, which is imperative in testing and trialling implementation strategies for future innovations and improvements in this area of practice (Kirchner et al., 2020; Powell et al., 2015). Future research should incorporate hybrid effectiveness-implementation methodology to robustly evaluate the clinical effectiveness of interventions, innovations or improvements, whilst also evaluating the implementation approaches. Hybrid effectiveness-implementation research has a dual focus on clinical effectiveness whilst evaluating implementation processes, techniques or strategies and outcomes to support rapid translation of research findings into routine practice (Curran et al., 2012).

10.3.4 Implications for policy

The Australian Commission on Safety and Quality in Health Care (ACSQHC) outlines National Safety and Quality Health Service (NSQHS) standards to provide nationally consistent care, protect the public from harm, and improve the quality of health service provision (Australian Commission on Safety and Quality in Health Care, 2017, 2023). Furthermore, the ACSQHC outlines clinical care standards to describe the care patients should be offered by health professionals and health services for a specific condition or defined clinical pathway (Australian Commission on Safety and Quality in Health Care, 2023). National policies and standards are imperative for funding to drive change in hospital organisations and systems to promote safe, high-quality and consistent care to patients.

This thesis has outlined that challenging behaviours are common after acute TBI in hospital settings, and that effective management of challenging behaviours is complex within the acute setting. Challenging behaviours are not unique to hospitalised TBI population groups. Challenging behaviours are also prevalent among hospitalised patients with dementia (White et al., 2017), particularly those with behavioural and psychological symptoms of dementia (Dyer et al., 2018; Sampson et al., 2014); patients with mental health problems (Johnston et al., 2019); and adults with intellectual disability (Kalb et al., 2016). Similarly to the findings presented in this thesis, other hospitalised population groups exhibiting challenging behaviours experience variable quality of care, the hospital environment is challenging, with the person surrounded by unfamiliar surroundings and changing staff (White et al., 2017). Care is often variable, lacking person-centred interventions and family involvement (Johnston et al., 2019), with restrictive devices and coercive measures utilised (Luciano et al., 2014; Muir-Cochrane & James, 2020; Muir-Cochrane et al., 2020). Given the complexity and barriers to effective, consistent care to diverse population groups who exhibit challenging behaviours during acute hospitalisations, more detailed national standards

of care should be detailed by ACSQHC. The NSQHS standards describe comprehensive care standards to predict, prevent and manage aggression and violence, and minimise restrictive practices (Australian Commission on Safety and Quality in Health Care, 2017), however these comprehensive care standards lack detail on the assessment of challenging behaviours or triggers, and lack tangible strategies for proactive, person-centred approaches. Therefore, a dedicated clinical care standard for challenging behaviours in acute hospital settings should be considered.

In collaboration with researchers, guideline developers, clinical experts, and consumer representatives, the ACSQHC should consider a dedicated challenging behaviour clinical care standard to outline: the identification and assessment of challenging behaviours; interventions and treatments for challenging behaviours and underlying triggers; patient-centred information and support; minimising restrictive practices; pharmacological management; minimising adverse effects of care; and transitions from hospital care.

In summary, further research, policy changes for a dedicated clinical care standard, and improvements to clinical practice trialling implementation strategies evaluated through future research are needed for improvements to the management of challenging behaviours after TBI in acute hospital settings.

10.4 Strengths and limitations

Each study within this thesis has strengths and limitations which have been discussed in the preceding chapters. A summary of these strengths and limitations is listed below in Table 10.3.

Table 10.3 Strengths and limitations of studies in this thesis

Study and chapter	Strengths	Limitations
Study one outlined in Chapter Four: Implementing a behaviour management approach in the hospital setting for individuals with challenging behaviours during acute traumatic brain injury	• Design informed by integrated knowledge translation. • Comparison of outcomes following implementation of a clinically pragmatic improvement approach.	• Methodological design limits certainty of outcomes occurring as a direct result of the intervention. • Limited implementation process outcomes. • Differing numbers of participants in intervention and control groups. • Missing admission cost data from one site • Retrospective evaluation is limited by documentation in records.
Study two outlined in Chapter Five: Evidence for the management of challenging behaviours in patients with acute traumatic brain injury or post-traumatic amnesia: An umbrella review	• Novel umbrella review methodology. • Comprehensive search strategy and inclusion criteria. • Quality appraisal and data extraction conducted by two reviewers. • Methodology summarises existing research syntheses.	• Review was not registered. • Findings are dependent on the reporting studies in the included reviews. • Limited currency of findings.
Study three outlined in Chapter Six: Clinical practice guideline recommendations for the management of challenging behaviours after traumatic brain injury in acute hospital	• Novel systematic review of clinical practice guidelines. • Comprehensive search strategy, inclusion criteria, and methodological rigour. • Quality appraisal and data extraction conducted by two reviewers.	• Late registration of review. • Guidelines only published in English. • Differentiation of high, moderate, low quality appraisal criteria.

and inpatient rehabilitation settings: A systematic review	• Excellent degree of inter-rater agreement of quality appraisal. • Summarised high-quality guideline recommendations.	
Study four outlined in Chapter Seven: Barriers and enablers to managing challenging behaviours after traumatic brain injury in the acute hospital setting: The perspectives of staff	• Robust qualitative methodology. • Design informed by i-PARIHS implementation framework. • Broad range of disciplines and experiences of participants.	• Differing number of participants and mix of disciplines. • Service leader participated which could influence open discussions by other participants. • Reduced workforce and hospital demand during COVID-19 could have influenced participants perspectives.
Study five outlined in Chapter Eight: The management of challenging behaviours after traumatic brain injury in the acute hospital setting: The perspectives of families	• Robust qualitative methodology. • Theory informed interpretation using Ecological Systems Theory (EST). • Novel perspectives of families.	• Reduced workforce and hospital demand during COVID-19 could have influenced participants perspectives. • People with TBI did not participate.
Study six outlined in Chapter Nine: Current practice and knowledge of the management of challenging behaviours after traumatic brain injury in the hospital setting: An audit of practice and a survey of staff	• Pre-implementation pilot data. • Systematic audit methodology. • Development and use of audit template.	• Large proportion of survey respondents were from one discipline. • Audit data was limited by documentation in records. • Limited generalisability of results.

Each study conducted in this program of research informed the next study, emphasising the theoretically and evidence-informed design strengths across the six studies within this thesis. This thesis has the key strength in providing a comprehensive profile of pre-implementation factors relating to the implementation of evidence-informed management of challenging behaviours after TBI, specifically relevant to the acute context. Additionally, incorporating ecological systems theory and implementation frameworks in this research highlights the methodologically robust strength in evaluating the evidence, the perspectives of recipients (staff and families), and the contextual factors relating to the multiple ecological levels within the acute hospital setting. This thesis provides a novel and valuable contribution by highlighting the need for further research; policy and guideline changes; the need for improvements to clinical practice; and the patient and family needs; with implementation strategies recommended to be trialled for implementation of improvements in this area of practice.

Limitations of this program of research should also be acknowledged. The study in Chapter Four poses the limitation in implementing a behaviour management approach into clinical practice with patients with TBI prior to undertaking reviews of evidence and guidelines. This limitation reflects the Higher Research Degree progression from Masters by Research to PhD candidature. After study one, upgrade to PhD occurred, therefore subsequent study designs were incorporated into this body of research (refer to Appendix 1 for timeline of studies). Findings from the quantitative studies (Chapter Four and Chapter Nine) should be interpreted with caution due to the lack of controlled comparator and small sample sizes which impact the certainty of outcomes and generalisability of the results (Altman, 1991). Broadly, the findings outlined in this thesis have limited generalisability, as studies were conducted within the South Australian context. However, recent studies (Carrier et al., 2021; Carrier, Ponsford, & McKay, 2022) have investigated the international context in relation to the management of challenging behaviours during the acute phase of TBI with results corroborating findings within this thesis. This thesis incorporates a broad range of perspectives (evidence, guidelines, staff, families) relating to the management of challenging behaviours after TBI in acute settings. However, the missing voice in this thesis is that of the person with TBI. Attempts were made to recruit people with TBI for interviews in Chapter Eight, but with no uptake. In the future, more effort should be made to incorporate the lived experience from the perspectives of people with TBI in research studies.

10.5 Conclusion

This thesis has explored the factors relating to the management of challenging behaviours after TBI in the acute hospital setting. Six studies were undertaken to address the aims of this thesis in the context of the acute hospital setting by: describing the implementation of a consistent TBI behaviour management approach in two hospitals; summarising the evidence and guidelines relating to the management of challenging behaviours after TBI; and exploring the barriers, enablers and contextual factors that influence the implementation of evidence-informed practice for TBI behaviour management. Key findings from this program of research emphasise the novel contribution to knowledge relevant to clinical practice, implementation, research and policy.

Findings of this thesis emphasise the need for improvements to the hospital environments, staffing, training and education, resources, teamwork, family involvement, future research and policy changes. There is a need for further research on the effectiveness and implementation of interventions for the management of challenging behaviours after TBI in the acute hospital setting. Further education and training are required to build staffs' experience, competence and confidence, with support from hospital leaders, and funding for the required resources to adequately manage challenging behaviours after TBI in acute settings. Family involvement in the care to patients with TBI can support person-centred care, and in addition families need support and information during the acute phase. Care to patients with TBI exhibiting challenging behaviours can be variable, with environmental, clinical skills, workforce availability, and resource barriers identified. Detail on the implementation of guideline recommendations into clinical practice, and policy changes for the development of a national clinical care standard may influence healthcare improvements for consistent, safe and high-quality care to hospitalised patients with challenging behaviours after TBI.

Tangible strategies have been outlined for the implementation of improvements into clinical practice, however further improvements, research and evidence are required. Multifaced improvements are required across individual, organisational and ecological system levels of the acute hospital context, therefore requiring implementations strategies. Importantly, this program of research has highlighted the complexity of the management of challenging behaviours after TBI in the acute setting, thereby identifying the need for implementation science in this area of practice and future research. In summary, this thesis has highlighted the pre-implementation factors that need to be considered for future implementation, evaluation, and sustainability of improvements for the management of challenging behaviours after TBI within the acute hospital context.

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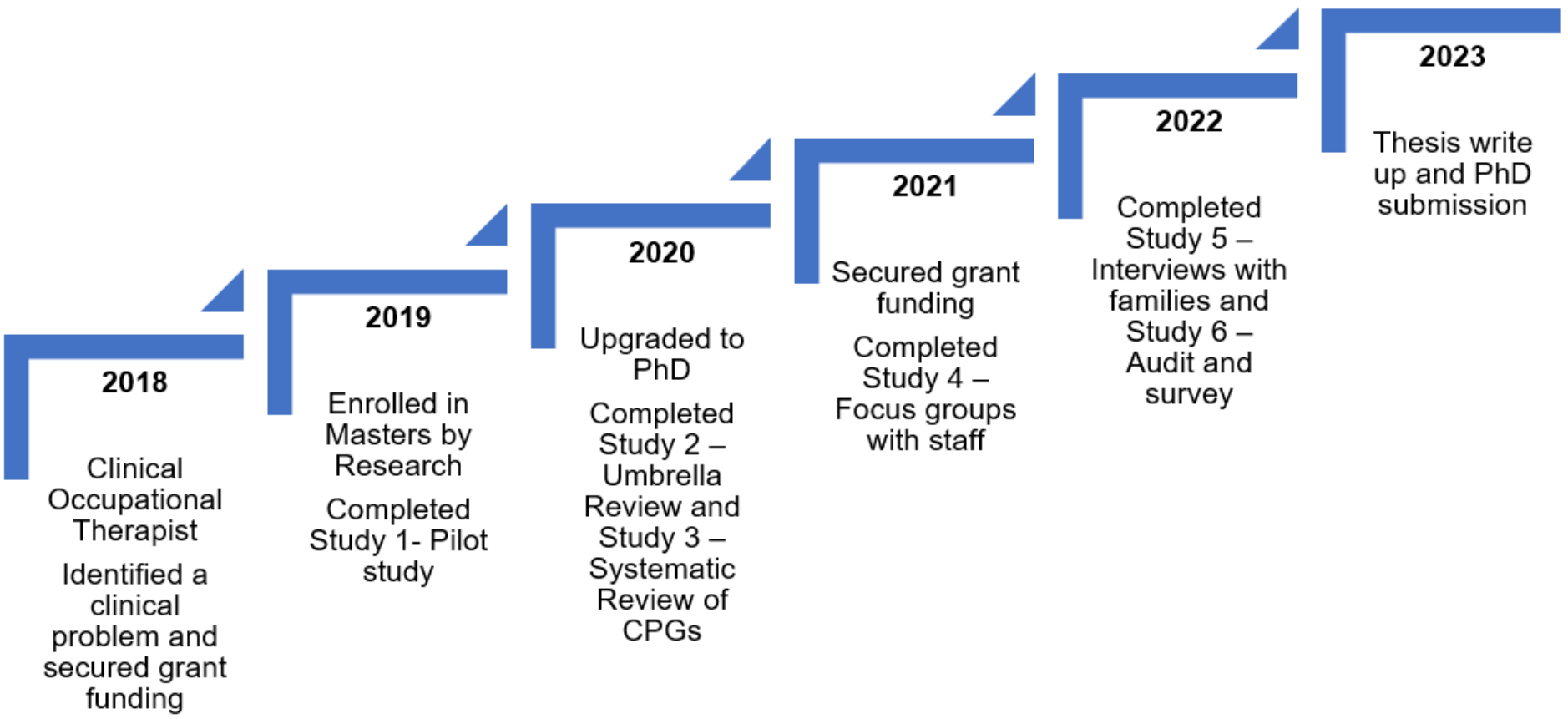
APPENDICES

Appendix 1 Timeline of studies undertaken during this PhD



Appendix 2 Ethics approvals

Office for Research

Flinders Medical Centre
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Flinders Drive, Bedford Park SA 5042
Tel: (08) 8204 6453
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Government of South Australia
SA Health
Southern Adelaide Local Health Network

Final Approval for Ethics Application

26 April 2018

Mrs Heather Block
SALHN Allied Health Occupational Therapy Department
Flinders Medical Centre
BEDFORD PARK SA 5042

Dear Mrs Block

OFR Number: 281.17
Project title: Improving and standardising the management of patients with behaviours of concern in acute traumatic brain injury.
Chief Investigator: Mrs Heather Block

Ethics Approval Period: 28 March 2018 – 28 March 2021

The Southern Adelaide Clinical Human Research Ethics Committee (SAC HREC EC00188) have reviewed and provided approval for this application which meets the requirements of the *National Statement on Ethical Conduct in Human Research (2007)*.

You are reminded that this letter constitutes **Ethics** approval only. **Ethics approval is one aspect of the research governance process**.

You must not commence this research project at any SA Health sites listed in the application until a Site Specific Assessment (SSA), or Access Request for data or tissue form, has been approved by the Chief Executive or delegate of each site.

Public health sites approved under this application:

- Flinders Medical Centre
- Royal Adelaide Hospital

The below documents have been reviewed and approved:

- HREA form dated 27 March 2018
- HREA project description v1 dated 12 October 2017
- Participant Information Sheet/Consent Form v1 dated 09 February 2018
- Consumer interview questions v1 dated 15 January 2018

Appendix 3 Umbrella Review MEDLINE search strategy

1. exp Craniocerebral Trauma/

2. ((brain or craniocerebral or forebrain or skull or forehead or frontal region or head or occipital region or parietal region or temporal region or diffuse axonal or intracranial or intra-cranial or cerebral) and (injur* or trauma* or concuss* or damage or contusion or lacerat*)).ti,ab.

3. exp Brain Injuries/

4. post traumatic amnesia.ti,ab.

5. or/1-4

6. acute.ti,ab.

7. and/5-6

8. affective symptoms/

9. aggression/

10. agonistic behavior/

11. apathy/

12. bullying/

13. delusions/

14. depersonalization/

15. depression/

16. malingering/

17. obsessive behavior/

18. stalking/

19. paranoid behavior/

20. problem behavior/

21. schizophrenic language/

22. self-injurious behavior/

23. self mutilation/

24. suicide/

25. suicidal ideation/

26. suicide, attempted/

27. wandering behavior/

28. (affective disturbances or affective symptom* or aggression or agonistic behavior or agonistic behaviour or bullying or delusions or depersonalization or depression or malingering or obsessive behavior or obsessive behaviour or stalking or paranoid behavior or paranoid behaviour or problem behavior or problem behaviour or schizophrenic language or self-injurious behaviour or self-injurious behavior or self mutilation or self-mutilation or suicide or suicidal or wandering behaviour or agitation or anxiety or behaviour change or behavior change or challenging behaviour* or challenging behavior* or confusion or delirium or irritab* or mood disorder* or mood swing* or violen* or emotional disturbance* or alexithymia* or disinhibition or apathy or withdrawal or lack of initiation or social inappropriateness or sexual inappropriateness or perseveration or behaviours of concern or behaviors of concern).ti,ab.

29. or/8-28

30. and/7,29

31. exp Therapeutics/

32. behavior control/

33. (therap* or treatment* or therapeutic*).ti,ab.

34. (management or behaviour management* or behavior management* or behavior control* or behaviour control* or behavioral manipulation* or behavioural manipulation*).ti,ab.

35. or/31-34

36. and/30,35

37. limit 36 to English language

38. limit 37 to humans

39. Limit to peer reviewed journal and all journals and ("0100 journal" or "0110 peer-reviewed journal" or "0120 non-peer-reviewed journal" or "0130 peer-reviewed status unknown

40. Limit 39 to (case reports or clinical study or clinical trial, all or clinical trial, phase i or clinical trial, phase ii or clinical trial, phase iii or clinical trial, phase iv or clinical trial or comparative study or controlled clinical trial or "corrected and republished article" or dataset or duplicate publication or evaluation studies or government publications or guideline or journal article or meta-analysis or multicentre study or observational study or practice guideline or pragmatic clinical trial or published erratum or randomized controlled trial or retracted publication or "retraction of publication" or "review" or systematic reviews or validation studies or peer reviewed journal or all journals or journal or peer-reviewed journal or non-peer-reviewed journal or peer-reviewed status unknown)

Appendix 4 CPG systematic review MEDLINE search strategy

Search term 1	Search term 2	Search term 3	Search term 4
"brain hemorrhage, traumatic" OR "brain stem hemorrhage" OR "traumatic" OR "cerebral hemorrhage, traumatic" OR "brain injuries" OR "diffuse" OR "diffuse axonal injury" OR "brain injuries, traumatic" OR "brain contusion" "TBI OR TBIs" OR "diffuse axonal injur*" OR "DAI or DAIs"	"guideline*" OR "practice guideline" OR "management or clinical or practice" OR "Clinical practice guideline" OR "clinical protocol"	"psychomotor agitation" OR "agitation" OR "hyperactivity OR restless" OR "aggression or self injur*"	"challenging behaviour" OR "challenging behavior" OR "behaviour of concern" OR "behavior of concern" OR "problem behaviour" OR "neurobehaviour" OR "neurobehavior"

Appendix 5 Constructs of the i-PARIHS framework utilised for data collection, data analysis and mapped themes for Chapter Seven

Constructs of i-PARIHS framework	Focus group questions relating to constructs of i-PARIHS framework	Data analysis	Themes identified as barriers and enablers mapped to characteristics of i-PARIHS constructs
Innovation Evidence for TBI behaviour management	Focus group questions relating to: • Current evidence and guideline recommendations • Relevance of the evidence to the acute	**Inductive-deductive coding and mapping to i-PARIHS constructs**	Innovation Barrier: Limited evidence to inform clinical decision making
Recipients Staff providing care and patients receiving care	Focus group questions relating to: • Staff skills and knowledge • Confidence in decision making		Recipient Barrier: Lack of experienced staff with practical skills
Context Ward level, organisational, and policy characteristics	Focus group questions relating to: • Hospital environment and resources • Leadership, feeling valued, teamwork, culture		Context Barrier: Hospital systems and resources
			Recipients and Context Enabler: Consistent, person-centred care
			Recipient Enabler: Supportive teams

Appendix 6 Staff focus group question guide

Acute Focus Group Guide

Focus Group Demographic Survey

- What is your professional discipline?
- How many years have you worked with patients with TBI?
- Which setting do you work at?
    - Acute setting
    - Subacute Brain Injury rehabilitation setting

i-PARIHS Construct	***Question***
Recipients Skills Knowledge Decision making	**1) What is your perspective on your current level of knowledge and confidence related to TBI behaviour management?** *Prompt:* Is there available knowledge/learning opportunities about effective management of challenging behaviours in your setting? If yes, what are these? *Prompt:* Can you describe any barriers to learning the practical skills of how to manage challenging behaviours with patients with TBI? If yes, what are these? **2) How easy or difficult do you find coming to a clinical decision about TBI behaviour management?** *Prompt:* How do you identify if a patient needs management of challenging behaviours? **3) Do your emotions (such as fear) ever influence your management of challenging behaviours in patients with TBI?** *Prompt:* What strategies could improve this? *Prompt:* How do you maintain resilience?

Evidence/Innovation - Evidence - Relevance to setting	**4) Current evidence recommends TBI behaviour management involves comprehensive behaviour assessment, commence with non-pharmacological approaches, then progressing to pharmacological approaches. Evidence and policy recommend reducing use of restraints (including physical, mechanical, and chemical). Beta Blockers for acute agitation. Positive behaviour approaches in rehabilitation. Do you think these recommendations are practical/realistic in your setting? Why/why not?** *Prompt:* How could TBI behaviour management be improved?
Local Context Leadership Culture Staff valued Environment and resources	**5) How does the physical environment influence effective TBI behaviour management?** *Prompt:* Does the physical environment in the acute setting help or hinder effective management of challenging behaviours? How? *Prompt:* Do you have suggestions on how the physical environment can be improved in hospital settings? 6**) What are the necessary resources to effectively managing challenging behaviours for patients with TBI?** *Prompt:* available staffing, access to doctors to prescribe appropriate medications, assessments used, forms, behaviour support plans, therapy **7) How is your role in managing challenging behaviours in patients with TBI valued in your setting? How is this demonstrated?**
Organisational and Outer Context	**8) What effect do colleagues and management team have on effective TBI behaviour management? How?**

Strategic priorities Policies & procedures Systems Teamwork	**9) What workforce factors influence effective TBI behaviour management in your setting?** *Prompt:* rostering, staffing numbers, stable teams, rotating staff, agency/casual v's regular staffing

Subacute Rehabilitation Focus Group Guide

Focus Group Demographic Survey

- What is your professional discipline?
- How many years have you worked with patients with TBI?
- Which setting do you work at?
    - Acute setting
    - Subacute Brain Injury rehabilitation setting

i-PARIHS Construct	***Question***
Recipients Skills Knowledge Decision making	**1) What has helped develop your knowledge/learning about effective TBI behaviour management in your setting?** *Prompt:* How are the specialised/specific TBI management approaches taught and applied to patients with TBI? *Prompt:* Acute staff report skills are learnt through experience and trial and error. How do you find this in developing skills in TBI behaviour management in the subacute setting? **2) Do your emotions (such as fear) ever influence your management of challenging behaviours in patients with TBI?**

	Prompt: What strategies could improve this? *Prompt:* How do you maintain resilience?
Evidence/Innovation - Evidence - Relevance to setting	**3) Current evidence recommends TBI behaviour management involves comprehensive behaviour assessment, commence with non-pharmacological approaches, then progressing to pharmacological approaches. Evidence and policy recommend reducing use of restraints (including physical, mechanical, and chemical). Positive behaviour approaches in rehabilitation.** **Do you think these recommendations are practical/realistic in the acute hospital setting? Why/why not?** **4) What could be implemented in acute hospitals to improve management of challenging behaviours in the early phase of TBI recovery?**
Local Context Leadership Culture Staff valued Environment and resources	**5) How does the physical environment influence effective TBI behaviour management?** *Prompt:* Do you have suggestions on how this can be improved in hospital settings? **6) What are the necessary resources required to effectively manage challenging behaviours for patients with TBI?** *Prompt:* available staffing, access to doctors to prescribe appropriate medications, assessments used, forms, behaviour support plans, therapy **7) How is your role in managing challenging behaviours with patients with TBI valued in your setting? How is this demonstrated?**

Organisational and Outer Context Strategic priorities Policies & procedures Systems Teamwork	**8) What effect do colleagues and management team have on effective TBI behaviour management? How?**

Appendix 7 Family interview question guide

1. Tell me a bit about your family member's experience in hospital with challenging behaviours in the early stage of recovery from TBI
2. How was your family member's challenging behaviour managed?
3. What worked well for managing challenging behaviours within the hospital setting?
4. How did the ward environment influence effective management of challenging behaviours?
5. What seemed to trigger challenging behaviours? How were triggers identified?
6. In your experience what could have worked better in managing challenging behaviours in the acute hospital setting for your family member after their TBI?
7. Did you receive any information or education about challenging behaviours or behaviour management after TBI in the acute hospital setting?
8. Do you have any additional thoughts you would like to share?

Appendix 8 Published paper: Evidence for the management of challenging behaviours in patients with acute traumatic brain injury or post-traumatic amnesia: An Umbrella Review

Block, H., George, S., Milanese, S., Dizon, J., Bowen-Salter, H., & Jenkinson, F. (2021). Evidence for the management of challenging behaviours in patients with acute traumatic brain injury or post-traumatic amnesia: An Umbrella Review. *Brain Impairment*, *22*(1), 1-19. https://doi.org/10.1017/BrImp.2020.5

Publication available at: https://doi.org/10.1017/BrImp.2020.5

Appendix 9 Published paper: Implementing a behavior management approach in the hospital setting for individuals with challenging behaviors during acute traumatic brain injury

Block, H., Hunter, S. C., Bellon, M., & George, S. (2022). Implementing a behavior management approach in the hospital setting for individuals with challenging behaviors during acute traumatic brain injury. *Brain Injury*, 1-11. https://doi.org/10.1080/02699052.2022.2110941

Publication available at: https://doi.org/10.1080/02699052.2022.2110941

Appendix 10 Published paper: Clinical practice guideline recommendations for the management of challenging behaviours after traumatic brain injury in acute hospital and inpatient rehabilitation settings: A systematic review

Block, H., Paul, M., Muir-Cochrane, E., Bellon, M., George, S., & Hunter, S. C. (2023). Clinical practice guideline recommendations for the management of challenging behaviours after traumatic brain injury in acute hospital and inpatient rehabilitation settings: A systematic review. *Disability and Rehabilitation*, 1-11. https://doi.org/10.1080/09638288.2023.2169769

Publication available at: https://doi.org/10.1080/09638288.2023.2169769