University of Southampton

Faculty of Environmental and Life Sciences

School of Health Sciences

Design of a web-based intervention for the rehabilitation of Balance following Traumatic Brain Injury in military personnel

by

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Abstract

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Traumatic Brain Injury (TBI) is the most common neurological injury treated at the Defence Medical Rehabilitation Centre accounting for approximately 80% of referrals to the Neurological Rehabilitation Team (Dharm-Datta et al. 2015). TBI is associated with a range of deficits including physical, cognitive, behavioural and those effecting executive function (Jaeger et al. 2014). Balance problems have been shown to be present long-term in 43% of persons with TBI, and dizziness symptoms are present in up to 80% of TBI patients in the first 24 hours (Jourdan et al. 2016, Maskell et al. 2007). 'Balance Retraining', is a web-supported programme, that assists older people to overcome balance problems and dizziness symptoms (Essery et al. 2015), but it has not been designed for use by people with TBI, taking into consideration their potential range of deficits. Gaining an understanding of the target population is vital to create an intervention that is accessible to people with TBI.

This study aimed to design an online balance rehabilitation programme for military personnel with TBI. The objective was to conduct FGs with HCPs that have experience of working military personnel who have sustained a TBI. The FGs aimed to discover their experiences of working with this population and gain their opinions on the existing 'Balance Retraining' programme to discover if changes were necessary so that it could be used by people in the military with TBI. This was an Interpretative Phenomenological Analysis study. A combination of previously described IPA methods were used to analyse the FG data. These findings were then used to inform design changes for a prototype website.

Findings from the FGs discovered that TBI is a complex and multi-faceted disorder and each TBI patient is unique. To meet these individual needs HCPs described the importance of a specialist MDT and the need to consider each patients' complexities when conducting balance rehabilitation. Being in the military is described as resulting in different challenges and demands from their rehabilitation. These complexities all effect the design of a web-based programme for this population and these factors were described in five categories, visual presentation, military concepts, programme features, communicating information and getting patient buy in.

Subsequent research should focus on creating a prototype website using the findings from this study. Think-aloud studies with TBI patients in the military followed by a series of case studies and a feasibility study should be considered to develop and create the prototype website programme.

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Research Thesis: Declaration of Authorship

Print name: Hannah Fitzgerald

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I declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

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Definitions and Abbreviations

TBI	Traumatic Brain Injury.
NRT	Neurological Rehabilitation Team
NHS	National Health Service
DMRC	Defence Medical Rehabilitation Centre
IPA	Interpretative Phenomenological Analysis
UK	United Kingdom
USA	United States of America
GSW	Gun Shot Wound
WHO	World Health Organisation
MOI	Mechanism of Injury
PTA	Post Traumatic Amnesia
RCT	Randomised Controlled Trial
BBS	Berg Balance Scale
FIM	Functional Independence Measure
RITS	Rehabilitation Intensity of Therapy Scale
HEP	Home Exercise Programme
DHI	Disability Handicap Index
ABI	Acquired Brain Injury
VR	Virtual Reality
HCP	Health Care Professional
FG	Focus Group
PT	Physiotherapist
OT	Occupational Therapist
SLT	Speech and Language Therapist
ERI	Exercise Rehabilitation Therapist
PIS	Participant Information Sheet

MSK	Musculoskeletal

Chapter 1 Introduction

1.1 The Purpose of this Chapter

This introductory chapter is an overview of the author's background with the reasons behind the choice of project for this Masters of Philosophy. This will explore the use of an online resource in the rehabilitation of balance issues following traumatic brain injury (TBI). The background to the subject will be discussed and go on to give the aims and objectives for the study.

1.2 Selection of the project

I am a military physiotherapist in the British Army with a specialist interest in the management of TBI. I have worked with the neurological rehabilitation team (NRT) at the Defence Medical Rehabilitation Centre (DMRC), a centre that manages neurological patients, among others, within the British Armed Forces. Due to the dynamic nature of work the Armed Forces conducts, service personnel are deployed to different environments, in locations across the globe. The patient population managed by the NRT are working throughout the world, where consistent healthcare for specialist conditions can be difficult to access. Therefore, all personnel with TBI are treated centrally by the NRT and required to travel to the DMRC for care. With ever progressing technologies, online interventions increase the opportunity to access specialist services. This increased access aims to improve outcomes for TBI patients. Therefore, I started to consider options for a project which explores options for military patients with a TBI to access specialist services online.

When considering how to progress with an online project, members of the supervisory team had experience in the development of a Lifeguide programme having recently created LifeCIT. LifeCIT is an online programme developed by Meagher et al. (2015) for constraint-induced movement therapy for stroke patients. I then discovered other Lifeguide programmes including 'Balance Retraining'. This is a Lifeguide intervention for balance and dizziness created at the University of Southampton (Geharty et al. 2017).

Balance is an area of TBI rehabilitation that I found very relevant to the military population. Having previously worked in the National Health Service (NHS), I noted that there were clear differences between the healthcare systems and patient population in the NHS and the military. My experience of working with the military showed that the demands on balance for those in the Armed Forces appeared to be higher when compared with civilian roles. Greater numbers of military TBI patients appeared to work on balance. This was potentially due to the types of environments and roles they were aiming to return to, requiring a higher demand on their balance. Could an online resource be used to improve military TBI patient's access to specialist TBI rehabilitation and the management of balance problems?

1.3 Background

TBI is the leading cause of death and disability in young people (Werner & Engelgard 2007). Due to the demographic of military personnel and the tasks they undertake, TBI is the most common neurological injury treated at the DMRC, accounting for approximately 80% of referrals to the NRT (Dharm-Datta et al. 2015). DMRC provides inpatient rehabilitation for injured personnel in the British military. The NRT assesses and treats all neurological patient referrals to DMRC including TBI. Balance problems are often associated with TBI (Jourdan et al. 2016). 'Balance Retraining' is a web-supported programme to assist older people (aged 50 years and older) to self-manage and reduce balance problems and symptoms of dizziness (Essery et al. 2015). The 'Balance Retraining' website could be used to assist the rehabilitation of balance for military TBI patients. However, due to the potential for cognitive, behavioural, and executive function difficulties (Jager et al. 2014) and the difference in demographic, it is anticipated that the needs of service personnel with TBI will be different to those currently targeted by 'Balance Retraining'.

1.4 Aim, Research Questions and Objectives of the study

1.4.1 Aim

The aim of this Masters of Philosophy is to conduct some of the preparatory stages in designing an online balance rehabilitation programme for military personnel with TBI. The study aims to discover what changes would need to be made to the existing 'Balance Retraining' programme for it to meets the needs of military personnel with traumatic brain injury.

1.4.2 Research Questions

The research questions are as follows:

RQ1: What are the challenges and opportunities experienced by healthcare professionals when rehabilitating balance in UK military personnel following TBI?

RQ2: What are the opinions of healthcare professionals on the use of 'Balance Retraining' with military TBI patients?

RQ3: What changes are necessary for the current ‘Balance Retraining’ programme to be used by people in the military with a TBI?

1.4.3 Objectives

The objectives are as follows:

1. Conduct a series of focus groups with healthcare professionals that have worked with military TBI patients to discover the opinions on the use of ‘Balance Retraining’ with military TBI patients.

2. Conduct interpretative phenomenological analysis to generate findings of the focus group data.

3. Using the findings from the focus groups to create a newly designed prototype website pages.

1.5 Thesis Contents

This thesis will now be broken down into a further six chapters;

Chapter 2: The literature review. This will examine existing literature of TBI, balance problems and current approaches to their rehabilitation. Also, the factors effecting rehabilitation of TBI, for example engagement in therapy, and the influence of being in the military.

Chapter 3: Methodology. This will discuss the ontological and epistemological stance for the project and how they support the chosen methods.

Chapter 4: The methods. This will describe and justify all processes for the study including participant recruitment, facilitation of the focus groups and data analysis. It will then go onto to detail processes for research governance and quality.

Chapter 5: The findings. The findings chapter describes the demographic of the FGs and discusses the themes generated from the Interpretative Phenomenological Analysis data analysis.

Chapter 6: Website design data analysis. This chapter describes how data from the focus groups was used to create prototype pages to be used as part of the website.

Chapter 7: Discussion. In this chapter the main findings are compared with current literature, alongside reflections from the author, strengths and limitations of the study and conclusions drawn from these discussions. Further work in the project area is detailed.

Chapter 2 Literature Review

2.1 Introduction

This chapter will discuss existing evidence behind the rationale for the study, specifically the background of TBI, its incidence, specifically in the military, the outcomes of TBI and the cost to society. It will explore why people experience problems with balance and the prevalence of balance problems following TBI. The rehabilitation of balance and physical problems will then be presented and the relevance of other impairments and their impact on the rehabilitation of TBI will be explored. The evidence behind progressions in rehabilitation technologies and how they might be used to improve rehabilitation outcomes for TBI will be presented alongside the evidence for the use of 'Balance Retraining'.

2.1.1 Conducting the Search.

The literature review search was conducted using the University of Southampton library systems and included the following search tools; medline, CINAHL, PUBMED.

Search terms included (head injury) or (traumatic brain injury) or (brain injury) and military or (armed forces) or (defence forces). This was then included with rehabilitation or management or treatment. Other searches were balance or dizziness then incidence or prevalence or numbers.

All titles were initially considered for relevance and if their content was deemed applicable then went onto consider abstracts. Where the paper held clinically relevant subject matter it was included in the literature review.

2.2 Definition of Traumatic Brain Injury

TBI is defined by the Scottish Intercollegiate Guidelines Network (2013) as a traumatically induced structural injury and/or physiological disruption of brain function as a result of an external force that is indicated by new onset or worsening of at least one of the following clinical signs, immediately following the event:

1) Any period of loss of or a decreased level of consciousness

2) Any loss of memory for events immediately before or after the injury

3) Any alteration in mental state at the time of the injury (confusion, disorientation, slowed thinking, etc)

4) Neurological deficits (weakness, loss of balance, change in vision, praxis, paresis/plegia, sensory loss, aphasia, etc) that may or may not be transient, or

5) Intracranial lesion.

2.2.1 Pathophysiology and Aetiology of TBI

TBI occurs when there is an impact to a person's brain great enough to cause physiological changes. The changes are often described as primary, such as the initial impact to the brain within the skull, or secondary, such as the cellular changes that occur causing further damage (Prins et al. 2013). TBI is categorised as mild, moderate, or severe depending on characteristics described on the Glasgow Coma Scale or the individual's level of consciousness at the point of injury, the length of post traumatic amnesia, and whether the injury has resulted in changes on a brain scan (Prins et al. 2013; Mustafa & Alshboul 2013).

The World Health Organisation (WHO) (2006) describes the most common causes of TBI to be road traffic accidents, falls and violence, with common contributing factors being drugs and alcohol, poverty and comorbidities. These factors bare resemblance to the causes of TBI in the military population, with the most common cause of TBI in the United Kingdom (UK) military being road traffic collisions, assaults and falls (Dharm-Datta et al. 2015). This changes during periods of conflict where combat injuries such as gunshot wounds (GSW) and blasts can lead to more open TBIs (Risdall 2011, Hawley et al. 2015).

2.3 The Implications of TBI

The impact of TBI is experienced around the world. The WHO published a report looking at global mortality and morbidity in 2020 which shows that injuries are a major and increasing cause of death and disability (WHO 2020). TBI is the leading cause of mortality and morbidity in people under forty five years and its numbers are rising (Werner & Engelgard 2007). The WHO (2006) estimates the annual number of individuals in the world affected to be 10 million. Each year in the UK 1500/100000 population report to emergency departments with a head injury and an estimated 1.2 million people in the UK live with some level of disability attributed to TBI (Kolias et al. 2013). This figure is often higher in undeveloped parts of the world. The predicted incidence of TBI in Africa is between 4 and 16 million new cases in 2050 (Wong et al. 2016).

There are several publications discussing the incidence of TBI. Peters et al. (2014) conducted a meta-analysis of twenty eight papers from sixteen different European countries, which calculated the European incidence rate of TBI as 262 per 100,000 population. The worldwide incidence rate of TBI has been shown to be slightly higher at 295 per 100000 with most TBIs occurring in the adult male population (Nugyen et al. 2016), which is the dominant demographic for this study.

2.3.1 The of Cost Traumatic Brain Injury to Society

In a report by the Centre for Mental Health, the annual cost of TBI was calculated at £15 billion (Parsonage 2016) with a potential lifetime cost saving of £863,000–£1.19 million when an individual undertakes effective rehabilitation within twelve months of injury (Humphreys et al. 2013). The cost of healthcare for military veterans and serving personnel in the United States of America (USA) has been shown to be significantly higher for those with TBI (Taylor et al. 2017). Taylor et al. (2017) looked at the comparative cost on healthcare of those with TBI diagnosis compared to those without and found costs two to three times higher for those with TBI than those screened as negative for TBI.

2.3.2 Outcomes of Traumatic Brain Injury

The cost of TBI can be attributed to a reduction in function, with 22% of people with TBI remaining moderately-severely disabled at a long-term follow-up 5-16 years after leaving rehabilitation (Schulz-Heik et al. 2016). TBI can result in long-term, multifaceted problems involving physical, cognitive, and related mental health issues which can lead to marked reduction in function (Jaeger et al. 2014). Neuro-motor impairments include paresis, involuntary movements, fatigue, and gait problems (Walker 2007). This has been shown to be present in 80% of the TBI population on admission, with over a third still displaying neuro-motor impairments two years after onset (Walker 2007). Management of these physical impairments can be negatively impacted by several issues that are related to TBI. These include behavioural, cognitive, and executive function difficulties for example, impulsiveness, anhedonia, obsessive behaviour, decreased attention, concentration, motivation, and insight difficulties (Arciniegas et al. 2002; Bailie et al. 2015; Lewis et al. 2015; Zacks et al. 2016).

2.4 Incidence of Traumatic Brain Injury in the military

This study will focus on UK Military personnel that have sustained a TBI. This section will discuss the numbers of these individuals to ascertain the potential numbers involved with comparison to world-wide militaries.

TBI is the leading cause of death and disability in young people (Basso et al. 2007) and the majority of the UK Armed Forces are aged under fifty years old with the average age being thirty one (Kirk-Wade 2024). Tasks undertaken by Armed Forces across the world can result in cases of TBI (Risdall 2011). When deployed overseas, the military will often be in high-pressured environments such as war zones in countries with varied safety standards. This results in increased risk of exposure to trauma and incidents such road traffic collisions and combat injuries. The conflicts in Iraq and Afghanistan saw rising numbers of TBI amongst the UK's military personnel (Hawley et al. 2015; Simcox et al. 2015). There was an increase in the incidence of TBI due to combat injury and terror-related injuries (Risdall 2011).

The literature search revealed four papers from the UK covering a 25-year period from 1989-2014. These incorporated years when the UK Armed Forces were deployed overseas in sustained conflict and times when they were not. These papers will therefore cover times when the UK was experiencing a higher incidence of TBI due to active conflict but will also reflect times when the military was not.

From these papers, TBI accounted for 19% (N=464) of all injuries requiring a trauma call in the UK Armed Forces from the Iraq and Afghanistan wars during 2003-2011 (Hawley et al. 2015). In the same period Smith et al. (2014) documented a total of 623 coalition military personnel (76.6% of the study population) that sustained a penetrating TBI. A total of ninety-one TBI patients from 2011-2014 presented to the DMRC (Dharm-Datta et al. 2015) and 8193 TBI diagnoses were recorded in the British Army in an eleven year period from 1989-1998 (McLeod et al. 2004).

Hawley's paper of UK Armed Forces reported a survival rate in of 39% (N=181) and of those survivors, 54.9% (N=102) went on to the DMRC for neurological rehabilitation. Hawley et al. (2015). Smith et al. (2014) reported a survival rate of 59% (N=368) however this study population included civilians and all coalition forces. Both papers retrospectively reviewed UK-Joint Theatre Trauma Registry (JTTR) data, a collection of data for every trauma call undertaken for a UK military casualty. Hawley et al. (2015) included only UK military personnel while Smith et al. (2014) reviewed all incidence of penetrating TBI regardless of the patient group. This could explain the higher numbers reported by Smith et al. (2014) despite including only penetrating injuries.

Dharm-Datta et al. (2015) provided details of all patients admitted to DMRC with TBI as part of a study of rehabilitation outcomes. Those with minimal consciousness were excluded however the numbers are provided. There were four patients (4.2%) during the study period with minimal consciousness in the UK military (Dharm-Datta et al. 2015). Hawley et al. (2015) states that 102 TBI patients were received at DMRC in a 9-year period from conflict zones. However, as DMRC treated ninety-five TBI patients in a three-year period, this suggests that even during periods of sustained conflict the UK military continues to see TBI patients from non-conflict causes. This is supported by the results from McLeod et al. (2004) who report over 8000 TBI diagnoses in the peroid they researched. While the UK was involved in conflict operations during 1989-1998 there were no sustained operations. The cause of the TBIs in that paper were not detailed however it is likely they were not all caused by battle injuries.

Hawley et al. (2015) stated that moderate to severe TBI accounted for 87% (N=402) of the injuries whereas Smith et al. (2014) included only penetrating TBI therefore, by definition, all patients would have sustained moderate to severe TBIs. The predominant mechanisms of injury (MOI) from both these papers were GSW and blast injuries. This provides evidence that conflict in that period resulted in moderate to severe TBI in the British military.

In addition, Dharm-Datta et al. (2015) reported 77% of TBI severity to be moderate-severe however did not include those with minimal consciousness which accounted for 4.2% but also explained that not all mild TBI were included either. Levels of severity reported could also be due to different tools for classification of TBI severity. Dharm-datta et al. (2015) used the USA Department of Defence tool and Hawley et al. (2015) used the Mayo classification. These elements will all lead to different representations of what is being reported however the results from Dharm-Datta et al. (2015) give a basis for the number of patients with moderate to severe TBI in the UK military that have received neurological rehabilitation in each period.

These four papers all present differences in numbers of TBI diagnosis, survival and severity in the UK military. Hawley et al. (2015), Smith et al. (2014) and Dharm-Datta et al. (2015) were all conducted during a similar time and included patients from all services of the military. The difference in numbers reported presenting at DMRC is potentially as a result of the wider cohort of patients that are included. Dharm-Datta et al. (2015) includes all sources of referral to UK Military rehabilitation therefore incorporates operational and non-operational injuries, not only Iraq and Afghanistan, whereas Hawley et al. (2015) and Smith et al. (2014) only discuss numbers from those specific theatre environments. McLeod et al. (2004) includes all TBI diagnosis regardless of cause however includes Army only not the wider military. The data was also collated during a much earlier period making this less applicable. In 1989 the UK military population was higher, and the operational environment would be less relevant than the more recent papers. Direct comparison between the papers is limited by these factors.

McLeod et al. (2004) retrospectively used data from Defence Analytical Statistics Agency and TBI was defined using the International Classification of Disease 9th and 10th revision. Smith et al. (2014) and Hawley et al. (2015) used JTTR data which is prospectively collected and includes all military personnel that have sustained an injury requiring a trauma call. Other nations use these classifications and data sources. This will give reliable data on all those where the injury or the scenario led to a casualty being evacuated however this does give the possibility that some mild TBI incidence will not have been included in the data if an injury did not require a trauma call which needs to be considered when drawing conclusions from this data.

2.4.1 Traumatic Brain Injury in the United States of America Military

The majority of military research is conducted in the USA. Papers from the USA explored the epidemiology of TBI in the military covering a period from 2000-2012. A total of 235,046 (4.2%) service members from all components of the military were diagnosed with TBI from 2000-2011. In 2013 The Centers for Disease Control and Prevention published a report to congress on TBI in the USA military. During a period of sustained conflict in Iraq and Afghanistan, incidence rates per year were reported at 1822.4/100,000 and when not conducting an enduring operation up to 720/100,000 (Frieden & Collins 2013). Documented incidence of TBI from all the USA articles ranged from 60.7/100,000 to 1811.4/100,000 (Ivins et al. 2010, Frieden & Collins 2013).

Regasa et al. (2016) discovered a significant increase in TBI diagnosis from pre- to post-deployment of service personnel. There is a spike in the first four weeks post-deployment where personnel are 8.4 times more likely to sustain a TBI. This is theorised by the author to be due to delayed reporting and diagnosis during the deployment. The increase continued for the entirety of seventy-six weeks in all but the Air Force. The causes of these TBI were commonly road traffic collisions and assaults (Regasa et al. 2016).

During the 13-year period, which incorporated the Iraq and Afghanistan wars, 4.2% of USA Military personnel were diagnosed with TBI. Military conflict results in an increase in TBI of up to 105% due to ballistic weapons, blasts and GSWs causing high numbers of penetrating and closed TBI (Frieden & Collins 2013). The risk of TBI following an overseas deployment is significantly higher than prior to deploying and this risk continues for an extended period (Regasa et al. 2016).

2.4.2 Incidence of Traumatic Brain Injury from additional Nation’s Armed Forces

Heoncamp et al. (2014) conducted an analysis of all Dutch battle casualties as the lead nation in the International Security Assistance Force mission in Southern Afghanistan. Results were drawn from the Dutch Medical Facility from 2006-2010. There was a total of 199 battle casualties, 1.2% of the total number of deployed personnel. The highest percentage of these were head and neck injuries at 32.2% and 90% of all the injuries were due to ballistic action. It can be deemed from this that 27% of the injuries were potentially TBI. Non-battle injuries were not included therefore incidence of injuries are very likely to have been higher as with other articles. GSW or blast is yet again a high cause of trauma to the head and neck providing further evidence from an additional nation that conflict results in head injury.

An article from Palestine carried out a retrospective study looking into the incidence of head injury from the three hospitals in Nablus (Younis et al. 2011). Medical notes from 2006 and 2007 were reviewed for diagnosis of all TBI. A total of 312 cases of head injury were recorded. GSW was the leading cause of injury. The data encompassed civilian populations from a conflict area. There is limited information provided regarding inclusion and exclusion criteria beyond the notes being reviewed if there was a history of head trauma. Additional inclusions were made in the presence of diagnosis of TBI however, it gives no details on how this was established. The author includes not just MOI but also perpetrators and demonstrates the results of actions of the Israeli military. No other papers discuss the perpetrators of the head injury, they purely look at the cause therefore the very fact that this is included does lead to the suspicion of potential bias however the authors report no conflict of interest. This paper provides evidence of an additional conflict and alternative conflict leading to head injury.

2.4.3 Numbers of Military Traumatic Brain Injury patients receiving rehabilitation

It is important to confirm that TBI is pertinent to the military population and with changes to the operational environment, confirm that TBI would still be relevant. The results show that over half of the survivors of TBI went on to neurological rehabilitation at DMRC (Hawley et al. 2015). In a five-year period, the USA military encountered 1654 head injury patients in the polytrauma rehabilitation system and in a three-year period the UK military rehabilitation system reported 91 patients (Nakase-Richardson et al. 2013; Dharm-Datta et al. 2015). This gives an indication of the numbers that require rehabilitation. Each of the papers utilised different methodology and sources of data. Dharm-Datta et al. (2015) included only patients referred to rehabilitation. However, this is very relevant data as this is the source of participants that will be used for this study. These participants include personnel from all services of the military with predominantly moderate to severe TBI. This paper captures three years of data of this patient group, from a period during a conflict, therefore provides applicable data for this study.

2.5 Rehabilitation of Traumatic Brain Injury

This section will now consider rehabilitation of TBI. This will cover literature from all populations, mostly civilian, where the majority of research has been undertaken however military studies have been included here when available. A period of rehabilitation is required to manage the physical impairments experienced following TBI. Conventional management of TBI involves specialist multi-disciplinary rehabilitation with a focus on repetitive task-orientated training being recommended for recovery of physical function (Vanderploeg et al. 2008; Turner-stokes et al. 2011; SIGN 2013). This approach seeks to achieve neuroplasticity through high intensity repetitions of functional exercises (Breceda and Dromerick 2013). This places a large demand on therapy hours and requires high levels of concentration and motivation from the patient at a time when fatigue management limits capacity for therapy (Klonoff 2010).

2.5.1 Rehabilitation outcomes

The following papers will discuss physical impairments associated with TBI and their rehabilitation. Walker (2007) conducted a multi-centre trial of 102 USA military service beneficiaries and sought to describe the neuro-motor impairments experienced by patients following severe TBI through conducting neurological examinations. Ataxia, gait impairments and paresis were the most common neurological impairments and were reported in 79.4% (N=81) of participants at the acute phase. Following 2 years of inter-disciplinary rehabilitation 35.5% (N=36) continued to display neuro-motor impairments.

Dharm-Datta et al. (2015) evaluated the vocational outcomes of British military TBI patients following inpatient neurological rehabilitation. The study found that 87% (N=69) were living independently and 13% (N=10) were living at home with support. A total of 92% (N=73) returned to work, of which, 34% (N=29) returned to military duties. The remaining 8% (N=6) were unemployed. This paper supports multi-disciplinary team (MDT) rehabilitation of TBI with favourable results for living independently and vocational outcome following TBI, however a longer outcome is required to see if this is maintained.

Walker (2007) reported that a third of TBI patients have residual physical impairments at 2 years after injury. When considering this with the findings from Dharm-Datta et al. (2015), at two years post-injury many patients will have returned to the community, some working in the military, others receiving support at home. Therefore, patients will be in varied locations and levels of dependency and may still require continued rehabilitation for ongoing physical impairments. The practical application of this may become more challenging as patients progress to higher levels of independence and are more dispersed. Therefore, therapeutic approaches need to be accessible to patients in all settings throughout inpatient rehabilitation and the community.

The outcome of TBI rehabilitation is multifactorial and improvement in physical impairments depends on a multitude of areas. Hart et al. (2014) considered what impact personal demographic, injury characteristics and rehabilitation input have on recovery trajectories following severe TBI in non-military patients. The study conducted a multicentre, multinational trial that measured functional outcome using the cognitive and motor components of the functional independence measure (FIM) which was carried out on admission, discharge and during rehabilitation. This paper found that recovery followed an upward trajectory with the rate of improvement slowing after 6 weeks. Walker (2007) concurred that most recovery was seen in the first six months and that interruptions in rehabilitation and severity of TBI at onset had a negative association with speed of recovery. Therefore, many factors can affect recovery and interruptions in rehabilitation can slow the rate of recovery. Programmes should be developed to provide consistent rehabilitation, and a web-based programme could assist with this.

2.6 Balance and TBI

Balance problems are a common physical impairment following TBI (Jourdan et al. 2016). This is due to somatosensory impairment and vestibular dysfunction (Basford et al. 2003; Pan et al. 2015). Impairment of the vestibular system is also often associated with dizziness, described as vertigo or the sensation of spinning, similar to feeling drunk (Maskell et al. 2007). Dizziness symptoms have been reported in 80% of patients in the first days following TBI and can last up to eighteen months following injury (Maskell et al. 2007, Maskell et al. 2009). Long-term impaired balance and co-ordination have been reported in up to 43% of patients after TBI (Basford et al. 2003; Jourdan et al. 2016). Dynamic and static postural stability has been shown to be reduced in military veterans who have sustained a mild TBI (Pan et al. 2015). The combination of reduced balance, with the cognitive difficulties associated with TBI, results in a high risk of falls (McCulloch et al. 2010) and fear of falling is reported to reduce general function following TBI (Maskell 2007).

2.6.1 Rehabilitation of balance

The following section will discuss four papers that have investigated the effectiveness of balance rehabilitation for TBI patients. All studies have been conducted with non-military patients. Sartor-Glittenberg & Brickner (2014) reviewed cerebellar ataxia rehabilitation, including balance, in single case studies of three TBI patients that underwent a neuro-rehabilitation treatment programme. The patients had varied age and time post-TBI and underwent an individualised programme to match each patient's needs regarding intensity and length of training. The programme involved activities for ataxia and mobility. Each of the patients improved in coordination and balance confidence as shown by significant improvements in the Berg Balance Scale (BBS), single-leg stand, and single-leg stand with eyes closed. The cases in this study were selected to show the potential benefits of this programme which must be considered when analysing the implication of these studies.

Kleffelgaard et al. (2016) concentrated on mild TBI with balance and dizziness with a series of four case studies. The patients completed an eight-week intervention of group and individual vestibular rehabilitation exercises and a home-exercise programme (HEP) with an exercise diary. The participants underwent a series of tests before and after the intervention, including the balance error scoring system, the high-level mobility assessment tool, the dizziness handicap index (DHI) and the quality-of-life after brain injury score. There were no adverse events from participants conducting home-based dizziness and balance exercises. Three of the four participants showed changes to all outcomes beyond minimal detectable change, however a larger number of participants are required to show significant difference. These case studies show successful and safe use of combined home-based and clinical setting exercise programme for balance rehabilitation. Furthermore, the diaries were reported to be beneficial and assisted participation in the programme. Where participants engaged with the diary, the introduction of a web-based programme could potentially assist in adherence to a programme and this paper details safe utilisation of home-based balance and dizziness exercises.

Drijkoningen et al. (2015) investigated the effect of an eight-week balance training programme with young TBI patients. The trial had three research arms, an intervention arm with TBI participants (N=19), an intervention arm with similar aged participants without TBI (N=19) and a third group without TBI that did not complete the training (N=10). There was no TBI control group. The balance training involved a computer-assisted HEP with a balance platform which maintained a log of the training. The results showed improvements in magnetic resonance imaging diffusivity of the cerebellar peduncle in the TBI group only, and in the cerebellum of both trained groups. The TBI group also displayed improvements in rhythmic weight shift testing and Equitest protocols which were carried out on the training platform. In this study, there was no functional measure, and these test protocols could have had elements of a learned response following the training. There was no long-term measure to see if these improvements were maintained. All TBI participants were at least four months post-TBI, at which point it was considered that neurological changes would have stabilised. A control TBI group would be required to confirm this as studies as such as Walker (2007) have shown continued neurological improvements after four months.

The above paper shows improvement in TBI patients in postural control at an impairment level following balance training, however, does not express if these improvements are carried over into function or maintained. It could be argued that these young patients are still experiencing organic TBI recovery however improvements were shown in the non-TBI trained group as well.

Functional and sustained improvements in balance and mobility have been shown in chronic TBI patients following physical rehabilitation in a study by Ustinova et al. (2015). A total of twenty-two participants completed twenty sessions of functional exercises focusing on gait pattern, postural stability and co-ordination over four weeks in an outpatient setting. There was no control group with this study however patients completed two pre-test sets at baseline, two weeks apart with no significant difference in results. Outcome measures included the BBS, FIM, ataxia scale, and the functional gait assessment. There was significant improvement immediately following the intervention in all the measures other than the FIM which showed improvements but not with significant difference.

These papers show some evidence of improvement in balance impairment and its functional application with TBI patients on completion of balance training in both clinical and home-based exercise settings (Drijkoningen et al. 2015 and Ustinova 2015). The length of time post TBI correlates with the intended patient group for this study and gives objective evidence that balance training could be beneficial for this patient group. This is corroborated by two series of case study reviews which have observed improvements in balance and function post TBI following physical rehabilitation.

2.7 Factors affecting rehabilitation outcomes in TBI

When a person has a TBI they can be affected by a multitude of difficulties including cognitive, behavioural and executive function problems (Jager et al. 2014). This can have an adverse effect on the rehabilitation of a patient's physical function. This section will discuss evidence on the impact of adherence and engagement when considering the development of an online intervention for TBI.

It is necessary to consider all potential factors influencing success of rehabilitation when developing an intervention. Rehabilitation outcomes can be dependent on patient participation in the interventions and the rehabilitation process (Essery et al. 2017). Different elements of participation will need to be considered for the website to be developed appropriately for the TBI group. Patient engagement in rehabilitation can be defined as deliberate effort and commitment to working toward the goals of rehabilitation therapy (Lequerica et al. 2006). It has been described as a continuum ranging from apathy to motivation and interest, and is associated with several different factors such as emotions and cognition (Matthews et al. 2002).

Patient effort is described as the use of physical or mental energy to do something (Seel et al. 2015). A large multi-centre trial was conducted exploring levels of effort exerted by TBI patients during therapy sessions (Seel et al. 2015). Levels of effort were observed by therapists during sessions and measured using the rehabilitation intensity of therapy scale (RITS). This was then compared with influencing factors such as age, injury severity and the presence of post-traumatic amnesia (PTA). Measures were taken by trained therapists during sessions. This paper found that the presence of PTA or agitated behaviour decreased effort and increased the number of days of inpatient rehabilitation by up to 90 days. Higher cognitive scores resulted in higher levels of effort. The therapists reported attention, level of arousal and impaired initiation correlated with reduced effort. This is supported by Horn et al. (2015) who found that increased effort was associated with better outcomes in TBI inpatient rehabilitation. This paper examined the correlation in 2130 TBI participants between patient factors and rehabilitation outcomes including length of stay, discharge home and the FIM. Effort was rated by therapists in specific sessions using the RITS. These scores were then combined to give the patient an overall rehabilitation effort score. These papers show that factors of TBI such as PTA and agitated behaviour can have a negative impact on the level of effort displayed by a patient during rehabilitation. This is very important to consider because improved levels of effort have proved to result in better rehabilitation outcomes (Seel et al. 2015).

Adherence is defined by the WHO (2003) as 'the extent to which a persons' behaviour, for example; taking medication, following a diet and or executing lifestyle changes, correlates with agreed recommendations from a health care provider'. Adherence is considered important in gaining successful rehabilitation outcomes and has been associated with key factors dependent on the patient, the therapy, the condition, the health system and social/economic factors (Essery et al. 2017). Hassett et al. (2011) conducted a secondary analysis of data to explore the factors influencing adherence to HEPs with the TBI population. Adherence was described as the percentage completed of a prescribed programme and was measured using a self-reported diary. There was no description of how patients were deemed able to complete the diary. This paper found injury severity, higher age and previous levels of activity all had a positive effect on adherence. When combined with the findings of Seel et al. (2015), these studies present the complexities of analysing TBI rehabilitation due to the varied nature of the motor and cognitive problems.

D'Cruz et al. (2016) conducted an explorative study into the engagement of acquired brain injury (ABI) patients in goal setting. Engagement in the goal setting process was measured using the goal engagement scale and was rated by the patient, relatives, and therapists. There was a reported difference in perception of engagement between relatives, patients, and HCP. Patients rated their engagement in goal setting higher than their relatives and therapists. The study carried out interviews and used a scale to measure engagement and acknowledged that the difference in perception of engagement was potentially due to altered awareness. This paper provides evidence of altered awareness of ABI patients in elements of the rehabilitation process.

Hamilton et al. (2015) aimed to discover the factors influencing levels of activity at the point of discharge from rehabilitation post-TBI. Step count was measured as an indication of activity levels prior to and following discharge alongside factors which influenced activity. This study reported a significant decrease in activity levels with only one participant achieving the recommended levels. Emotional, motivational and cognitive factors were reported more influential on levels of activity than the physical factors. This paper provides evidence that activity is reduced on discharge and is lower than the recommended levels.

Pegg (2003) evaluated the success of information provision for patients following TBI with regards to generalised or personalised information. This paper found that personalised information led to a higher level of participation in physical therapy and superior cognitive function. Therefore, it is important to consider the type of information provided to patients during rehabilitation as it can result in changes to patient satisfaction and rehabilitation outcomes.

Potentially all or none of these factors of participation will affect the success of rehabilitation and physical outcomes with the patient group involved in this study. The above papers would suggest that engagement, effort and adherence need to be considered when planning rehabilitation for patients with TBI. Explorative work is required to discover what elements are relevant with this patient group, to then gather information on how best to approach these challenges. The initial stages of this study will aim to discover which of these elements are most relevant and how they affect rehabilitation quality, be that negatively or positively.

2.7 The use of technologies for traumatic brain injury rehabilitation

From the evidence above, we can see that rehabilitation following TBI requires consideration of numerous factors, without which progress will be difficult to attain. The use of technologies with the TBI population to enhance rehabilitation is growing and can used to aid many things such as memory and engagement. The use of computer technologies with TBI currently appears mostly with cognitive rehabilitation for assisting with memory tasks and executive function (Cole 2013). There is a requirement for user interface for TBI patients with cognitive difficulties to be individualised and different to that of usual software design (Cole 2013). This section will explore the use of assistive technologies with TBI.

Dowds et al. (2011) found that the introduction of personal digital assistant devices resulted in significantly higher rates of memory task completion for individuals with TBI who report memory problems. Pavliscsak et al. (2016) evaluated patient engagement with the introduction of a mobile application with military service members during rehabilitation in the community. It analysed engagement levels with presence of behavioural problems or TBI. This study found an increased length of time to respond and decreased level of response in those with TBI or behavioural problems however the overall level of response was higher than in the civilian population and was reported as a useful intervention during transition into the community. This paper shows there is decreased engagement in some healthcare interventions with TBI in the military and provides information regarding the levels of engagement with military personnel at the point of transition into the community. The use of alternative modalities for rehabilitation could be beneficial with the military population that have sustained a TBI. Utilisation of additional methods could improve engagement at point of discharge into the community.

Engagement could be enhanced by developing conventional therapeutic approaches. Virtual reality (VR) and other media domains have been considered as alternative approaches. A literature review explored the employment of VR and videogames in TBI rehabilitation (Pietrzak et al. 2014). This included articles which assessed cognitive and physical symptoms and found positive outcomes for balance but without significant difference when compared to conventional interventions. Whilst the studies held small participant numbers this review supports the use of VR and videogames for TBI rehabilitation of balance impairments. The interventions received positive feedback from participants which is a very important factor when considering interventions for TBI participants.

Huijgen et al. (2008) assessed the feasibility of home-based tele-rehabilitation for arm and hand function with a mixed group of patients which included TBI. This paper conducted a randomised controlled trial (RCT) to compare home activity with tele-rehabilitation compared with usual care. Outcomes were found to be equal between groups and there was good compliance to the programme, and patients and therapists were satisfied with the intervention (Huijgen et al. 2008).

The literature above demonstrates that TBI results in a number of factors that can reduce engagement with rehabilitation which can lead to increased length of stay and reduced function with a drop in adherence at the point of discharge from inpatient rehabilitation (Hamilton et al. 2015; Seel et al. 2015; D'Cruz et al. 2016). New technologies have shown favourable results when utilised with TBI patients (Huijgen et al. 2008; Pietrzak et al. 2014). Development of new interventions must consider the complex cognitive, executive and behavioural needs of TBI patients in order to achieve the outcomes of rehabilitation. If a website-based programme could be developed to help overcome these needs within rehabilitation it could increase therapy intensity and potentially improve outcomes of rehabilitation.

Qualitative research to test whether a product is user friendly, known as *usability testing*, is common in the development of websites, however, this focuses on system design and interaction rather than the target population (Yardley et al 2015). This study aims to develop a website that will be engaging and motivating to a specific patient group. In order to create a website that can be used effectively by the TBI population it will be essential to first understand the needs of this population and when taking into consideration the range of potential problems with behaviour, cognition and executive function, it will be essential to be thorough in the preparation to ensure the website meets its aims. The person-based approach was adopted by

Essery et al. (2015) for the development of ‘Balance Retraining’ where a prototype intervention was presented to their target population and their feedback was gained during think-aloud studies. The author describes this method as providing valuable data for informing small amendments to further enhance acceptability for their target users. With the TBI population, acceptability may go as far as to mean the programme is accessible or cannot be used at all.

2.8 Efficacy of ‘Balance Retraining’

‘Balance Retraining’ is a web-supported programme to assist people to self-manage and reduce symptoms of dizziness and the functional limitations of altered balance (Essery et al. 2015). This intervention utilises balance exercises that can be conducted independently or as part of inpatient management. The online programme provides support for people with balance problems through videos of exercises, feedback on progress, education, and additional advice on managing dizziness symptoms. The programme was designed to be used by people with vestibular deficits using features such minimal scrolling across pages which could elicit dizziness symptoms. ‘Balance Retraining’ is a behavioural change intervention that aims to encourage increased adherence to the rehabilitation programme (Essery et al. 2015).

The efficacy of the ‘Balance Retraining’ website for improving dizziness symptoms was tested in an RCT by Geraghty et. al (2017). A single centre, single blind RCT was conducted with two research arms; usual primary healthcare compared to the ‘Balance Retraining’ internet-based programme, each carried out over six weeks. All participants were over 50 with dizziness symptoms elicited by head movements. There were 296 participants recruited, 160 of which entered the intervention group and a total of 230 completed the study. Outcome measures were taken at baseline, 3 and 6 months and results showed a statistically significant improvement in dizziness symptoms. This was measured by the vertigo-symptom scale-short form and there was a significant reduction in disability related to dizziness using the DHI. Both these scales are subjective and were completed independently via the website. This has shown a significant benefit from the use of the programme in both dizziness symptoms and disability due to dizziness. This shows efficacy of ‘Balance Retraining’ website which was used as a basis for designing the new intervention.

2.8 Literature Review Summary

TBI affects a large number of people around the world and has a high incidence in the military due to service personnel demographic and combat roles. Balance problems are frequently associated with TBI, and the resulting deficits have a negative effect on function. Effective balance rehabilitation does improve outcomes however this can be challenging in this patient group who experience a wide range of impairments.

‘Balance Retraining’ is an effective tool for helping symptoms of dizziness and the related disability. It has therefore been selected as an appropriate programme as the basis for designing a new intervention for assisting in the rehabilitation of balance. However, it is developed for persons over 50 years old and has no allowances for cognitive or behavioural impairment often associated with TBI. This review provides evidence that there is potentially a marked difference in the needs of the population this intervention was designed for compared with a military population with a TBI. Given the evidence regarding TBI, there are many features that would need to be considered to make this programme useable by individuals with TBI. Therefore, a careful process of gathering information to prepare appropriate amendments is essential prior to trial with TBI.

Motivation is essential for adaptive behaviour; however, this is difficult to achieve in a cohort of people with cognitive and behavioural problems. It is essential to have a thorough understanding of the target population and how best to overcome any difficulties to determine how a website should be presented. If this type of programme could be modified for use with military patients who have balance problems having sustained a TBI, it could potentially assist with balance rehabilitation and improve outcomes.

Chapter 3 Rationale for chosen Methodologies

3.1 Introduction

This chapter will discuss the ontological and epistemological stance for this study and the rationale for the chosen research paradigm and methods. It will provide justification for the methodological approach and the specific method processes selected. This will include how the ontological and epistemological stance have informed the selection of the methodology and methods. It will go onto describe studies which support these selections.

3.2 Ontological and Epistemological Stance

The ontological perspective chosen by a researcher sets out the nature of the world that they intend to explore (Hjorland & Hartel 2003, Marsh & Stokes 2002). To create a website programme that would meet the needs of the target population, it was essential to know what is important to the TBI patients who would use the programme, and the therapists who work with them. The insights discovered in this study would be dependent on the context of the individual and their situation, therefore a relativist ontological stance was considered most relevant (Finlay & Ballinger 2006).

For this study, the perceptions of the participants in the FGs were expected to uncover multiple realities because of their varying experiences, knowledge and understanding which may be complementary or contrasting. Multiple realities are created by involving different people's opinions on a subject. Every person will have a different way of seeing the world and that will be relative to each individual (Mason 2014), therefore, a relativist approach offered opportunities to discover multiple versions of the truth dependent on the individual and their experiences and knowledge (Finlay & Ballinger 2006). This could be in relation to many things such as their perspectives on rehabilitation, their concerns and hopes that might occur with their condition with regards to the use of a web programme and how they feel it should be presented and designed. Their opinion on what was needed for a web programme to function appropriately will be relative to their situation. Without a relativist approach the breadth of ideas would potentially be narrowed and the findings may not have produced a website to meet the needs of the range of individuals that may go on to use it.

Epistemology describes the researcher's view of the knowledge they are seeking and their relationship to it (Marsh & Furlong 2002). In order to explore the perspectives of the participants an emic epistemological stance was needed, where the researcher is integral to the knowledge and data being collected (Killam 2013). Each individual's perceptions of how a website should be designed for people with TBI may present differently and the researcher's interpretation of that is a perception of this phenomena. For this study, I needed to explore the opinions of others to create a website that will meet the needs of different target users. It was essential that I would be involved in that data capture to gather the subtleties and depth to the information from the participants.

In my position as a physiotherapist that has worked with the patient group and a member of the Armed Forces myself, it would be impossible to extract myself from the study and its resulting data. I chose to utilise this position within my study design to gather the information and data from the participants. Being a physiotherapy officer, I have an understanding of the situation and awareness of the population which has enabled me to develop the study with a greater comprehension. Because of this, I feel this emic epistemology could strengthen the relevance of the data. With my insider knowledge of the participants and their environment, I have a unique position to create a study designed to develop a website that will meet the needs of the populations involved. The data generated should produce results more likely to answer the research question appropriately.

The emic epistemological stance was chosen with a methodology and methods that enabled an insider position of the researcher (Beals et al. 2019, Knott 2009). This will include an iterative approach to data analysis creating inductive theories and allow the interpretation that is necessary to ensure the website design takes into consideration the needs of the target user optimising findings that will achieve the research aim.

3.3 Why a qualitative paradigm?

With relativist ontological and emic epistemological stances, this study used a qualitative paradigm. Qualitative research allows the exploration of multiple versions of reality (Clarke & Braun 2013). This could be in the context of multiple opinions, creating multiple truths. This study required numerous views to gain the information that informed the findings. A quantitative approach would have been unlikely to cover the breadth of individual's perceptions depending on their different context to the subject. Without this, the resulting website would be unlikely to meet the needs of a variety of people. It was anticipated that there would not be one correct answer for what an online balance programme should look like for people with TBI. A qualitative paradigm would reflect the epistemological stance where the researcher's relationship to research can result in close involvement with the participants and interpretation of data (Finlay & Ballinger 2006).

3.4 Methodology

This study explores a phenomenon and requires interpretation of the findings therefore Interpretative Phenomenological Analysis (IPA) was the chosen methodology. Phenomenology is the exploration and description of the lived experience (Finlay & Ballinger 2006, Laverty 2003). Hermeneutic phenomenology was described and has been presented by Laverty (2003) as an interpretive process that seeks to bring understanding of the phenomena which has supported the development of IPA as qualitative research methodology.

This methodology was chosen as it meets both the ontological and epistemological stance of the study with the exploration of multiple truths and through embracing the researchers' interpretation through an emic approach. Heidegger's philosophy supports the importance of perception in the understanding and engaging of the world (Heidegger 1962, Laverty 2003). Horrigan-Kelly et al. (2016) described the key components of this philosophy for interpretive phenomenological research which includes concepts of the lived experience. This would allow the relativist ontological approach because the knowledge being sought is that of the perceptions and experiences of the participants.

Interpretive phenomenological research has been developed from a number of philosophical theories. Heideggers' key philosophy has been presented by many authors as the world and those within it, e.g., study participants, are inseparable (Horrigan- Kelly et al. 2016, Laverty 2003). With this study, the researcher could not be meaningfully detached from the data. IPA therefore supports an emic stance and encourages the researcher and their hermeneutic element to any phenomenological research. This study has therefore used an IPA methodology with Heidegger's philosophy using two hermeneutic elements with both the study design and analysis procedure.

IPA has been an increasingly popular qualitative methodology which specifically focuses on the individual's opinions allowing the researchers' interpretation of this, through an understanding that to gain the individual's lived experience will require interaction with the researcher (Smith et al. 2012, Cooper et al 2012). IPA was first used in the research of pain to gain an in-depth understanding of the experience of living with pain. Osborn & Smith (1998) conducted one of the early examples exploring the experiences of women with chronic low back pain.

IPA has continued to be used in wider fields of health and social research. Howes et al. (2004) aimed to discover women's experience of living with TBI. The authors felt it was important to include the patient's perspective in the research of TBI. They chose an IPA methodology 'to investigate acquired brain injury through the eyes of the head injured person' and is an example of IPA being carried out successfully to explore individual's own perspectives of TBI.

IPA allowed a methodology that embraced interpretation and was therefore selected as it would allow interpretation of the participants' perceptions to create design decisions for a new website programme. Interpretation of the participants' lived experiences was included not only in the analysis process, but it has been written into the study design as the researcher led the participants through the data collection phases.

3.5 Methods

When conducting IPA, interviews are the most common method to gain an in-depth and detailed first person account (Smith et al 2012). This study, however, used focus groups (FGs). FGs encourage open discussion amongst a group with potentially differing opinions. It was felt this was necessary for this study and could not be gained from interviews (Gill et al. 2008, Wilson 2012). FGs were selected to encourage participants to share their lived experience, while allowing the researcher a level of involvement that enabled interpretation and active engagement within the study. The ontological approach for this study required conflicting opinion, seeking multiple complex thoughts and ideas and depth of discussion. The use of FGs aimed to enable inter-group discussion to encourage conversation amongst therapists to gain an awareness of the challenges and opportunities of managing TBI patients.

Examples of the use of FGs in similar research include (Hammond et al. 2016), who conducted a multicentre trial with a mix of HCPs, service users and family of those affected by TBI. FGs were used to successfully explore the experiences of HCPs working with TBI to develop a conceptual model of irritability following TBI. FGs have also been successfully used for the development of other online interventions, for example (Morrison et al. 2015) designed a website for asthma self-management. This paper used similar methodology and methods to develop a well-received website where a RCT showed it resulted in the desired behaviour change (Morrison et al. 2015).

Hollander (2004) describes how FGs allow social construction, and with this study, were utilised to allow co-construction of ideas for the website, building a theory together of what may work well. However, the use of the IPA process for FGs as described by (Smith et al. 2012), was necessary to ensure social construction didn't lead to shared assumptions and generalisation of thoughts and ideas. This study benefited an idiographic approach, taking into account that each individual's experiences are unique, but these could be used in collaboration to build shared knowledge. FGs would also enable the interaction required by the researcher with the participants to focus the discussion on the required topics therefore meeting the emic epistemology stance.

3.5 Summary

For this study I chose a relativist ontological stance to gain insight into the perceptions of each individual, which may be different according to the context to which the participants approach the design of the website. As an Army Physiotherapy Officer, that has worked with the target users, I felt an emic epistemological stance was essential, utilising my insider position to purposefully drive the relevance of the data captured to meet the desired output.

The objectives of the study aimed to design a programme that meets the needs of the population and taking advantage of my position in relation to the data to assist this. This ontological and epistemological stance required a qualitative paradigm. IPA was the chosen methodology because of the requirement for exploration of the participant's lived experience and perceptions and the necessity for the researcher's interpretation of this in an iterative way throughout required a hermeneutic approach.

This is also the justification for the selection of FGs which would create an environment for sharing a breadth of perceptions and opinion. With IPA analysis of FGs, the researcher's interpretation of the data was used to assist in achieving the research aims and objectives.

Chapter 4 Methods

4.1 Introduction

This chapter describes the processes undertaken to conduct the study methods. This includes the steps taken to recruit participants, conduct the FGs and their analysis and the measures taken to ensure correct research governance and quality.

4.2 The Focus Groups

This section will describe the details of how the FGs were conducted. Two different FGs were carried out, each with a separate purpose and schedule. The FGs participants were HCPs with experience of working with military personnel with a TBI. The first FG was the Exploratory FG. This aimed to gain insight into the challenges and opportunities facing HCPs of TBI patients conducting rehabilitation. Participants were then shown example pages from ‘Balance Retraining’ programme to gain opinions on how a website like this might be used with the TBI population. The second FG was the Design Specific FG. This aimed to gather information regarding the specifics in the use of a website for military personnel with TBI.

It is recognised that having the opinions of military TBI patients in the design of this website pages, would be essential to ensure this it met the needs of the population. Having feedback from the service user would add valuable insight into the possible changes required and gain a better understanding of how to improve aspects of the website pages such as navigation and engagement. There are potential challenges that would need consideration when involving TBI participants for this study. Behavioural, cognitive and communication deficits this population might experience could present challenges in the welfare of the participants and their ability to give reliable feedback. Participants would potentially not be able to comprehend discussion, become overwhelmed or fatigued, or have difficulty in communicating their feedback. These are all aspects that would need to be considered and supported with alternative methods possibly being required such as interviews rather than FGs. Also, on presenting the use of TBI participants to an ethics comment, participants without capacity to participate in a research study were declined from being included.

Consideration was given to the participation of TBI patients in the FGs, however because the website pages presented at the FGs had no adjustment for use with patients it was felt that would not be appropriate. Websites have been assessed for the quality and readability and a number have been found not to meet the required reading age or accessibility (Manivannan et al. 2021). It was felt more appropriate to introduce TBI participants once some initially alterations had been made to the pages to make them more accessible.

4.2.1 Pilot Focus Group

The researcher had no prior experience in conducting FGs therefore a pilot FG was run. This enabled the rehearsal of methods such as asking open questions, note taking, recording the session, and analysing the data. The pilot FG was conducted by the researcher with a group of HCPs with experience in rehabilitation of brain injury. These individuals were not potential participants of the study FGs. The group consisted of the three supervisors of the study. Other HCPs were invited to attend but did not have time available.

The pilot FG was conducted in a private room at the University of Southampton. The researcher prepared a separate schedule, facilitated the FG over 30 minutes, recorded the session and analysed the data in the same way as planned for the main study FG through transcribing the data and trialling analysis. The analysis was then presented to the supervisors for comment and feedback.

Through conducting the pilot FG, the researcher learnt lessons on questioning techniques and gained experience of the practicalities of running a FG. Feedback received from the supervisors was used to streamline techniques and improve the detail of analysing data. It was still understood however, that the researcher was a novice FG facilitator for the purposes of the study FGs.

4.2.2 Focus Group Participants

The selection criteria and the recruitment procedure for both FGs were identical; they were conducted together as one process. The selection criteria were as follows:

1. All participants must be a clinical member of the DMRC NRT.
2. A minimum of one year experience of working with TBI patients.

A purposive sample of experts in the field were recruited from DMRC Headley Court NRT. The study aimed to recruit 6-8 participants for each FG. This number has been shown to allow every participant to contribute without being too big to result in fragmented discussion (Freeman 2006). Specialists from all clinical professions in the team were invited, to enhance the diversity of disciplines in attendance. This included: physiotherapists (PT), Occupational therapists (OT), Speech and language therapists (SLT), Exercise rehabilitation instructors (ERI), Doctors, nurses, social workers, Neuro Psychologists, and psychology assistants. Key professions considered essential in each FG included a PT, OT, SLT and Neuro Psychologist. It was deemed that half of the HCPs attending each FGs needed to be from these professions to enable the necessary information to be gathered. This required a minimum of 10% recruitment rate of these professionals from the NRT which was considered realistic therefore if this was not achieved in initial recruitment, an extended period would have been given for recruitment.

Participants were encouraged to attend both FGs. This was to prevent a need to go over the points from the first session in detail so that participants were aware of the topic. It was also to avoid repetition of what was said at both sessions. It was recognised that it would be ambitious to get all participants able to attend both sessions. Therefore, it was not made a requirement of the study design.

4.2.3 Focus Group Recruitment

The study was advertised via posters throughout the NRT Department (Appendix A). On this poster, the invitation to attend came from the neuro-rehabilitation consultant. This was done to reduce the potential of coercion to participate because the researcher was part of the NRT where participants were recruited. Interested parties then contacted by the researcher, stating their interest in participating via an email as advertised on the poster. A participant information sheet (PIS) (Appendix B) was then sent to the interested HCP. Participants that met the selection criteria were then contacted via email with information regarding attendance of the FGs and to conduct written informed consent (Appendix C). Each participant completed witnessed informed consent with the researcher prior to attending the FG.

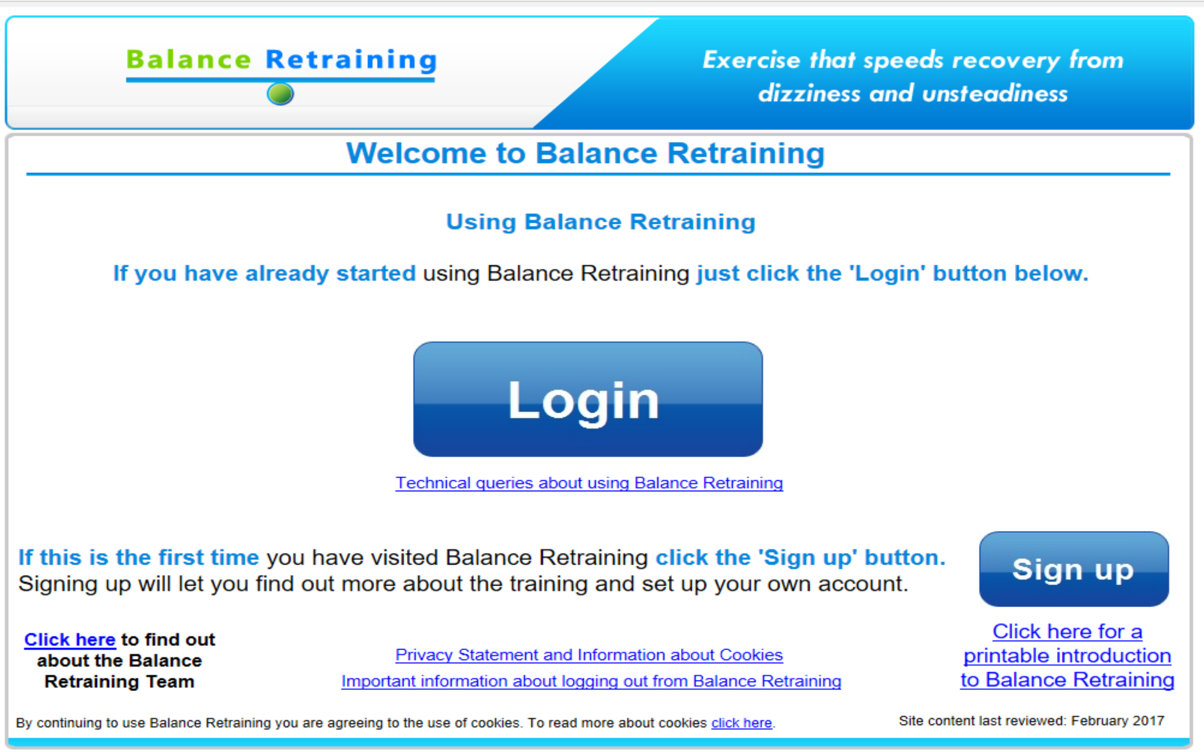
4.2.4 Facilitation of the Focus Groups

The FGs were carried out in a private and comfortable venue where participants could not be overheard outside the FG, and which enabled good quality audio recordings. The researcher facilitated the FGs with additional field notes made by an observer who was a rehabilitation assistant from the NRT with experience in research. Unfortunately, it had been the intention for the observer to attend both groups, but they were not able to make the first session therefore it was conducted without an observer. This meant that only one set of field notes was available for the data analysis. This was mainly pertinent during transcription when it was difficult to comprehend which individual was speaking. However, all participants and the terminology were known to the researcher, who conducted the transcription of the FGs and therefore it was clearer which participant was talking.

A schedule was used to facilitate the FGs using a structure with an introduction and background followed by the guidelines for the FG, questions and a closing statement. Questions were written by the researcher. These were developed using experience from the pilot FG, using an open question style and thinking of the requirement of findings to answer the research questions. Where necessary, the researcher gave additional prompts in addition to the questions on the schedule, to get more information regarding a question, and asked additional questions to clarify points if there were differences of opinion.

4.2.5 Exploratory Focus Group

The first FG was exploratory, and, as per the schedule, (Appendix D) posed open questions which aimed to create discussion regarding the engagement of TBI patients with physical therapy and rehabilitation. A selection of pages from the ‘Balance Retraining’ website (Fig. 1) were presented via power point slides. Each of the pages were chosen to give examples of the different elements of the website and the design features of the pages. This was to gain some initial thoughts and feedback on the website, to prepare new pages to present at the next FG. Information from this FG was used to create simple example pages for the design specific FG.



Exercise that speeds recovery from dizziness and unsteadiness

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Site content last reviewed: February 2017

Figure 1. An example page from 'Balance Retraining'

4.2.6 Preparation for the Design Specific Focus Group

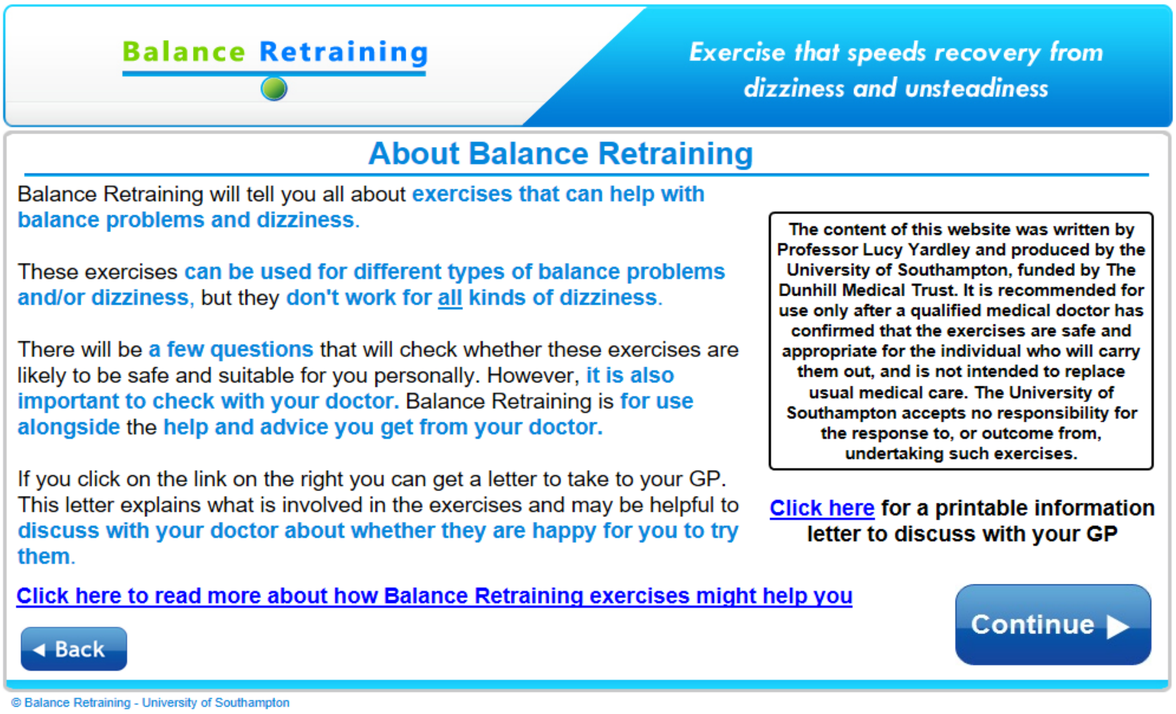
It was the intention to complete data analysis of the first FG prior to conducting the second FG to allow reflection of the process and detailed preparation for the Design Specific FG. Unfortunately, due to the delay in starting data collection, the FGs were conducted very close to the date for relocation of DMRC to a different part of the country. Following the relocation, a large number of participants were no longer going to be available. Therefore, the decision was made to conduct a brief analysis of the exploratory FG, enough to create the example pages for the design specific FG without conducting a full analysis. This was done immediately following the first FG. The recording was listened to repeatedly with notes made on the specific suggestions for changes to the pages. This enabled the second FG to be conducted promptly before staff with the required level of experience would no longer be available.

PowerPoint was used to create mock-up pages (Fig. 2) from comments made during the first FG, for example, text was formatted differently, arranged on the page in specific ways, different colours were used for text and background and different pictures were used. A total of 10 mock-up pages were then selected and put into a power point presentation alongside an example page from 'Balance Retraining'. Pages were selected to ensure they covered all key aspects of the suggestions and responses collated from the first FG as well as a spectrum of the elements of the website pages would be required to cover for example, the front page, a patient information page.

4.2.7 Design Specific Focus group

The design specific FG was then conducted, as per the FG schedule (Appendix E) with a summary of the findings from the exploratory FG presented as an introduction. The researcher presented the PowerPoint slides with the mock-up pages from the exploratory FG responses alongside the example 'Balance Retraining' pages.

Open questions were delivered by the researcher to create discussion regarding specific content, such as, what exercises and information should be included. Feedback and discussion was gathered on how this content could be best presented for a user with a TBI, covering topics such as communication of information and instructions, navigation of pages, physical use of a computer, how to progress through the programme and at what phase in an individual's rehabilitation should this intervention be introduced.



About Balance Retraining

Balance Retraining will tell you all about exercises that can help with balance problems and dizziness.

These exercises can be used for different types of balance problems and/or dizziness, but they don't work for all kinds of dizziness.

There will be a few questions that will check whether these exercises are likely to be safe and suitable for you personally. However, it is also important to check with your doctor. Balance Retraining is for use alongside the help and advice you get from your doctor.

If you click on the link on the right you can get a letter to take to your GP. This letter explains what is involved in the exercises and may be helpful to discuss with your doctor about whether they are happy for you to try them.

The content of this website was written by Professor Lucy Yardley and produced by the University of Southampton, funded by The Dunhill Medical Trust. It is recommended for use only after a qualified medical doctor has confirmed that the exercises are safe and appropriate for the individual who will carry them out, and is not intended to replace usual medical care. The University of Southampton accepts no responsibility for the response to, or outcome from, undertaking such exercises.

Click here for a printable information letter to discuss with your GP

Click here to read more about how Balance Retraining exercises might help you

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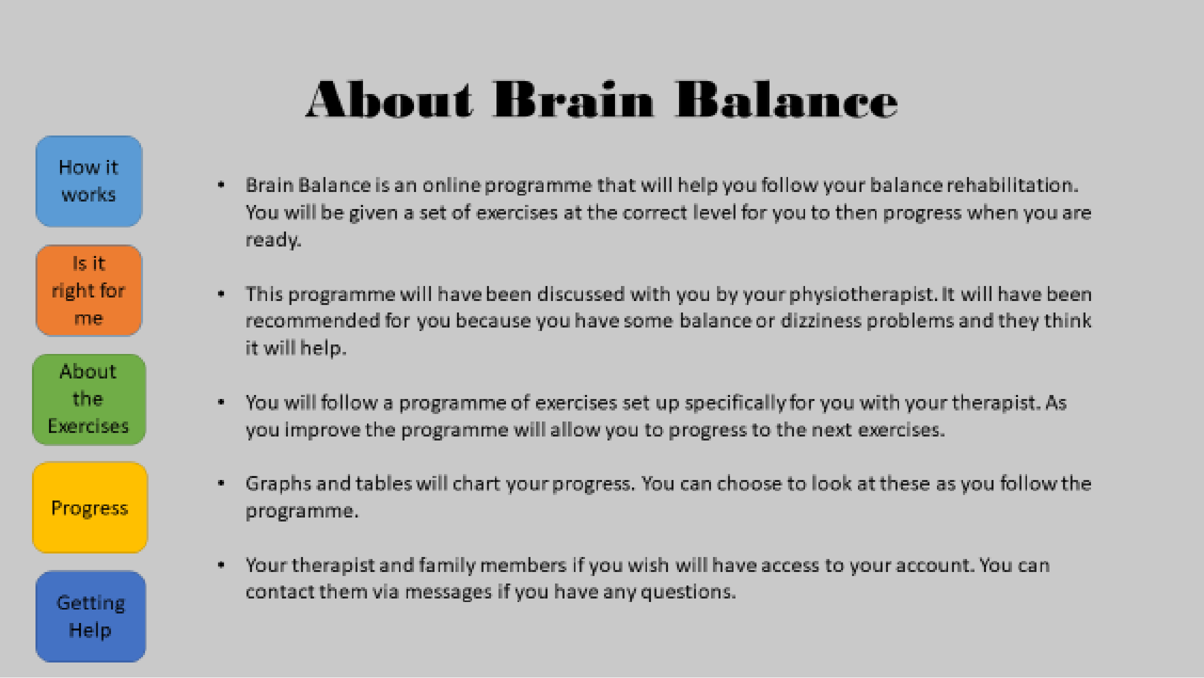
Figure 2. An example 'Balance Retraining page with a PowerPoint FG page



About Brain Balance

- Brain Balance is an online programme that will help you follow your balance rehabilitation. You will be given a set of exercises at the correct level for you to then progress when you are ready.
- This programme will have been discussed with you by your physiotherapist. It will have been recommended for you because you have some balance or dizziness problems and they think it will help.
- You will follow a programme of exercises set up specifically for you with your therapist. As you improve the programme will allow you to progress to the next exercises.
- Graphs and tables will chart your progress. You can choose to look at these as you follow the programme.
- Your therapist and family members if you wish will have access to your account. You can contact them via messages if you have any questions.

4.3 Data Collection

The two FGs were held separately, two weeks apart but in the same location. The FGs were audio-recorded using a dictaphone and a voice memo application on the researcher’s phone. Field notes were made by the researcher in both groups, with the addition of an observer for the design specific FG. The researchers’ notes covered key points that participants had made that would require clarification or where the researcher felt this was a new area which would benefit more prompting. Field notes were also used to follow the schedule and ensure that all areas had been covered when the group spontaneously moved on from subjects and away from the format of the schedule. If key points were made by the group these were highlighted in the field notes and prompts made if necessary to clarify. For the design specific group, the observer made notes on which pages were being discussed at each point so that during data analysis when a participant made a comment it would be clear which page was being discussed.

In addition to this the researcher maintained a reflexive diary. This was started during the analysis stage following a supervision session on data analysis. The researcher kept a note of their thoughts throughout the analysis process and was able to note down relevant things that were had observed throughout the process of the study from the moment of putting the posters up in the department. This included conversations regarding participant's decisions to attend and reflections on the process of conducting the FGs.

4.4 Interpretative Phenomenological Analysis Process

This section will outline the methods used for analysing the FG data and generating the findings. The analysis of qualitative data can be carried out in different ways depending on the data set and the aim of the results. Many authors describe qualitative research analysis as a series of stages in a process with others allowing flexibility (Braun & Clarke 2013). With IPA studies, it is essential that the analysis process explores the lived experience of the participants, incorporated with the researcher's interpretation. Smith et al. (2009) outlined the process of analysis for IPA within six main steps presented in Table 1.

Table 1. Smith et al. (2009) IPA data analysis process

Step 1	Reading and re-reading	Immersing in the original data, reading and re-reading the original transcript
Step 2	Initial noting	Exploring the data, noting anything of interest.
Step 3	Developing emergent themes	Exploring the transcript and the comments for emergent themes, looking for interrelationships, patterns or connections.
Step 4	Searching for connections across emergent themes	Mapping of how the themes link together.
Step 5	Moving to the next case	Moving to the next interview and repeating the first 4 steps.
Step 6	Looking for patterns across cases	Looking for patterns and connections that exists across the cases.

4.4.1 Focus Group Data Analysis in an IPA Framework

The above steps of data analysis by Smith et al. (2009) have been developed for IPA study designs that ordinarily use multiple semi-structured interviews. However, this study has used FG methodology within an IPA framework. Therefore, the method of data analysis was adapted to take into consideration the differences when analysing FG data.

4.4.2 The complexities of using Focus Groups for IPA

Using FGs as part of IPA has been debated (Palmer et al. 2010, Love et al. 2020), with concern raised about achieving the idiographic, lived experience when participants are sharing in a group (Larkin et al. 2019, Tomkins & Eatough 2010). There is a requirement to ensure the practical application of the FG has considered the comfort of the participants to allow everyone to share personal thoughts. Palmer et al. (2010) suggests that the complexity of individual's and shared contexts, and the interactional complexity of the discussion itself make it more difficult to infer and develop personal, phenomenological accounts.

The data analysis process comes under particular scrutiny by Tomkins & Eatough (2010) who pay particular attention to balancing the group alongside the individual. They argue that some papers have not represented the individual, whereas with the analysis of other work, it has been difficult to tell that the comments were made from a group at all. To ensure the phenomenological aims were achieved, the analysis had to ensure each participant's contributions are considered and how a researcher would present, and weight the opinion or experience of one participant, for example, if it was not shared with the rest of the group.

With the above being considered, the 6-step analysis process did not allow analysis of the data as a group of individuals. Palmer et al (2010) presented an 8-step protocol for analysis of FGs with an IPA approach (Table 2). With these steps, the author introduces stages to the analytic process which incorporate the conversations within the group, the double hermeneutic, and ensure the data analysis process takes into consideration factors such as positionality, roles and relationships, and organisations and systems.

Table 2. Protocol for using IPA with FG data (Palmer et al. 2010)

Step 1	**Objects of concern and Experiential Claims** a. Pick out experiential claims and concerns as they appear in the transcripts b. Summarise these, and sort into emergent patterns
Step 2	**Positionality** a. Explore the role played by facilitators, keeping track of questions, permissions, encouragements, redirections etc. (what is their perspective, stance, position?)

	b. Explore the function of statements made by respondents. (what is their perspective, stance)?
Step 3	**Roles and relationships** a. Examine references to other people: what role and relationships are described? What sorts of meanings and expectations are attributed to these relationships? b. What are understood to be the consequence of these?
Step 4	**Organisations and systems** a. Examine references to organisations and systems: How are they described? What sorts of meanings and expectations are attributed to these? b. What are understood to be the consequences of these?
Step 5	**Stories** Examine the stories told by participants: look at the structure, genre; imagery and tone. What does each story achieve? How do participants support or impede each other to share tier experiences? What temporal referents exist?
Step 6	**Language** Throughout stages 1-5 monitor language use, paying particular attention to use of metaphor, euphemism, idiom etc. consider: a. Patterns Repetition, jargon, stand-out word and phrases, turn-taking, prompting – are these identified in individuals or the whole group? b. Context Impact on language used; descriptions of feelings/emotive language; jargon and explanation of technical terms; impact of facilitator. c. How/why is certain language being used? (eg. To emphasise/back-up a point to shock, to provoke dis/agreement, to amuse/lighten the tone?)
Step 7	**Adaptation of Emergent Themes** Return to the emergent themes from Step 1b and adapt them according to the work done subsequently. Answering the following questions will help: a. What experiences are being shared? b. What are individuals doing by sharing their experiences? c. How are they making those things meaningful to one another? d. What are they doing as a group? e. What are the consensus issues? f. Where is there conflict? How is this being managed/resolved?
Step 8	**Integration of multiple cases** Where more than one focus group has taken place, integrate the work done with each to build up an overall analysis of the topic under investigation. Data should be checked to ensure sufficient homogeneity between focus groups to allow for successful integration. To draw the analysis to completion: a. Pick out commonalities and standout differences between groups drawing out superordinate themes b. Frequently revisit the transcripts to check themes in relation to original claims made to help ensure accuracy. c. consider the analysis in the wider context of existing relevant theories, models and explanations.

4.4.3 Adapting IPA analysis for Focus Groups

Drawing on the work of Smith et al. (2012), Palmers et al. 2010 and Tomkins and Eatough (2010), Love et al. (2020) then made further adaptations and presented a step-by step guide for adapting IPA for FGs (Table 3). With this guide, Love (2020) aimed to add rigour to the process with self-reflexive interviews prior to the FGs and a stage of credibility checks. There are notable additions which aim to resolve the concerns of FG analysis not capturing the double hermeneutic or the idiographic account and these include the iterative loop described by Tomkins & Eatough (2010) (to bring about emergent group themes), considering the stand-alone themes and ensuring the idiographic account is privileged. Through reviewing the progress of all other authors, Love et al. (2020) collated the additions from each new protocol and generated the latest presentation of analysing FG Data with an IPA approach.

Table 3. Procedure for IPA FG Analysis: A step-bystep guide (Love et al. 2020)

Step 1	Immersion in the data
Step 2	Identifying the researcher's orientation and potential bias
Step 3	a. Identifying significant life experiences and relationships b. Adaptation to IPA for identifying life experiences and relationships in focus groups.
Step 4	a. Identifying emergent themes b Adaptations to IPA for identifying emergent
Step 5	(a-c) Clustering themes and identifying superordinate themes a. Using Power point and word files b. Clustering theme and identifying and developing superordinate themes for each focus group c. consider the complexity of the focus group dynamics and 'multiple hermeneutics'
Step 6	Amalgamating themes and superordinate themes from all focus groups. a. adapting IPA for use with focus groups – 'integration of multiple focus groups b. consider the importance of stand-alone theme
Step 7	Checking the reoccurrence of superordinate themes and themes
Step 8	Credibility checks
Step 9	Organizing the superordinate themes into a hierarchy

Having reviewed the processes used by previous authors, the homogeneity of the participants in the groups had to be considered, alongside the methods of conducting the FGs to finalise the data analysis methods chosen for this study. The FGs were conducted with a homogenous group, despite there being different individuals in the two FGs because the participants were all HCPs working in the same team. With other IPA studies that have used FGs, participants were always considered homogenous when they have been made up of the same participant type, for example, Love et al. (2019) where participants were NHS mental health service users.

4.4.4 The chosen Analysis Process

The data analysis process was adapted using the protocols from Palmer et al (2010), Smith et al (2012) and Love et al. (2020) and is presented in the table below (Table 4). The first column describes the stage of the process, with further details to each stage of analysis where necessary in the second column. The third column then gives the justification and reference for that stage.

It was decided to analyse the data from both FGs together as one set of data despite the two FGs having a different schedule. Whilst the questions were covering different topics, there was a lot of cross over in the discussion. The data was analysed together to mitigate the risk of missing the development of a potential theme, that would only be generated with both FGs being analysed together.

Table 4. Data analysis process

Stage	Description	Detail	Source
1	Identification of any potential research bias and recognition of the researchers position	Sessions were held with the researcher supervision to discuss the position of the researcher and the relevance of any relationships with the work and others. This was repeated prior to analysing the data. This included maintaining a reflexive diary.	Love et al. (2020) Palmers et al. (2010)
2	Immersion in the data	The researcher verbatim transcribed the FG. The recordings were repeatedly listening to and the transcripts were read.	Smith et al. (2012), Palmers et al. (2010), Love et al. (2020)
3	Initial noting	Going through the transcript and noting anything of interest. This will include significant experiences and relationships, the use of language and presence of emotion.	Smith et al. (2012), Love et al. (2020)
4	- Developing Emergent Themes	Exploring the transcript for emergent themes, patterns and interconnections.	Smith et al. (2012)
5	- Considerations for Life experiences as a Focus Group	Positionality, roles and relationships, organisation and systems, Stories and language.	Palmers et al. (2010)
6	Adaptation to IPA for identifying emergent themes.	Answering the questions from Step 7 Palmers et al (2010). a. What experiences are being shared? b. What are individuals doing by sharing their experiences? c. How are they making those things meaningful to one another?	Palmers et al. (2010), Love et al. (2020)

		d. What are they doing as a group? e. What are the consensus issues? f. Where is there conflict? How is this being managed/resolved?	
7	Identifying superordinate themes.	Searching for connections across themes. Cluster themes to identify subordinate themes. Check the themes against original claims made.	Smith et al. (2012) Love et al. (2020) Palmers et al. (2010)
8	Checking Themes	Check the reoccurrence of themes and superordinate themes. Organise into hierarchy of themes and superordinate themes.	Love et al. (2020)

4.4.5 Conducting the Analysis

The first stage was completed with a one-to-one supervision session discussing the researchers' role, position, and any potential bias this may bring to the work. These sessions attempted to increase awareness of the potential effect this could have on the data.

For the second stage the researcher transcribed verbatim both FGs. This involved the recordings being listened to repeatedly to decipher text where multiple participants spoke at the same time. There were very few occasions where text could not be understood, and these were annotated in the text. The transcripts were then read repeatedly, initially to correct errors then to immerse in the data.

Gradually this reading process progressed to stage three and initial notes were made. The transcripts were printed with wide margins to allow for notes. The left column was used for initial notes and thoughts. These included descriptive and conceptual notes and anything that stood out regarding group interaction and language used. Different colour text was used if the note was regarding the patients or the website. Emergent themes were then annotated in the right-hand column. Different highlights and colour text were used for excerpts, conceptual themes, group interactions (Appendix F).

Stage four involved tabulating notes and themes into two different categories; 1) notes about working with patients with TBI and 2) any aspects of the website design. The tables included notes, the theme or themes associated with that note and any excerpts from the text (Appendix G). An additional document was produced for stage five and six where notes were made under the relevant headings and questions (Appendix H). The researcher read back through the transcript making notes that captured information under each heading.

All the data was then reviewed to check the themes. This included the documents and tables from all stages. The transcript was regularly referenced back to, to ensure the themes were a true representation of the FG data.

4.5 Research Quality

It is essential to assess the quality of research processes to consider the impact and trustworthiness of its findings and conclusions (Stenfors et al. 2020, Smith 2011). Nizza et al. (2021) generated guidance for producing quality IPA research, and as part of this introduced four quality indicators for IPA. This section will use these four quality indicators to describe the processes undertaken to ensure the quality of this study.

4.5.1 Constructing a compelling, unfolding narrative

The first quality indicator is; constructing a compelling, unfolding narrative. This is described by Nizza et al. (2021) as the analysis telling a persuasive and coherent story, and highlights the need to build an unfolding narrative using appropriate and interpreted quotes from participants. In this study, the processes of analysis and generation of the themes involved repeatedly referring back to the transcript to ensure resulting interpretation and themes were a true representation. As the themes were generated, key quotations from the transcript were carefully selected to represent the participants' views, construct a picture of each theme and build on the narrative. These quotes were then woven into the text with description and interpretation to develop a robust story. The narrative aimed to progress throughout the themes, giving detail and discussion on each whilst the developing the overall narrative.

4.5.2 Developing a vigorous experiential and/or existential account

The second quality indicator is developing a vigorous experiential and/or existential account. Here the authors describe focusing on the important experiential and/or existential meaning of participants' accounts to give depth to the analysis (Nizza et al. 2021). The use of IPA as the qualitative method for this study allowed interpretation and depth to the data analysis. The analysis process aimed to focus on the significance of the participants' experiential account of their work to develop themes and a narrative. The existential account was considered in order to add value to the analysis and interpretation of the participants' meaning of their lived-experience. It could be assumed that as HCPs discussing their patients, the accounts would be experiential rather than existential due them talking mostly about other people. Through seeking for the participants' existential account the analysis gained depth to participants' meaning and developed a commentary which included an understanding beyond the experiential account.

4.5.3 Close analytic reading of the participants' words

Nizza et. al (2021) describe the third quality indicator, named, close analytical reading of participants' words, as 'thorough analysis and interpretation of quoted material within the narrative helps give meaning to the data and the experience it describes'. The researcher personally transcribed the data then repeatedly re-read the transcript to be fully immersed in the data. This was done to help draw out the meaning of the transcript and then support careful selection of the quotes for interpretation. Because FGs were used instead of individual interviews the transcript was read repeatedly to ensure the participants' comments were read both individually and also together to gain the individual and group meaning. Close reading was conducted and then interpreted. This was expressed through discussion of the tone of the participants' quotes and interpreting their use of language to decipher the meaning. This included recognising the use of metaphors, repeated words and strong language. This was described in the third stage of the analysis process, noting the use of language and the presence of emotion which was then interpreted for depth of meaning.

4.5.4 Attending to convergence and divergence

The final quality indicator is; attending to convergence and divergence quoted by Nizza et al. (2021) as 'idiographic depth and systematic comparison between participants creates a dynamic interweaving of patterns of similarity and individual idiosyncrasy'. For this study the consideration of convergence and divergence was key in creating the findings required to answer the research questions. This is why FGs were used instead of interviews. It was anticipated that between the participants, multiple version of the truth would exist and creating the ability for them to discuss these, creating divergence and convergence through conversation and interaction aimed to create meaningful data. The interpretation of these and analysis to bring together further convergence and divergence aimed to generate meaningful findings from the data. It was highlight when there was general agreement in a statement a participant made and when there was consensus or disagreement between statements.

In conducting an IPA study, the use of the quality indicators presented by Nizza et al. (2021) have supported an understanding of how to draw out meaningful findings from the data with a depth and compelling narrative. The use of FGs instead of interviews did add nuance to the analysis process but these quality indicators could be applied to this study despite this.

4.6 Research Governance

This section describes the processes for data protection, measures taken to reduce risk of coercion to participants and the researcher's effect on the data, as well as management of safeguarding.

4.6.1 Ethical Approval

This project was conducted as part of military funded studies and was sponsored by the Academic Department of Medical Rehabilitation, a department of the Ministry of Defence. All supervision has conducted by the University of Southampton. Ethical approval has been granted by the Ministry of Defence Ethics Committee and the University of Southampton Ethics and Research Governance Organisation.

4.6.2 Data storage and Anonymity

All data was stored in locked cabinets and was anonymised through allocating an alias to each of the participants. The one document which contained both alias and participant details together was stored separately to transcripts and other data. All systems were password protected including computers and specific folders and files. All records including data and consent forms were returned to the Ministry of defence research ethic committee Secretariat for retention in accordance with extant UK legislation and Ministry of Defence policy. The normal retention period for all documentation is 50 years, but this will be reviewed periodically on the basis of potential litigation liabilities (Joint Service Publication 536).

4.6.3 Managing the Researchers impact on the Data

The researcher was a colleague of the participants of the FGs and worked as part of the team and work setting being discussed. This created the potential of the researcher holding preconceived opinions on the views that were expressed in the FGs which could potentially influence the data. There is the possibility that this relationship with the participants could have influenced the discussion because the participants knew the researcher. Participants could have been keen to give 'the correct' answer to assist the study rather than giving their true opinion. However, participants maybe more comfortable to talk openly with a recognised individual rather than someone from outside the institution. Whilst it was felt necessary that the researcher facilitated the FGs to ensure it stayed to topic, the participants were encouraged to speak freely, and the FG schedule and questions were structured to encourage this with open questions.

Efforts were made by the facilitator to reduce the impact on the data as a colleague of the participants. The facilitator wore non-clinical, non-military attire, the method of questioning was aimed at open questions to encourage free flowing discussion. The introduction and guidelines for the FG were made in first name terms and encouraged open conversation and debate stipulating no right or wrong answers. Also, the location for the FGs was in a different building to normal working, with large sofas and a comfortable environment. This was to highlight the distinction in the role of the researcher that day as facilitator as opposed to the researcher's normal role with the team and aimed to introduce a relaxed but professional atmosphere in which people would feel comfortable to express all views. For example, if they wanted to say something negative about the way the military carry something out, or a different discipline wanted to share a potentially negative comment about physiotherapy they may have felt more comfortable sharing those opinions if it was obvious that the facilitator of the FG was there as a researcher, not physiotherapist or military representative.

4.6.4 Ethical considerations of facilitating the Focus groups

All participants of the FGs were informed that 'on the researcher discovering concerning information regarding the practise of the clinicians involved, the researcher will inform the appropriate bodies, either the line manager of the individual or in more serious cases the governing body for that profession'. There were no such events during the FGs.

The potential risk of discussing distressing topics in the FGs was highlighted in the protocol for this study. There were no notable occasions of this, and all participants were invited to leave the study at any point without repercussion. There were no occasions where a participant required to leave due to being distressed.

In order to attend the FGs, participants would be taking time out of clinical work. To minimise time away from rehabilitation, time taken to conduct the FGs was kept to a strict schedule to allow prior planning and reduce any impact on clinical hours. Line managers were informed of the intention to recruit from their team with details of the potential time it would take for each participant and the maximum number of staff attending.

4.6.5 Health and safety

Risk assessments were conducted for the study as part of the health and safety assessment. These were conducted to ensure the well-being of participants throughout the study through raising awareness of any risk. This then allowed in any necessary mitigations.

Chapter 5 Findings of Focus Group Data analysis

5.1 Introduction to findings

This chapter will present the findings of this study that were generated from the focus group data. It will describe how they have been arranged into two categories of themes and then a description of the themes alongside quotations from the FG transcripts.

5.1.1 Demographic of the participants

The exploratory FG consisted of six participants and the design specific FG had eight. Individual disciplines recruited included PTs, OT, Neuro psychologists, psychology assistants and ERIs. Four of the participants attended both FGs. There was a mix of both military and civilian attendees in both FGs.

The themes are presented in this chapter alongside quotes from the transcript. The names used in the quotes are the pseudo names given to each participant for the purposes of the study.

5.1.2 Preparation of themes

The plan for analysis was to identify superordinate themes from main study themes, however, on analysing the data, no superordinate themes were clearly identified. There were no obvious superordinate themes that would add value to the data analysis and then conclusions. Instead, the data from both FGs was analysed together into codes which then generated themes. The themes were then grouped into two categories:

Category one included the themes generated from codes and comments that mainly focused on the patients. This evolved from the experiences of the participants in managing TBI and working with service personnel who have a TBI.

Category two comprised of comments relating to the design of the website. This included the use of a website as part of a rehabilitation service, what the participants felt the patients needed from the website and what the participants and other therapists may need from the set-up of the website.

5.2 Category one: Comments about managing traumatic brain injury

The first category discussed the issues and opportunities of managing the rehabilitation of serving personnel with a TBI. There were four themes generated from the FG discussions; 1) The impact of TBI, 2) Each patient is different, 3) An MDT is fundamental to proving the specialist care these patients need, 4) Having a TBI as a person in the military is different to compare with the civilian population. These themes compared differences between rehabilitation of a civilian compared to military personnel and explored the nuances of rehabilitating a person with TBI.

5.2.1 Theme One: The impact of traumatic brain injury

This theme discussed the groups' experiences of the impact of TBI on an individual's life and rehabilitation of their injury. The participants described several physical impairments including balance issues, cognitive and behavioural problems, such as difficulties with memory. This led to discussions of how these factors negatively impact on each other. Rachel gave an example of this, where psychological aspects of anxiety can increase a patient's symptoms of dizziness.

> *Rachel - The more sort of anxiety phase, that's probably where I have seen it a bit more from our role, is if their lack of confidence is over a fall then it might be working on psychological help to influence it because anxiety can lead towards dizziness in itself without balance problems anyway, so that probably how cross over in that sense. FG1 Pg 2 (08:21)*

The participants shared a number of ways that the patient's impairments can affect the management approach. Tina explained how factors such as sleep, distractions, mood or levels of anxiety and stress will impact a patients' balance and these factors could be made worse by their TBI.

> *Tina – Massively, especially if they've got a vestibular component to their balance or their head injury. The stress, anxiety, cognitive overload, external stimulus, internal distraction, all of that takes up the brain capacity and all kind of accumulates into dizziness which will make their balance a lot worse in itself so before even looking at their balance or dizziness as an individual impairment you've got everything that has already accelerated those symptoms. FG1 Pg 11 (35:14)*

The experiences shared by Rachel and Tina show the direct effect of how the medley of issues can exacerbate each other. For example, if the therapists were aiming to treat a balance issue, they needed to be aware that there may be several issues impacting balance related to the TBI.

Therefore, they suggested that balance cannot be considered on its own if it's going to be successfully managed.

Rachel mentioned the effect balance problems had on their patient's confidence and Rob continued to say how it can impact their quality of life because of their reduced mobility.

> *Rob - We also have patients who are impacted from more of an environmental point of view where if you get them to do stuff in a safe environment where they are in a gym or in their room where they feel more comfortable compared to then bring them into the real world, into a real life experience, in an open space where actually there is a lot more risk, they perceive that there is a lot more potential for them to loose balance or potentially injure themselves, then that can impact on their confidence and quality of their balance and that often effects their walking gait and how they mobilise around. FG1 Pg 2 (07:22)*

In this statement Rob described a potential negative spiral, where the loss of balance reduced confidence, which negatively impacts their balance and resulting mobility. The challenge to provide the appropriate rehabilitation to help this can be seen where he discussed the impact the 'real world' would have on a patient's confidence.

The participants discussed other factors that affected their patient's ability to complete rehabilitation such as fatigue, being mentally overloaded or an inability to focus and concentrate on tasks. Beth went on to describe some of the behavioural aspects where changes in patient behaviour will result in new behaviours from individuals compared to before their injury.

> *Beth - And there is that behavioural aspect as well, with their brain injury they might not understand social queues or the behavioural side where actually they wouldn't have done that before. FG 1 Pg 15 (50:32)*

Beth also described examples of the cognitive and perceptual aspects of TBI that can impact an individual's ability to complete their physical rehabilitation. The description Beth gave provides an understanding of how their physical performance is only one predictor of success in the rehabilitation of the patient. She gave another example of a cognitive impairment where memory problems will impact rehabilitation. The comment below described how a patient is educated on an area, but then are not able to recall it again and this means the patient has not processed the important information to help their rehabilitation.

> *Beth - because some of them actually the session where you explained all of this they may have taken in so much information that by the time they don't quite remember what you've said. FG1 Pg 21 (66:21).*

That was one example of cognitive impairments of TBI impacting the physical rehabilitation. The participants described other potential cognitive and perceptual issues with experiences of the patients having poor insight into their condition. In the conversation below they explained how understanding TBI is difficult for the patients as the impairments they experience may differ to what the HPC around them are describing. Maggie highlights how this can be difficult for all those around the patient and therefore helping others understand the complexities of TBI is something the team are challenged by.

> *Tina - I think it could be down to multiple things, it could be down to the cognition side. We have the side of, they have no insight into their actual impairments, or limited insight. So then by doing it through the exercise they are starting to realise what they can and can't do. You then have the internal pressure that they put on themselves that, 'I should be the best of the best and I can't do this silly thing that you are asking me to do'. I think you have also got the external pressures as well from their being in contact with their unit still or they have got people here that they have got pally with that are maybe a bit further on in their rehab and they are seeing that they should be doing that already or they should be at a different level than they already are.*
>
> *Maggie - It's that classic challenge of neuro isn't it, it's like if you've broken your leg and you've got a big plaster cast on your leg everyone can see, 'well no of course you can't go for a run, of course you're not fit for duty, you've broken your leg, I can see there is something to see for it'. If you had a head injury a few months ago, you can't, no one can look inside that persons skull and look at their brain and see the state of it. FG1 Pg 10 (32:38)*

This conversation built the picture of the potential difficulties an individual will have in understanding their own TBI due to the cognitive impairments of their injury. Tina described the patient's potential lack of insight and Maggie expanded on how TBI is difficult to understand even for an individual without the cognitive deficit that can be associated with TBI. The discussion also considered the psychological aspects of adjustment as well, which Rachel also picked up on.

> *Rachel - you're probably also seeing them going through the adjustment stages as they are doing it because they come here and they are doing the exercises and they might realise that they are worse than they thought they were to begin with and then that might be when they start to go down a little bit and then come back up again and go through it. FG1 Pg 9 (30:36)*

Steve also commented on the patient's struggle with adjustment or in Steve's words the realisation of just how physically effected they are.

> *Steve - It's a realisation thing for them as well because they don't really do things like stand on one leg, or stand on wobble boards or the exercises that they do with physios. And I think when they do that they think 'oh my god I understand now'. It's that realisation hits them a little bit, to understand that they are potentially worse than they think they are which is sometimes a struggle for them. FG1 pg 11 (36.08)*

Further to the struggle mentioned above, the participants described other ways in which completing balance rehabilitation is difficult and hard work. Tina and Kate discussed some of the impacts of undertaking TBI rehabilitation.

> *Tina - And warn them (non-specialist therapists) that they will make their patients feel weird and they might fall over but it's all part of rehab, this is normal.*
>
> *Kate - They might be sick, many times, have a sick bowl nearby and don't be too concerned if your patient goes green FG2 Pg 27 (51:27)*

The participants described how TBI rehabilitation is not simple or easy because the actual physical rehabilitation of balance will potentially make the patients feel unwell, is physically demanding and hard work. Added to the cognitive and behavioural issues, this is what led the participants to express a need to warn any non-specialist PTs that might work with TBI patients of potentially unwanted side-effects with this patient group that they may not experience when working in different specialisms.

5.2.1.1 Summary: Theme One

Participants described a range of impairments their patients experienced, including those effecting physical, cognitive, perceptual, behavioural and executive functions as well as the potential of psychological issues having an additional impact on rehabilitation and quality of life. The HCPs experienced a range of challenges when rehabilitating their patients due to the wide range of impairments associated with TBI. The group described how the physical impacts of TBI can affect the patient's mood and confidence and the cognitive and executive difficulties will further challenge the physical recovery.

The participants found that TBI impairments often negatively affect each other, especially a lack of insight coupled with some of the effects of treatments, like fatigue, which can make rehabilitation difficult to undertake. Rehabilitation of TBI was described as hard work that is made more difficult by the various impairments some of their patient's experience.

5.2.2 Theme Two: Each patient is different

In the first FG, Maggie opens the conversation with the quote below, stating 'there is a spectrum of patients we work with'. This theme represents the participant's experiences of the variation in the population and how this can be seen between each patient. Participants described how every patient presented differently. This was in relation to the resulting impairments from their TBI but also encompasses all potential factors in their recovery as well, such as their pre-morbid physical abilities or job role. This theme describes how the variation in presentation impacts the rehabilitation each individual will undertake.

Maggie described a spectrum of patients. This spectrum covered diversity in the range of impairments as well as the patients' physical abilities and the physical level that they started rehabilitation with. Her repeated use of the word the 'need' gave the sense of her really wanting to impress the variety of demands from these patients.

> *Maggie – there is a spectrum of patients we work with. I am working with some incredibly high-level individuals who need to be challenged, it needs to be creative, it needs to be interesting and quite a lot of the time I find I need to be able to link it to why, how's it going to better fit them, how's it going to help them. FG 1 Pg 1 (03:30)*

Maggie's description led other participants to discuss the wide variation in relation to balance and physical impairments.

> *Tina – They come at us with different levels of balance to start with but ideally, we need to get them all back to very high levels of balance. FG1 Pg 1 (04:37)*

This difference in presentation was not just regarding the physical aspects but many elements relating to their TBI, such as varied cognitive and behavioural aspects they may have presented with, as Beth expands on.

> *Beth – They've all got a range of cognitive independence as well so some of them you can set up with tasks and as long as they were explained properly and you knew they were doing it with the correct techniques you could leave them to get on with it, whereas with others you wouldn't be able to leave them. FG1 Pg 1 (05:50)*

In this Beth describes how the breadth of patient ability can affect the approach taken with each patient. This included how cognitive and behavioural factors can lead to variation. The participants gave examples where the patient presentation would sometimes change depending on how they were at each moment. The participants described dealing with a lot of variation. This occurred because no one patient was the same, but also because the individuals themselves sometimes presented differently.

> *Maggie - even things like what else they have had going on in the day, because if you see them first thing they might be much more able to take on what you are asking and what you are telling them compared to last thing in the day and they have had the full whack of MDT work and loads of cognitive testing and they're absolutely exhausted and fatigued, so it's not just on an individual basis it's also an individual's day to day changes, time of day, what they have had on etc FG1 Pg 15 (47:21).*

There were many ways participants described the need to understand the patients, which involved fully assessing their needs on multiple levels to lay the foundation of how the team would go on to work with the patients. Given the high-level demands on the patient's performance, participants continued to highlight how an individual approach was essential to ensure the management was effective and how a bespoke programme was imperative.

> *Rob - it is still important to keep the MDT involved for the higher-level guys as well that can do most of this stuff, and would be able to pass a fitness test and things, but we're still picking them apart because we need them to be at their best because we need them to be in firing positions and on different unstable grounds and things like that. FG1 Pg 14 (44:54)*

Building on the variation mentioned before, participants described how this broad variation in their presentation required an individualised approach to managing the patients. This was described in the amount of care and supervision they require, the type of management and approach and lots of detail given about how each programme would be different for each patient.

> *Maggie - balance could be affected for different reasons. It can be more strength and stability, it can be sensation proprioception, it can be vestibular, we should be aiming to target as specifically as we can towards the impairment rather than a sort of general capture of hopefully something in this programme will, if we give you umpteen exercises then hopefully something will hit the nail on the head. FG1 Pg 2 (06:33)*

Maggie and Steve continued discussing the importance of making each programme specific to the needs of the patient. Steve described some of the challenges in creating these programmes. He explained how 'off the shelf programme' used with other groups of patients would not be suitable for their patients and a bespoke approach was required.

> *Maggie- we should be targeting it according to each individual's specific impairments and needs, and then he can be here for a very long time, weeks, months, in some cases years so to keep it novel and interesting it's quite a challenge I think sometimes.*
>
> *Steve - your imagination with the exercises, or imagination in what they are doing needs to be sometimes really out the box for them to get involved with what you want them to achieve. FG 1 Pg 8 (27:53)*

The concept of the entire approach needing to be individualised involved several elements of patient rehabilitation being customised, which included flexibility in the therapist approach to sessions, exercise prescription, and varying communication styles. This flexibility would be between different patients or even with the same patient depending on how they are that day.

> *Julia - I do agree, sometimes a patient doesn't understand a particular word and you just say it differently and they are like 'oh of course' so ordinarily you would write that differently for them. FG2 pg 18 (30:27)*

Participants described several different ways in which they moulded their entire approach to accommodate the ways in which patients varied, as highlighted by Steve.

> *Steve - They are all used to like I spose being in the military as well. I am used to giving instruction and them understanding straight away what I want them to do and visa versa where they will expect that as well and it's certainly, with the speech and language aspect of it, that can just totally go, whereas I can't just give an instruction and it gets done. Sometimes it has to be right, how am I going to get what I want them to do without me speaking, if that makes sense, the use of language, is it body language, is*

> *it voice tone, is it visual demonstration that is easier to utilise and that is an aspect that I think is totally different when you are working with neuro patients. FG1 Pg 15 (49:35)*

Steve and Julia's examples showed how they adapted their entire approach. This brings to light that flexibility is required in HCPs roles to meet their patient's needs. In the above statement Julia gave the example of how communicating with these patients couldn't be the obvious or automatic format. She explained how words or descriptions needed to be altered, which is also described by Steve when discussing how he had to adapt every element of communication with his patients. This is expanded on by Rob when he described having to be a completely different person to treat different patients.

> *Rob - It's like Steve says, he has to put on a different hat for different patients that he works with cos he knows that you, with some of the patients you have to be straight and direct, and they will crack on with it, where as there are guys that have a bit of attitude or they are very easily disengaged or shall we say angry, then actually you have to get them on side before the session starts and then think about vocal tone and how you go speaking and portraying what you're saying. FG1 Pg 12 (51:25)*

An important part of the bespoke programme appears to be the HPC's ability to adapt their approach with each patient where required. The participants shared experiences of having to be very flexible and alter their approach sometimes to each treatment session. Rob explained this with how he starts each session.

> *Rob - taking the first 5 minutes of the session to get on their level, so rather than getting straight into the session and saying oh we are going to do this, this and this, you might give them something straight away and actually they are feeling, as Maggie was saying, terrible, and they might just want to offload something so you might want to, that first sort of 5 minutes of the session.*
> *FG1 Pg 15 (48:18)*

Rob's statement was an example of how the team must be very flexible when working with the patients. This illuminates the measures taken by the group to, as Rob said, 'get them on side'.

5.2.2.1 Summary: Theme Two

This theme centres on the participants' experiences of working with such a diverse group of patients with unpredictable elements to their impairments and a wide variation in their presentation. The participants share how the variation in presentation requires a unique programme for each individual. The participants described the skill set they require to meet the needs of this varied population to gain the required outcomes and how the entire therapy approach needs to be specific to each the individual's needs.

5.2.3 Theme Three: A multidisciplinary team is fundamental to providing the specialist care these patients need.

The participants were all specialists working with neurological conditions. In this theme the participants described how their MDT approach is central to their specialism and how each discipline's expertise and input is essential for an effective MDT. The participants shared the value of their specialism and a will to ensure all those working with military patients with neurological disorders held the necessary skills and knowledge.

The importance of the team's specialism was discussed. This included how specialist treatment and management is essential for these patients with the HCPs combination of knowledge of neurological conditions, with experience of working with this specific group enabled them to make appropriate decisions. The participants gave examples where treating a patient was often difficult without the input of other professions due to the multifaceted nature of the TBI.

> *Rob - if they have any attentional problems then keeping them engaged is going to be something that we will obviously work alongside other therapists with so it doesn't just come down to physio, but working with the team to make sure that they are motivated and they are engaging in that. FG1 Pg 9 (28:51)*

Rob described how getting patients to engage with physical rehabilitation was reliant on working alongside other team members. He related this to the issues associated with TBI including attentional problems. Tina then expanded on this describing her work with members of the team that worked with cognitive issues.

> *Tina - Some of the guys that have been here for the year mark or over, you have more of the cognitive element as well so linking in with the OTs and the cog(native) rehab guys. Their memories probably lack in terms of being able to recall where they have actually come from and how far they have progressed already in their rehab, and being able to just still, they may have that memory but being able to have the emotional recognition to that and to be able to give themselves that pat on the back yeah actually I have done really well. FG1 Pg 12 (39:40)*

Tina described how working with the other disciplines in the MDT was essential to help her patients see their progress because of the difficulties they may experience with memory. There were many references to physical rehabilitation requiring the support with cognitive and psychological issues. Further to this, Rachel then explained the importance of all the team understanding all of the patient's impairments.

> *Rachel - There is always reasons why we do certain behaviours and why they are doing those certain things is probably because they are actually feeling really really (expletive) so that really needs to involve the MDT and talking so that everyone understand where those people are at so that we can help them altogether. Because how are you meant to know, you're not going to sit down and chat with them for an hour you're not going to know it are you, so it's sort of responsibility from everyone to make sure that everyone has that information. FG1 pg 17 (55:28)*

Rachel highlighted why some of their patients behave in particular ways and empathised with the position of other HCPs recognising it's not within the remit of PTs and OTs to be psychologists. She did share that the responsibility is with everyone to understand the patients.

Rob then also explained how the MDT approach is necessary for all patients at different levels for both assessment and the treatment purposes. This statement appeared to suggest that some needs could be missed without the MDT assessment.

> *Rob - I think as well it is still important to keep the MDT involved for the higher level guys as well that can do most of this stuff, and would be able to pass a fitness test and things but were still picking them apart because we need them to be at their best because we need them to be in firing positions and on different unstable grounds and things like that. FG1 Pg 14 (44:54)*

The participants also discussed the inclusion of the wider MDT, the patient's support network, and unit medical team. The integration of all those working around the patient, and the patients themselves were relevant.

> *Rob - All I was going to say is that I think contact with the unit is important, that they are engaging with their medical team because you will get soldiers who will go away and sort of loose interest so having regular contact with someone just to make sure that they maintaining that and continuing. FG1 Pg 7 (24:08)*

The participants described how the wider team roles are more pertinent as a patient begins to prepare for discharge and are engaging with their unit. This then introduced the relationship with the next clinicians being referred to, who are located at the patient's units and would be continuing care, often without the specialist skill of the NRT.

> *Rob - We also need to consider whether, can they still continue their role in a basic sense go back to unit but then continue with a programme that we have given them because as long as we have given them the appropriate knowledge and education, as long as we transfer that with the treating team at their unit they feel they are able to do that side of things, then there is always that option.*
>
> *Tina- that is what we struggle with. We are the specialists in this area for treating these guys in the military and the unit rehab centres aren't as specialised in this neurological area as us so we can push them to a certain point and get all those programmes sorted but there is only so much we can do before the others take over so that is where the specialism falls away. If we could have more of a an interactive role and keep that specialism going for longer when they are back at the unit and see them all the way back to end of recovery then that would help one: with the time pressures and how long we need to have them here for and two: give the individual the better care out of all of the recovery. FG1 Pg 6 (19:36)*

Tina shared strong opinions here regarding the requirement of specialist input for these patients and her description of being the specialist gives a sense of ownership of that. Her emphasis on 'we are the specialists' gave a sense of the pride the team have in their work and the importance to them, and their patients' care that the HCP working with them have access to support from the specialist. Beth then goes onto describe some of the potential struggles the non-specialist teams may have.

> *Beth - I think giving the unit they are going back to the confidence that they can treat these patients as well, because we send the referral back to whichever rehab unit they are going back to and they see TBI and instantly get nervous because they may have not seen anyone with a TBI in years or months or had no experience and actually then from our service we are having the difficulty with them then accepting them back when potentially they could be treated at unit rather than here and if there was something that would make the therapists that they are going back to feel more*

> *confident it would free up some of our higher level patients because they could be managed elsewhere if the therapist felt more happy to. FG1 Pg* 6 *(20:50)*

The therapists described how neurological patients are rarely seen in facilities outside of the specialist facilities resulting in a potential gap in the provision for TBI patients at units. Due to the complex nature of their injuries, it can be difficult for non-specialist HCPs to be confident when taking on TBI patient care. Indeed, the participants displayed some fear of their patients being made worse by non-neuro specialist therapists.

> *Helen - Also, you guys don't want to lose the quality of your speciality, and I worry that if you give too much before a diagnosis. If someone starts ploughing in with this and actually it's a totally different diagnosis it could get really dangerous. I don't know.*
>
> *Claire (46:13) it could muddy the water a bit.*
>
> *Helen (46:13) because you guys hold that speciality and I think you can carry on holding it and then you can enable others to help. Fg 2 Pg 25(45:57)*

The specialism appears to mean a lot to them as therapists and Helens' description of 'ploughing in' and 'dangerous' highlights the strong feelings around this. Helen appeared to take on the role of advisor here in the group, warning them to protect their specialism. Her profession was not a physiotherapist and with this she positioned herself here outside the group to help them see the potential issue. The participants also give the impression of really caring about the outcome for their patients. They want to make sure their patients are getting the right care delivered by the right team. The way Helen described the speciality as something they hold brought to light the importance of it to them as HCPs and how strongly they value their specialism.

The combination then of the participants wanting to ensure their patients were getting the best outcomes, with the awareness of potentially a gap in the specialist service led to conversation around a risk of inappropriate management. The below conversation tracks a concern that patients could undergo medical discharge from the military where more optimal care could have prevented this.

> *Beth - and you can stay in work, and you can just do that (their rehab) on the side.*
>
> *Tina - and that patient is not going to get the optimal out of their rehab, and get back to all they're supposed to do.*

> *Maggie- exactly, exactly and then get medically discharged when they could have been rehabbed. Fg1 Pg 35 (100:44)*

The participant's described pressure experienced by both the patients and the treating team. The above conversation is an example of why this pressure may be felt, knowing that an individual could end up with medical discharge if not getting the required outcomes. Tina gave an additional cause for pressures felt by the team and patients.

> *Tina - You've also got the pressure of these guys have trained in that specific role to be the best that they are in that area. In a civilian world it's quite a lot easier to say 'Ok well you're not quite managing that so we have thought about looking at an alternative or did you ever do anything else before you started this career that you might be able to switch over to or use some transferable skills. These guys have been training for the last 4 or 5 years to shoot a rifle and defend and do what they need to do. For us to then turn around and then go 'well that's probably not going to work well with the way that you are balancing or were not going to get you back to that level just at the moment have you thought about doing anything else?' That is their whole work crumbling away and trying to find transferable skills out of that very specific knish role is very difficult. FG1 Pg 5 (16:26)*

Steve described 'putting on different hats', and how you 'lose them' (the patients). This could be interpreted as an expression of how much it matters to him that a good outcome is achieved for his patients. Possibly however, another interpretation is how this demonstrated the pride he finds from working with this population. He appeared very keen to shares stories and experiences of working with a specialist team and the measures he takes to support his patients.

> *Steve - yeah cos you can lose them, you can lose them especially if you're specifically their therapist in that area. You can be the wrong way with them and then for the rest of the time that they are here they won't work with you, 100%, so it's knowing about, it's not just knowing about what they understand, its knowing about what place they are in at that specific time. FG1 Pg 16 (52:02)*

Maggie described the pressure of getting the right balance in how much to push her patients in sessions, to strike the right balance of not losing the patients' confidence. There is a feeling though that the pressure is drawn from a higher sense in the need and will to help do the best for their patients.

> *Maggie - I think it's a real challenge for, as a therapist or any professional working with the individual to, when you know that confidence is an issue to know when to push and when to hold back and how far to push and how far to take them out of their comfort zone. FG1 Pg 11 (36:36)*

This pressure to provide a high-level of care is a multifaceted challenge for the entire treating team. Some participants described the difficult decisions that they feel they must make, whilst others experienced this pressure from the patient in achieving their goals, or the requirement of their chain of command to return to work.

5.2.3.1 Summary: Theme Three

Successful management of such a complex group of patients requires the participant's specialist care and experience. A crucial factor in providing their patients with the specialist care they required was working together with all elements of the whole MDT. This was supported by all HCPs in the FGs who described the potential issues of trying to manage patients in any sessions without understanding of all problems a patient may be challenged with. The participants described the difficulties non-specialist teams have experienced without the full MDT. They reported the difficulties non-specialist teams can have in confidently managing neurological patients which brought out the participant's fears of how to best ensure patients are receiving the care they need. The participant's specialism was valuable to them in enabling them to provide the care patients need but with a conflicting need for the patients to progress and return to their unit where the specialist care isn't available.

5.2.4 Theme Four: Having a traumatic brain injury as a person in the military is different compared to the civilian population

Working with patients that were serving military personnel appeared to be very important to the participants, and they were keen to make a clear distinction between their patient group and civilian patients. They shared many examples of how this has a notable impact on the way they work with patients. This included the content of the rehabilitation, the goals being aimed for and also changing their approach for example with communication styles. This theme draws together several views that illustrate the impact of this on the rehabilitation process.

The participants highlighted that being in the military made their patient group different. Whether a patient was preparing to remain in the military or leave, this would have a marked variation on the rehabilitation plan.

> *Steve - I think it's good to say that they are in the military as well, because they are either going back to the military or obviously not depending on the severity of their injury and if they can go back to military work so that's obviously a factor that we have got to take into consideration. It's not all just nicey nicey stuff as well it got to be going back to, can they do TABing? Can they do fitness testing? They have got to do, it's not just about balance. FG1 Pg 2 (08:02)*

Participants discussed how military patients were different to civilians. They suggested they were more driven, motivated, determined and engaged with tasks in rehabilitation to meet their high expectations of their physical ability and be the best they can be. Steve elaborated on the physical demands on a patient who is aiming to return to the military. This was compared to a civilian who may take a 'Nicey nicey' approach, whilst a serving soldier is perceived as duty bound and must do it. Tina also discussed the level of physical demand the patients are being prepared for as different to someone rehabilitating into a civilian role.

> *Tina – they're not just getting back to function in terms of getting good mobility or even getting them to run and stuff. They are having to do that stuff at much higher demand and having to run they are having to run over maybe bog-land or beaches or terrains that we would just tell other people to just completely avoid. And then maybe doing it with 30kgs on their backs as well and accessories that might be moving around that could sway their centre of gravity. FG1 Pg 3 (12:18)*

Tina eloquently described the potential differences with the physicality of the role, not just the high physical demand of the task, but the differing environments that the military are required to work in. This was supported by Steve who highlighted that these patients could not opt out of difficult scenarios and it was their job to go to very physically challenging environments. Maggie expanded on this giving some helpful examples.

> *Maggie – There's higher expectations and higher demands, yeah, because even when not in sort of an active role, sometimes some of the environments that they're living in in the military are, like on a navy ship for example just getting into bed is a task in itself, walking from one room to another, there's trip hazards, there's narrow corridors, there's dim lighting*

> *so like Beth said, it's the fact that there isn't a lot of opportunity for employing strategies that you might give in more of civilian world.' oh this is how you cope with your symptoms' because there just isn't the opportunity to do that. FG1 Pg 3 (10:45)*

Maggie explained how the nature of the roles undertaken by patients provided less flexibility and opportunity for returning to work within the military following a TBI. The reality of all the above points were brought together by Steve.

> *Steve – you can talk about the physical aspects, but we have touched on that sort of anxiety stuff as well and at the end of the day they have got to be able to hold and shoot a rifle and that is something that is important that you would never have to have a mind-set having to think about if you're getting a population back fitness. They've got to carry weight, they've got to do bits and pieces like that but they've potentially got to go back to war as well. FG 1 Pg 4 (13:12)*

This fundamental point raised by Steve highlights how patients are essentially being prepared to return to war. He described this as a 'mind-set' that the therapists must hold.

Maggie highlighted the pressure the patients experience because of their military role and the fact they may have to return to war. Participants discussed that the patient's role in conflict appeared to impact both staff and patients by placing pressure on them to return to previous fitness levels and roles.

> *Maggie – I find they put a lot pressure on themselves to need to be better for reasons in terms of returning to work, reasons in terms of just needing to be that fit strong individual that they are, but also a bit of kind of a more responsibility to the rest of their team or the rest of their unit is feeling like while they're away they are letting them down, while they're away someone else is having to pick up for them. Also talking about the sort of more significant war situation, that if they're not at their peak performance, if they're slightly below par at the, being steady with a gun, at defending, then they are potentially not just only putting themselves at risk but the rest of the unit as well. FG1 Pg 4 (14:06)*

Maggie elaborated on this demonstrating how an inability to perform at previous fitness levels could result in them letting others down. Maggie described how the potential of returning to war led to a strong reliance on that individual when returning to their work and their own awareness of this could lead to a fear of letting their team down. Tina then expanded on this experience of the pressure the patients put themselves under and how this impacts balance rehabilitation.

> *Tina - it's quite common with the high level guys that you will give them quite specific balance exercises or vestibular exercises and very minimal and in their eyes quite pathetic and 'I should in the gym pushing huge weights or going for the really quick runs' and you're getting them standing on one leg moving their head from side to side so it's definitely, and then they actually struggle with that, it's quite an eye-opener for them that they, why am I finding this so difficult, I shouldn't be finding this so difficult, I am in the British Army, I should be much better than this. FG1 Pg 10 (31:41)*

The participants appeared to feel that the patients place a much higher pressure on themselves compared to civilians. That pressure can be from the patient's own higher expectations of what they should be able to achieve due to military mind-set of the importance of being physically fit.

Throughout the analysis process, I gained the growing sense of this additional pressure the participants experienced. However, it was difficult to find specific quotes in the text that encompassed this specific point. Wanting to stay true to the voice of the participant and minimise my personal bias I initially felt I wasn't able to add this to the findings despite feeling this was part of narrative being expressed by the participants. On reviewing my pre-reading, I was reminded of my emic stance, and the Heidegger's work on hermeneutics (Heidegger 1962). This encouraged me to utilise interpretation with more confidence and include my own interpretations where perfect examples from the quote were not available

Examples were given of this pressure spilling into their rehabilitation, which will result in different treatments compared to a civilian patient. Maggie expanded on how these expectations and values impact on the rehabilitation she is required to develop.

> *Maggie -The difference with the military population is, that person that they used to be is a much, so much different to a civilian in terms of ability and physicality and ability but in general that is your challenge in terms of keeping people engaged and motivated, is trying to find that common ground in terms of what marker is going to be significant. That instead of the physio just going 'oh look you've got two more points, or you're sitting better' or you know things that might not matter to that individual that much its finding that common marker that is going to be meaningful and going to be, you know, matter to them so that you're not just almost frustrating them with these little achievements, with all the best intentions.*

Military patients were directly compared to civilians with Maggie describing how they are different in both physical ability and motivation. She suggested that military personnel differ because they need to be kept motivated and engaged, which creates its own challenges for the participants where careful instruction and monitoring was needed.

Tina gave examples of how this was due to the access to rehabilitation, the requirement for occupational specific rehabilitation and the provision of time allowing patients to remain under their care for longer periods and undertake more hours of rehabilitation.

> *Tina - In terms of comparing these guys to your NHS civilian treatment time, we do have a lot more time and we have a lot more contact with our patients compared to the NHS services which is great. We do however have the pressures of, the Unit wants them back and the unit wants them back as quickly and as best they can be. We also have the need for a waiting list and other patients coming in so there is always a time pressure however, if this individual patient has the abilities to progress their balance and their cognition and all of their elements to get back to their role and fulfil that job that they were doing before we can push to have them for that little bit longer and to work more with that individual if we know that we can get them back to filling their role. FG1 Pg 5 (17:58)*

In summary, this theme describes the difference participants have experienced working with military patients compared with civilians. They described a military mind-set, in a driven population who aimed to maintain a superior level of fitness to be ready to go to war. This resulted in pressure on the patient to complete their rehabilitation and not let down their peers. The participant’s awareness that this is what they are preparing patients for saw the group describing in great depth the physicality of what is required of their patients if they are to return to a military role with an underlying sense of fear for their patients.

5.2.5 Category 1 Summary

The first category generated four themes that each discussed an element of the experiences shared by the participants regarding the management of military patients with a TBI. These themes cover aspects of the complexity of TBI including the impact it can have on all aspects of an individual’s life and their rehabilitation. The variation was discussed between individuals and within a patient, leading to a requirement for therapists to be flexible and provide individualised programmes.

The participant's speciality in neurological rehabilitation was very important to them, and they described ways in which they rely on interdisciplinary support. Working together as an MDT is essential to the participants for quality patient care. This created the specialist environment that was important to them in promoting the best outcomes for their patients and something they wanted to extend access to once the patients left their direct care.

Finally, the factor of the patients being serving military personnel generated an important theme that discussed the military mind-set and the differences between them and civilians. The impact of this on the rehabilitation was discussed due the environments and roles the military patients are being prepared for and the fact the patients would potentially return to war.

5.2.6 Reflections on accepting my interpretation into the analysis

Throughout the process of writing this thesis my understanding of a number of elements of conducting qualitative research have developed. While I produced the findings of the study, I recognised I was avoiding making my own interpretation of the data and needed to move away from needing to be able to relate everything in my writing to something that had been said by the participants. I realised I wasn't using the advantage of the insider position to its full advantage and I was limited the potential of the findings. I was using the emic stance purely to justify my methods as the rationale for the researcher being part of the team of participants. As read more I started to under more how to utilise the my emic stance to create interpretation and support findings.

5.3 Category 2: Website Comments

This category consists of five themes, each covering the different elements of discussion regarding the development of a website, its use and how to generate a safe and effective programme.

These themes were generated from both FGs where some example pages were presented. Many of these comments are in response to pages seen from the 'Balance Retraining' website or the mock-up pages presented at the second FG.

5.3.1 Theme Five: Make the website easy to navigate for the users

The discussion in the FGs centred on making the programme fit for purpose, accessible for patients, and incorporating it into the current rehabilitation service the participants provide so that it could be used easily by the clinicians. This theme provides specific details of how the participants felt the website could be made easier to use for the population they were working with and draws on comments from theme one regarding the impact of TBI.

The participants felt that all adaptations to the pages should be aimed at making the programme easy to follow for military patients with TBI. Some of the pages were deemed too busy and wordy for these patients.

> *Beth - I just think that is really wordy, and actually are they going to see the next button, see a screen that pops up with a load of words and you're like, this isn't the exercises, next, rather than actually sitting and learning. FG1 Pg 22 (70:38)*

Other recommendations included additional prompts and guides being needed. The example below discussed goal-setting and how the patients would benefit more involvement in this process, and ways the website pages could be adapted to help this. Helen and Tina considered ways to improve the goal-setting pages and ways to combat some of the patient's difficulties with engaging in the goal-setting process.

> *Helen - It would be good to have some examples though, because often they are like, 'oh I don't know'. But if you could give some cues.*
>
> *Tina - You could have some set ones, some standard ones, that they chose from for people who either struggle to make choices due to a cognitive reason or their engagement, and they are like 'I don't know you pick it'. But then you could have a free text option as well so if people want to set specific individual goals then they can, or they just select from the options. FG2 Pg 8 (06:54)*

There were many suggestions on how to make the website easy to follow and the participants worked together to create ideas and were supportive of each other's suggestions. The discussion above between Helen and Tina is one example of where they built on ideas as a group and generated their own thoughts and concepts.

A clear presentation was deemed essential in making pages simple and easy to follow and navigate. Maggie discussed ways in which to achieve this, such as using bullet points, options to go direct to regularly used pages and text being succinct.

> *Tina - could you have an option right at the beginning that goes 'go to exercises, go to education'. And they can always go back to the education whenever you want to.*

> *Maggie - Yeah but broken down, like we said before, with bullet points that are a bit more short and snappy.*
>
> *Tina - the sort of things that we would say to the patients FG1 Pg 23 (70:52)*

Ease of navigation was important for use with non-specialist rehabilitation teams that may also use the programme in a later stage of rehabilitation. It was felt that this needed to be developed in a way that was easy to use for other therapists working with TBI patients.

> *Tina - And I think the PCRFs would be more comfortable. Because basically they are just pressing play*
>
> *Maggie - it needs to be minimally labour intensive really. FG1 pg 34 (97:53)*

Consistency in presentation was seen as important in facilitating simple navigation of the pages. Having clear and consistent buttons to direct to key pages and throughout the pages.

> *Beth - I like the little sign there, could that be what is utilised and that is a constant thing that stays there the whole time, maybe not that big and maybe not taking up that much room it could always be just they are spread out along the bottom but could that be where the 'your education' bit is or that they clicked on that bit? FG1 pg 32 (94:58)*

Rob then gave another example of a way in which the page presentation could be changed to be easier for military patients with a TBI to follow. His suggestion was to allow the exercises to be more familiar. This suggested consistency through all exercises in the programme and consistency with what the patients would already be familiar with.

> *Rob - they also respond well to using reps and sets because that's what they will often be given. If you give them stuff like reps, sets and rest in between and the tempo as an example and use that as the instruction, then they can follow that. Otherwise it doesn't tell them how many times they need to do it, do you do it once, do you do it for 10 minutes do you do it until you get dizzy, you need to give them a specific. FG1 Pg 26 (78:30)*

As discussed in previous themes, no one person with TBI is the same. Therefore, to make this programme easy to use for each person the participants repeatedly discussed ways that the programme should be able to be individualised to each patient. The way to make the programme easy to follow for one patient, would not necessarily be same for someone else, as suggested by several participants.

> *Tina - That could be what the therapist sets up at the beginning. Do you want it to be numbered, do you want it to be smiley faces, sliding scale. Do you want it to be written words. FG2 Pg 11 (13:48)*
>
> *Researcher - options would be good, for pictures or voice recording?*
>
> *Maggie - definitely, because if the therapist is setting it up for them they could give them some guidance as to, I recommend you use the instructions that involve pictures as well, I recommend that you use the instructions that are read out to you. FG1 (64:45)*

Suggestions for reducing written text were regularly provided by participants due to the high numbers of patients with learning difficulties, such as dyslexia. All the different professions gave ideas for different options and described some of the practical implications of using the programme.

> *Kate - I think it might be quite nice if on the boxes, if you hovered over or clicked on the box the text for the area like Tina was saying, it highlights the area, comes up bigger and then you like a small audio speaker kind of thing that if you want it to be said. Because some people might want to do this quietly. So on a train if they want to do the education bit, they might not be at home, there might be someone asleep, it might be something that they want a non-audio version as well. Fg2 (18:32)*

In the example above Kate appeared to be disagreeing slightly with a previous comment, but then discusses options for verbal instructions over written, appearing to agree with the previous point showing how participants developed ideas together.

5.3.1.1 Summary

This theme recognises the importance the participants place on ensuring the programme will be accessible for their patients. They made suggestions around ease of navigation, simple and consistent presentation and lots of options so that each individual’s needs could be catered for. Above all, the programme needs all aspects to be aimed at making it easy to follow for military patients with TBI and the therapists working with them.

5.3.2 Theme Six: ‘It’s how you sell it to them’

This theme introduced the way in which the participants felt the website should be adapted to encourage engagement with the programme. The participants considered elements, such as language use, feedback, goal-setting and what steps could be taken to make the content relatable to the user.

The participants discussed the importance of the patients understanding what they were doing and why. This was considered important to ensure buy in with the programme. There were numerous points in the previous themes where participants discussed some of the issues they experienced in achieving engagement of their patients with rehabilitation. Steve described how ‘you can lose the patients’, and really needing to ‘think outside the box and use his imagination’ to help patients achieve goals and Rob described ‘putting on different hats’ to get better engagement. This theme gives the participant’s discussion on this in relation to a website programme and goes on to give their solutions on how to improve engagement.

One factor raised by Beth was having a link to the military in the presentation of the pages. She explained how any stories or examples being used in the programme must be related to military work for patients to see a relevance. This statement built the overriding picture of need for this to be applicable to the military.

> Beth - then they have bought into to, you’ve got the buy-in to the stories. And you would have to be picky about what stories you use, because if it isn’t related to military work then they are like. FG 1 Pg 19 (63:33)

In Helen’s example below, the group discussed the use of tests and the issue of patients not completing them in the intended way. Helen drew on her experiences with this patient group offering suggestions on how to enhance engagement.

> *Helen - I think a lot of it will come down to how you sell it to them. And how you educate them in the first place. And if you say at some point we’re going to bring you back for an objective test. If you haven’t done it, you could even say, we’re doing this for you, don’t feel the need to race through it. Because when we objectively test you at the end, if you’ve just gone through it, you won’t be, your balance won’t be better, and we won’t be able to upgrade you. Because probably the motivation for a lot of them is to be able to be upgraded. That’s probably the most obvious one to say. And if you’re just clear from the start, and it’s even written there, saying please, you know this is for you, do it as it is explained, and take them as adults. Because we can’t double guess everything. If they’re going to cheat it then there’s obviously a*

> *reason for that but ultimately, they will come back, and they won't be better Fg2 Pg 38 (73:40).*

Beth gave other options for increasing engagement with the programme. Her description of the programme needing to have an 'impact on our guys' highlighted the need to gain their attention and explained how getting that buy-in would mean understanding, for them, why they would use the programme.

> *Beth - I'm not sure stuff like the retraining information on the side, whether that would have much of an impact on our guys. They just want to know it's going to work FG1 pg 19 (63:04).*

The discussion below then expanded on this by explaining how getting patient engagement would require their understanding of how it will help them. However, participants had ideas on how this would work best, building on Helen's opinion that it is how you present it to patients.

> *Jemma - On the education side is there something about the evidence of doing the balance retraining to aid motivation so that 50% of people did it and balance improved in 38% or something.*
>
> *Researcher - if you think that would be useful then yeah, there is a lot of evidence out there of people that have ongoing balance problems after a head injury long-term. There is actually evidence from this Balance Retraining that people had reduced symptoms.*
>
> *Jemma - Maybe it's an option that they could read if they wanted to but it might be nice to have it there as a resource.*
>
> *Researcher - But do you think actually having it as a one-liner?*
>
> *Many voices - Yeah, a statistic*
>
> *Researcher - 50 % of people who did this programme, a similar programme, improved their symptoms.*
>
> *All – Yeah FG2 Pg 14 (22:09)*

The suggestion of giving evidence in the form of statistics could be a good way to aid engagement with the programme. However, Rachel highlighted how incorrect approaches could discourage patient's engagement. This example again is around the topic of testing the patients.

> *Rachel - Also if you say things like extreme, people might avoid those sought of words because people don't want to say I'm extreme. Or 10s,*

> *they will steer away from saying I am really good or really really bad just because they don't want to be on either end, so its like wording.*
>
> *Researcher - So actually 1-5. 5 doesn't seem as bad as 10.*
>
> *Rachel - 1-5 would work yes FG2 Pg 11 (14:22)*

Tina then gave another example regarding testing, which showed what a contentious issue it can be, but clearly an important one given the amount of discussion it generated. Participants expanded on the specificity of the language being used to help achieve the response required.

> *Tina - Can you change the word test to repeat review or something like that? Because if these guys think they are being tested then they will push themselves and they won't be honest because they will want to get a low score.*
>
> *Maggie/beth - yep*
>
> *Beth - or like weekly evaluation, something like that, a bit more neutral.*
>
> *Maggie - maybe change it in the terms of, relating to whether they could do more or not, I felt a little bit dizzy but could carry on, I felt dizzy but wouldn't want to do much more, I felt dizzy and definitely couldn't carry on. Something like that, relating it.*
>
> *Beth - or I had to stop*
>
> *Maggie - Yeah Yeah,.with them collected together or two separate, so you had the two slightly , or very minimal and then a separate thing of I had to stop the exercises, I could carry on for a short time, I could carry on for much longer, as two separate things or collected in.*
>
> *Rob - Because I think if you get them to say, they make me feel dizzy but I could carry on for some people that would be, they might be put off by a small amount of dizziness whereas some guys might feel very dizzy but might want to crack on. FG1 pg 28 (84:10)*

The use of testing clearly generated debate to ensure it was conducted in the best way. The reasons they were so intent on including it was because it gave the patients some feedback on their performance. This was considered very important by the group.

> *Claire - Well if you are trying to just keep it as a motivating thing it could pop up randomly, so say that at the start it could give you a fact about statistics*

> *about how many people improved and then when your scoring, each week or whenever, how they've done, as a bit of a motivator, and just say, don't forget that engagement in the programme for minimum of x amount of weeks is necessary to see improvements as a bit of a, 'don't give up' 'keep going, you're not going to see results right now'. FG2 Pg 15 (23:46)*

The participants did not want patients to feel like they were blindly going through a programme without seeing their progress or knowing that their therapists were monitoring their engagement. Helen also shared her experience and knowledge of how beneficial motivating statements were when implementing behavioural change programmes.

> *Helen - motivating statements would be really good actually and it could come also bespoke to their scores, so like brilliant you've reduced your symptoms by like 50% or 25% compared with when you started just to show or keep them going. Or if there is no improvement well done, you've been doing this now for three weeks. The research shows that any kind of motivating pop ups might be really good. FG2 (24:20)*

In addition to this, the participants wanted elements of interaction and two-way feedback to aid engagement and motivation.

> *Kate - some kind of feedback, to make them feel that the website is interactive and it's not just, oh I'm doing these exercises, oh I'm just copying them off a sheet and no-one is giving me feedback. At least if they're putting the effort into doing the exercises, they are getting feedback straight away. Even if it's just a comment saying, well done for completing. You have completed 3 times this week, look forward to seeing you next week. Just something to say, it's getting some kind of feedback from this programme. Someone is actually keeping record of and it's not just me staring at a screen. Do you know what I mean? Because if they have got no feedback, they might think well no one is monitoring this, there is nothing to say that anyone is keeping track of this so I could just chin it off.*
>
> *Rachel - You want something to grasp don't you.*
>
> *Helen - a bit like the fitbit. Obviously FitBit has been hugely successful and they have shown that with these kind of motivating, 'well done you've got three out of 5 days of your X amount of calories. That kind like, whatever you do on a fitbit it rewards you for something. I do very little, and I get rewarded a lot, it's amazing and I feel so good. Genuinely. It's like, well done, it's cool.*

> *Researcher - so some praise for just logging in?*
>
> *Kate - Yeah there could be some predefined targets on there. Which is I presume how Fitbit works, that it records every log in. So then when it gets to three log ins it says 'you've logged in three days in a row'. Well done or you've logged in twice this week, keeping going, or something like that. Or if you sit so many hours or whatever or it picks something up, so if you've shown an improvement with your tick boxes if there has been any kind of upward trend with anything it flashes that up at the end of your exercises, which says we've noticed you've made an improvement this week. Congratulations'. FG2 Pg 16 (25:26)*

The conversation above started to introduce goal-setting. It discussed small goals that the patients can achieve throughout completion of the programme. It was felt that the goal-setting process and the feedback would have to be individualised to enable the most buy-in.

> *Jemma - and making those motivating statements personal in relation to the progress and those scores and how long they have been doing it would be good. FG2 Pg 16 (25:05)*

This was also to ensure the programme would progress with the patients. The therapists expressed concerns of the patients getting bored or frustrated if the programme did not continue to be relevant to their level of difficulty. The participants shared experiences of the patients disengaging if progress wasn't seen.

> *Helen - So actually this could be based on their scores. So as soon as their score drops to a certain level it could automatically bring that exercise up a level, presumably so it is much more bespoke. When the symptoms gone, it goes, so they don't have to rate themselves on it anymore.*
>
> *Claire - Because otherwise that is a bit boring for them and irrelevant after a while. But it also gets measures.*
>
> *Kate - I suppose that would look like progress as well. If they had a list of 5 things they had to rate themselves on once they start hitting top score, like so many times, and then it drops down to they only have one thing that they are working on.*
>
> *Claire- Yeah absolutely. And then that feels really progressive*
>
> *Kate - Yeah it's quite rewarding, Fg2 Pg 31 (60:15)*

There were many examples, like the one above, where the group worked together to resolve differences in opinion or to find solutions together. There were times when the group would completely take the lead and asked each other questions. This was especially seen between professions, where one HCP would not understand something that they might see as a potential issue and would therefore direct the question to the group or a colleague with a different role in the group.

5.3.2.1 Summary

The title of this theme ‘It’s how you sell it to them’, was created by a brilliant summary by one participant, but it is essentially a description of all factors the participants felt were important to encourage engagement with the programme. These factors involve the patients understanding why the programme would help, meaningful communication, and use of individualised feedback and progression. The participants felt this would be helped with a goal-setting process, clear demonstration of progression and a military link in the pages.

5.3.3 Theme Seven: A nod to the Military

Theme seven discussed what it means to the patients to be part of the military and how using military links in the website could help engagement with the programme.

Participants often commented on how the individuals they worked with were very proud to be in the military and it meant a lot to them. The military was familiar to their patients. It was suggested that using this association with something familiar and meaningful would help their patients both follow the programme and engage with it. In the conversation below the participants discussed the importance of presenting the content of the website with links to things the military would use such as phrases and pictures.

> *Kate - Always using a familiarity, like parade is a familiar thing, PT is a familiar thing it’s like certain routine, like you give people orders or admin instruction, that’s fine, but you’re not in their face saying this is military. But it’s kind of using the same phrases that they would use.*
>
> *Rachel - Yep*
>
> *Kate - Because it’s using military language but not labelling it as military.*
> *Fg2 Pg 21 (36:31)*

Kate mentioned the use of routine they would be used to. Below, Jemma also suggested an instruction method that the patients would be familiar with. All of these built on the picture of how to introduce military elements to the website.

> *Jemma - I'm just thinking with the videos do we approach use the EDIP explain, demonstrate, and giving them time to imitate and then practice so that they are going through the kind of usual instructor type.*
>
> *Claire - You can have all the videos 'in position ready, go Ha ha, Stand by.*
> *FG2 Pg 8 (12:05)*

Beth then introduced the notion of not only using military components to encourage engagement, but also that having non-military elements could result in disengagement.

> *Beth - then they have bought into it, you've got the buy in to the stories. And you would have to be picky about what stories you use, because if it isn't related to military work then they are like. FG1 Pg 19 (63:33)*

Beth alluded to the attitude of the patients towards a civilian example for stories of how the website has helped them. While she stopped short of explaining what 'they are like' she is clear that the examples would have to be from other military personnel. Beth was military herself. Her reason for stopping before extending the comment could be because she didn't want to paint too much of a negative light on her military colleagues or perhaps, she felt the language she was about to use wasn't appropriate for the audience of senior civilian and military participants however the point was made of an attitude of military personnel toward non-military examples.

In addition to the presentation, the participants also discussed that the content of the material should also be linked to military activities.

> *Beth - you could potentially link into stuff that, like if you look at the Battlefield casualty books how you could almost do it like that. That stuff in red you need to read, colour code it like that. FG1 Pg 24 (74:30)*

Beth leant on her experience of learning things as a person in the military to offer suggestions for how the patients may benefit from tasks in the website being taught.

> *Tina- if you could relate it as well, a struggle to something that they would do in their job, so walking over uneven ground if you change that to maybe walking, so like unstable surfaces change that to uneven grounds like dessert, bog land, something that they would have to do. FG1 Pg 22 (69:51)*

Tina used examples similar to earlier in the FG. The suggestion was to link a military functional activity to the website. This would be conducted with any occupation, making the task for rehabilitation relevant to the role the patient is preparing for.

The participants did have some hesitations however in using too much of a direct link to the military. They discussed the need to be considerate of those that would be leaving the military. They shared their experiences of how difficult the patients can find this transition and how a website that was solely designed for military patients may be inflammatory to the sensitivities for those having to leave due to their injury.

> *Rachel - I like the military in it because obviously it is the military and that distinguishes it from other.*
>
> *Julia - I agree*
>
> *Kate - my only hesitation with the military is, not all your patients are going back to the military and is that a bit of a, this is military training, you're not going back. Some patients might be a bit 'well what's the point of me doing military training, I'm not going back to the military'. I think depending on the patient, you could, not upset them but you could just them a bit like, 'what's the point?'.*
>
> *Claire- it's another reminder of what they are not.*
>
> *Kate - of what they are not going to achieve. It's that 50:50, some are leaving some are not.*
>
> *Rachel - but then they were in the military and they are in the military when they are here.*
>
> *Kate - Yeah but people have a different perception of how they feel towards it about being out. Some are like 'yes I was in the military, proud, but I can't go back and they are accepting of it, where as other people are a bit like, a bit resentful of the fact they can't go back. Fg2 Pg 20 (34:06)*

This came across as a very emotive topic for the participants and one they were repeatedly challenged by. There were points where a particular topic being discussed, for example preparing individuals for returning to being in the military, the group built on this together, giving different opinions, often depending on their standpoint. This could be an individual that was in the military, sharing a fear that if they had been too soft on patients, they will not be ready for work compared with a neuropsychologist exploring the reasons behind different behaviours, justifying some of the difficulties an individual would have making the transition. These two participants discussed the same behaviour with very different opinions due to their own experiences and knowledge both of the patient group and or their own career and life experiences.

Suggestions were made in how to have more subtle links in the programme, to hold the familiarity but not so directly military. It was described in the first comment at the start of this theme as being ‘in your face’ and also Claire used the word threatening. While they did not expand on that, this does imply that for some patients, a direct military component to the programme could be difficult. Kate gave options for how to have a less direct feel of military on the website.

> *Kate - But could you have some way that it is linked to the military but not specifically saying military. So have certain terminology, I don’t know, balance PT. PT is a very military term but it’s not saying military retraining, but it’s kind of implying a term that you would use if you were in the military, but not specifically saying.*
>
> *Claire - it’s not threatening FG2 pg 20 (35:22)*

5.3.3.1 Summary

The participants shared how, for their patients, being part of the military is important to them. Because of this, having links to the military on the website may help their patients engage and comprehend the website material. However, for patients leaving the military, a very direct link may be threatening or result in disengagement and a less direct link may be more beneficial but still hold the familiarity to help navigation of the pages.

5.3.4 Theme Eight: Therapists want control over the programme to ensure it is safe and secure

This theme discussed the participant’s opinions around the potential risks of introducing an online intervention to their service. They considered the online security, reputation of the service and the use of such a programme with a potentially vulnerable group. This theme highlighted access to the programme for patients and others and how therapists felt the need to control this. The use of clinical reasoning throughout the content and accessibility of the programme was also raised.

During the FGs, participants shared a variety of concerns regarding online security. This was due to the potentially vulnerable nature of their patients due to their TBI and a need to maintain patient confidentiality. The conversation below with two of the participants outlines some potential issues with using videos.

> *Kate - I know you said about some patients not wanting to be videoed, but I would be concerned with where we stand with confidentiality. Bearing in*

> *mind this is a website, if you are uploading. Because if they lose their log-ins, or give their log-in to someone else. I know it's their choice but if they lose it or whatever and then someone signs into it or if they sign in on a public computer. If they sign into the library and then don't log-out and then you've got videos of themselves in a public space.*
>
> *Julia - And people with brain injuries who are probably more vulnerable anyway.*
>
> *Kate - I would probably rather have personalised videos. FG2 Pg 19 (32:25)*

The other concern regarding online security was the potential open accessibility. It was felt that measures would be needed to prevent unwanted access, setting up a profile on their own and following the programme when it hasn't been prescribed for them. Whilst the participants raised concerns, they also offered solutions that could be developed for the programme to be used effectively and safely.

> *Helen - Going back to the very first page, just thinking about the mTBI website, I don't think you need a new patient log-in. I think the therapist would set them up and they just log-in. As in that is certainly what we do. Because otherwise you could get just any Tom Dick or Harry setting themselves up on it.*
>
> *Julia - Because particularly for inpatients obviously they all chat. If someone says 'oh I've got this website' log-in and the other person has got it.*
>
> *Helen - I can so imagine that happening. We monitor our one ourselves. We set each one up individually. Fg2 Pg 31 (60:29)*

As well as the online security, the matter of protecting the brand and reputation of their workplace was also highlighted. The participants discussed potential issues around the website being used incorrectly.

> *Kate - Yeah, what's the worst that can happen, is there any danger in them doing it more. I know they could do it more from a printed-out handout but the fact that obviously it's, you're labelling this as a Headley or Stanford hall kind of programme, is there any come back on them saying 'well my physio said I could do this and I've now got this X Y and Z problems'. Is there anything that could be a negative? FG2 Pg 38 (75:39)*

Maintaining control over access to the website and its content appeared very important to the participants. There was a fear of potential misuse by other therapists that were not part of their team as well as patients. Helen suggested additional training for any therapists setting patients up with the programme.

> *Helen - but you guys could potentially keep an oversight of the training by someone can't get a log-in until they have received the training. Because I presume the therapists will need their own log-ins for this Fg 2 pg 26 (48:06)*

The participants also expressed concerns over adverse effects to the current service. Tina raised an issue about becoming overwhelmed with work if taking this on increased the caseload.

> *Tina - I think from our point of view we need to be careful because this would be a fantastic thing and would definitely help us with maybe discharging our patient from here a bit earlier and then maybe keeping a bit more of a like outreach through this, but then as soon as the patient has left the bed here then we are going to get another patient in. So actually the time it is going to take to keep managing this patient we need to bear that in mind in terms of our capacity. FG1 pg 33 (97:23)*

This sense of wanting control could be better understood when seeing statements like the one below from Tina. Here her use of the word danger really highlighted their fears of letting their work out into the open with the potential to be exploited. It gave a sense wanting to protect the programme from misuse by patients or therapists.

> *Tina - Obviously you would need to make sure that is was all consented. I think if you didn't have a therapist or someone overseeing the forum and it was just a chat room for them I think you would get yourself in danger. FG1 pg 32 (94:03)*

The participants also wanted to control the content to ensure it followed clinical reasoning. The participants gave examples, like the one below, where they wanted to confirm regular interaction with a therapist to ensure a patient would progress through the programme as prescribed.

> *Kate - going back to that point of it automatically upgrades you to level two or level three, does it have to be almost like an approval from the therapist. Because if someone has clicked, I know it gives more work back to the therapist.*

> *Beth - Is the therapist involved in saying that it is OK to move on.*
>
> *Researcher - Not at this stage, it happens automatically.*
>
> *Tina - Can you link this test, if you move on, so if they pass the test or if they get a better score then you can progress the exercise? FG2 Pg 36 (82:47)*

Clinical reasoning was also needed to decide which patients would use the programme. The participants felt that only certain patients would be appropriate. There were experiences shared of the patients being unreliable in reporting their symptoms following exercise. The participants expressed concerns that some patients may be untruthful about how they were genuinely feeling.

> *Tina - It would also depend on what patient you give it to because it would come back to the whole therapist onus wouldn't it. If you don't think that this patient is able to do something honestly, and self-correct themselves then you just wouldn't give this to them. FG2 Pg 36 (69:42)*

The participants needing to control the content and ensure the correct patients use the programme maybe came from wanting to avoid adverse events. Tina's comment above alluded to issues over trusting the patients. The next example considered how hard the patients will push themselves.

> *Tina- We have a lot of trouble with slowing these guys down. So they want to be doing more, want to be pushing and they will carry on. So I think you would have to limit it to doing your three exercises in this session or something like that because they would, or how, no not necessarily limiting the amount of exercises but maybe limiting how much access they have to it in a day. Because then they might go through it all and give themselves 20 minutes and then go through it all again, and then go through it all again so. Fg 2 Pg 38 (74:39)*

The participants expressed that they know the patients will potentially have a flare of symptoms following the exercises and therefore need the ability to interact with the patient to allow clinical reasoning throughout the programme and keep it safe.

> *Julia - And actually their symptoms shouldn't be getting worse. I know sometimes they are made worse by a manoeuvre but then doing the exercises it shouldn't mathem worse, like progressively worse.*
>
> *Tina - they'll get worse initially*

> *Claire - so that's why you need that information about if it's a bit rough for a few days then that is fine. FG2 pg 30 (57:52)*

5.3.4.1 Summary

The participants commented on the potential in a balance website to help provide a new element to their service, however the introduction of an online service was risky for some. Concerns were raised about the risks to patients accessing a programme inappropriately or sharing confidential material in an unintended manner. The participants wanted reassurances and design features that would allow specialist clinicians to control the content to protect the health and safety of their patients and protect the reputation of the service.

5.3.5 Theme Nine: Education to enable patient independence

This theme highlighted the participant's regard for the education of their patients and the need to improve their knowledge and the knowledge of those around them. Education was linked to patient independence and enabling patients to take ownership of their rehabilitation.

The participants felt that the therapists they refer onto have a lack of confidence in managing TBI patients. A discussion was held by four different participants building on the picture of how they found Musculoskeletal (MSK) teams lack confidence when faced with a TBI patient. This highlighted potential issues they saw teams having if presented with this programme.

> *Claire - What are the sought of questions they come to you guys with? Because they are usually not that confident are they?*
>
> *Tina - They panic, that they don't like this type of patient.*
>
> *Kate - But that's why surely this is better because all they are doing is observing that the patient is completing that. You've set it up. You've given them the exercises. If the patient has got any cognitive difficulties with it, all you're hoping is that the PCRF physio will be there kind of cognitive function to make sure and just guide them through the process and just oversee that it is happening.*
>
> *Jemma - But then if you've got an MSK physio who doesn't know how to tweak it or upgrade it or progress them, I don't know, then they are literally just going to come back to you Fg2 Pg 23 (42:12)*

The participants went onto highlight how tools could be used to help educate and support the non-specialist teams that managed their patients. It was suggested how education of these individuals, as additional training for the therapist could be beneficial.

> *Rachel - That therapist log-in could have more detailed information about vestibular and balance. Teaching and theory on it anyway and sign posted to further reading. Because if they're not neuro or vestibular by background then they might want to research more before they are just dishing out exercises. They might want a bit more.*
>
> *Researcher - As an additional feature just some therapist education.*
>
> *Claire- as a bit of a training tool for them, if we are asking them to carry on the vestibular exercises, you feel like you should give them the background behind it rather than just say, do this do that do this with them. So they understand it they are probably more likely to then implement it if they understand why they are doing the exercises that we are asking them to do. FG2 pg 27 50:34*

The need for education extended beyond the treating therapists. The team highlighted the need for additional education for family members, the patient's Unit and the patient themselves. Maggie described patients as desperately trying to explain things for their spouse, but an easily accessible page could provide support to this or help patients with memory difficulties.

> *Maggie - I think as an option it's a good idea because we might have been through it with a patient, and they might have been desperately trying to explain it to their wife or someone at home and then to be able to say, 'oh look it's all in this education section and I can talk you through it' or if they are having a tough time it might be someone directs them to and says ' look go through that again and remind yourself of why you're having a tough time, remind yourself why it's tricky to do that. But I don't know if it needs to be almost a deliberate you've got to go through this bit to get to the next exercises. FG1 Pg 20 (65:49)*

The requirement was summed-up by Rachel stating the need for education for everyone. She used strong blunt language with a 'huge need' to get the point across.

> *Rachel - plus a huge need for education for everyone really, not just the individual but the units themselves to understand because I reckon they don't. FG1 Pg 10 (33:55)*

The participants communicated a fear of the education not being correct and potential repercussions of that, particularly with this patient group. They shared a need to ensure the education was accurate.

> *Tina - I think it's like you don't want to get in trouble with someone who haven't got that kind of problem then thinks that, 'Oh well it took me to this so I have got this kind of problem. And kind of a misappropriate education they are getting*
>
> *Claire - So you want to manage the information that they are getting, yeah. FG2 Pg 13(18:13)*

Tina and Claire suggested that presenting education on multiple conditions and impairments, the patients may assume they are affected by all of them not just those relevant to them. Beth and Rachel then went on to give a potential solution to how the website may manage this and a better way to present the education information.

> *Beth - is that something on the settings page you have specific vestibular education sessions, specific proprioception and then as the therapist, when you are setting up the page you tick what education pages are appropriate for your patient, so actually if you've got a patient that is more proprioceptive, they've not actually got any vestibular issues, do they need to learn about the inner ear. So then those education pages just don't come up so it's just making it more individual to each patient.*
>
> *Rachel - yeah because you could almost say, I struggle with dizziness or I struggle this. Fg1 Pg 17 (71:35)*

One of the benefits of education discussed by the participants was that this would enable the patients to have a better understanding of their injury and therefore be more independent with their rehabilitation. The independence of the patients in their rehabilitation was frequently discussed.

> *Kate - I think you need to have an open App, because you can check any teething problems with the programme. So you could set them up, even if it was in their last couple of weeks, set them up with it. And they are doing that alongside whatever you are doing face to face and you can just check in. So if you have been doing a balance programme with them, and then in their last week you might aim for them to be more independent programme,*

> *and then that is their independent programme rather than giving them a work sheet. Fg2 pg 22 (39:28)*

Kate described how a patient's rehabilitation could include independence with the programme and this would help to show progress. She described how a programme might be used to encourage this independence by setting it up to be used independently during preparation for discharge.

Rob also discussed independence and patients taking ownership of their rehabilitation. He deemed this important for engagement and planning for eventual discharge from the team. Rob expanded on the wider elements, not just for independence, but suggested that maybe the patients are kept in the dark with their progress if achievements are shared proactively.

> *Rob - I think giving them that ownership of their rehab because we have already discussed, were not always going to be there so if you get them engaged and they take ownership of that straightaway then they will easily be able to consider how they can progress themselves without having to spoon feed that to them as well. It's all good us having our notes and we can see on our weekly MDTs that yep that guy has achieved that goal and that and ongoing. I think it's really important for these guys from a mental point of view and mood point of view, that they are part of that decision and they see, and they are the ones giving you that information 'oh yeah I was that bad and now I can do this'. Fg1 pg 18 (58:36)*

The participants highlighted some of the potential barriers to patients achieving their independence. Maggie's description below gave the impression that the therapists were the ones holding their patient's independence and the challenge for them was giving it back to them.

> *Maggie - yeah, but we all have that nature as well I believe as therapists, that slight control freakiness in us, that wants to tweak, wants to perfect and wants to make it just so, and really I think it has to keep throughout all this, it has to come back to what is the purpose this, it's actually to give them more independence. FG1 pg 34 (98:12)*

Jemma suggested how options can be made available for the patients to enable them to have their independence. She suggested the programme allowing flexibility will enable more engagement and this highlighted the importance of patient choice.

> Jemma - I think giving them the flexibility so that they can put it into their day at any time that suits. Fg2 Pg 10 (11:30)

This linked closely with other themes for making the programme individualised and showed ways of enabling patient ownership of their rehabilitation.

5.3.5.1 Summary

This theme highlighted how important the participants found education for all those involved in the rehabilitation of the patients due to the lack of understanding around TBI. The participants felt that education must be specific to each patient and sensitive to their needs. Increased education is required by everyone, the patient’s family and unit and the treating team that will be referred onto.

The participants felt that education allows increased independence in rehabilitation. Options and flexibility should enable more ownership of the rehabilitation process by allowing them to conduct their rehabilitation when it suits them.

5.3.6 Category 2 Summary

The themes in this category were predominantly generated from participants’ comments in response to website page examples. The themes highlighted that all aspects of the programme need to be aimed at making it easy to follow for military patients with TBI. To achieve this many adaptations were suggested to help TBI patients navigate the website and encourage engagement. The use of military elements in the presentation and content of the pages were supported if used sensitively when considering those transitioning out of the military.

Other important elements included education for all those involved in the patients’ care. The therapists highlighted the need for a safe online platform that allows a balance of patient choice and therapist control. The participants wanted the design of the website to encourage patients to be more independent and take ownership of their rehabilitation.

5.4 Chapter summary

In re-designing these website pages the aim was to make positive behaviour changes through patient engagement with a programme that was generated for a different patient group. The findings from FGs have generated themes covering two main areas; the first centred on the patients, and the participants lived experiences of working with military TBI patients. That category helps to outline some of the key differences between the group ‘Balance Retraining’ was designed for and the patient group this study is considering. The second category has taken the participant’s comments to propose how the website should consider the challenges and opportunities these differences presented and how a website should be adapted to help meet the difference in the population’s needs.

The findings from this chapter will be combined with comments from the FGs regarding the website itself and specific suggestions made by the participants regarding the presentation and functionality of the website. These will be presented in the next chapter in the design of example pages for the website.

Chapter 6 Website Design Data Analysis

When developing a website, specific design decisions need to be made so that its' features and pages are targeted to meet the needs of the user. This section will describe how the analysis of the FG data was undertaken to generate these specific design decisions. It will describe the process of using the IPA themes and website design features, which were generated from the FG analysis and how service standards were incorporated to generate the design decisions that informed the prototype website pages.

6.1 Generating the website design codes

IPA analysis of the two FG transcripts was conducted as per the details in chapter 4 and created the themes presented in chapter 5. These themes discussed some of the complexities of working with this bespoke patient group and the multifaceted approach required when managing them. However, in addition to these complex details, which were generated into themes, the FG findings also generated a collection of specific participant comments on features and concepts for website design. These were short and descriptive for example a suggestion of what colour font to use and therefore were not incorporated into a theme. Instead, these were moved into a separate table (appendix H) consisting of the comment and the relevant quote. See Figure 3 for a diagrammatic representation of how the data was pulled together to create the new example pages.

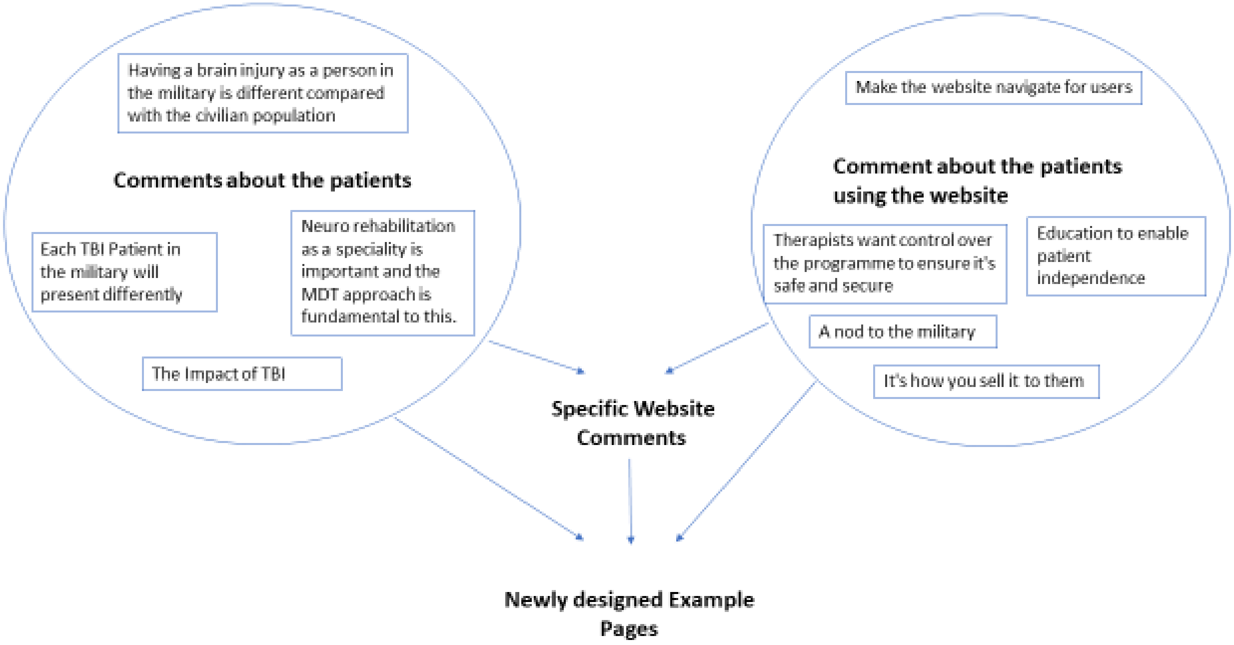


Figure 3. Diagram of themes with categories

The comments were then analysed and generated into codes. There were many examples where comments were very similar, repetitive or individually brought little value to a potential design. In these circumstances, repetitions were deleted, or similar comments amalgamated to create more meaningful codes. The codes were then collated into categories when a number were describing a similar concept, for example, codes discussing font size, colours and use of bullet points and borders were all categorised into presentation of information on a website page. A total of five categories were generated from the codes. A new table was then created with the codes organised into categories. Codes were listed against relevant quotes to ensure the codes and categories were staying true to the transcript. Appendix J lists the categories with its related codes and quotes.

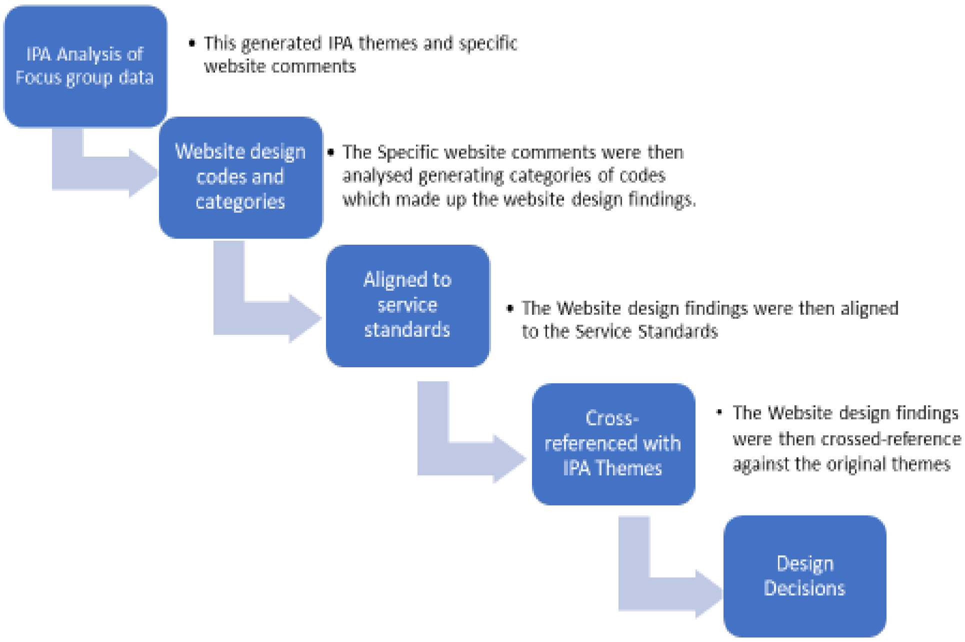
6.2 Introducing service standards

When designing the website it was important to ensure the pages and website navigation were fit for purpose. To achieve this, it was important to incorporate fundamentals of website design alongside the findings of the participants. Government service standards exist to support those developing websites for public service and were incorporated at this stage of the analysis to ensure the website design met the necessary service standards under best practise. Service standards consist of fourteen principles to be considered when creating websites that are great for the service user (Service Standard Manual, 2022). The standards address matters concerning the entire process of website creation and onward monitoring.

6.2.1 Aligning against service standards to create the design decisions

All findings from the IPA analysis stages, including the codes and categories and the IPA themes were aligned again the service standards to generate the design decisions. Table five shows the process where codes and categories from appendix H were arranged with all relevant service standard principles. Each category and code was re-read with the fourteen principles of the service standards and when the subject of a principle was relevant to that category or code it was added to the table (Table 5). A principle was considered relevant when its' content would have bearing on the final design decision. For example, the category visual presentation which included codes such as minimal text on each page and use bullet-points was aligned to three of in the principles; make the service simple to use, understand the user and their needs, make sure everyone can use the service as each of these principles were relevant.

The IPA themes were then revisited, considering how each were related to the standards and categories to ensure the findings from the analysis were true to the transcripts, and similar to the process with the service standards, those relevant were listed alongside the categories, codes and service standards. All these factors were then considered together to create a list of design decisions, thereby using all findings from the IPA analysis with alignment to service standards to generate informed design decisions where best practice has been applied. Figure four displays the process of how the design decisions were made.



- This generated IPA themes and specific website comments
- The Specific website comments were then analysed generating categories of codes which made up the website design findings.
- The Website design findings were then aligned to the Service Standards
- The Website design findings were then crossed-reference against the original themes

Figure 4. Process of design decisions

Table 5. Alignment of service standards with findings and resulting design decision

Code category and relevant service standards	**IPA Theme**	**Design Decision**
Visual Presentation Make the service simple to use Understand the users and their needs Make sure everyone can use the service	Make the Website easy for people to use for people with Brain injury The impact of brain injury	• Reduce amount of text on each page • Configure photos so there is no glare and do not have text over them. • Configure colours as per suggestions eg pastel colours with contrasting text. • Add text boxes with borders • Maintain consistency in presentation throughout pages. • Add bullet points for text • Remove layout of feature on the page that aren’t in ordered sequence

		• Have a clear Next button on each page and ensure it is very clear where a patient needs to click to move on • Design logo for website taking on all concepts. • Position text so clear and not over pictures. • Use buttons such home button, settings cog wheel, speaker and 3 dots for menu.
Military Concepts Solve a whole problem for users Understand users and their needs Make sure everyone can use the service	Having a brain injury as a person in the military is different compared with the civilian population A nod to the military	• Name of program that is 'nod to military' but still civilian friendly • Use EDIP/traffic system/ for presenting some information • Use military style pictures where being used. • Present exercises with Physical Training Instructors
Program Features Provide a joined up experience across all channels Create a secure service which protects user's privacy Have a multidisciplinary team	Each BI patient in the military will present differently and to meet these needs requires an individualised management approach The impact of brain injury Neuro rehabilitation as a speciality is important and the MDT approach is fundamental to this Education to enable patient independence	• Remove sign-up option for patients • Add exercise bank with option to add bespoke therapist designed exercises. • Add comments section after exercises for feedback and aide memoire for patients with the ability here for the therapist to see this and reply. • Add initial settings page for the therapist to individualise the program to the patients' needs with video, text size, audio, colour background, education content, print outs and ability to remove unnecessary features for higher-level patients. • Set-up ability to monitor when the patient is logging in and how long for. This should ten send a trigger

		message to the therapist if the patient isn't engaging. - Have a page for setting goals with prompts for goals to assist.
Communicating Information Understand users and their needs Make the service simple to use Make sure everyone can use the service	Make the website easy to use for people with TBI The Impact of Brain Injury	- Ensure continuity in language and scores between pages. - Remove technical language where possible and use layman's terms - Remove unnecessary stages and steps to be navigate and add tabs/buttons for quick access to regularly used pages.
Getting Patient Buy-In Provide a joined up experience across all channels Understand users and their needs	Having a brain injury as a person in the military is different compared with the civilian population Education to enable patient independence It's how you sell it to them	- Add progress pages for feedback on patient progression. These are to include graphs and different options for presenting feedback data to the patients. - Keep the patient experience stories however adjust these to be relevant text and pictures to the target population. - Include bespoke information for education and progression and targeted testing that is individualised. - Ensure the content of each page is clear what is to be gained from it so that it will have an impact – follow decisions from presentation group - Add frequent motivational pop-ups for completion of pages, logging in etc. - Give a timings for completion of pages, sections and the program where possible.

6.3 Prototype design website pages

This section will present how the design decisions were used to create the new prototype website pages. The pages are displayed at each stage of the design process, together with a description of the alterations made and the reasons behind them, referencing back to the details of the website design analysis. These were considered throughout the design process to ensure the changes being made were true to the opinions of the participants and analysis.

A selection of pages have been chosen to display the pertinent design adaptations and suggested website features from the design decisions. As the data was analysed, particular pages or design features were commented on most. These have also been chosen as the examples for the designed pages in this chapter and included; the sign-in page, an initial information page, an introductory page, an education page, a test page, and a page for how to manage side effects.

The first figure with each design presentation is the original page from the ‘Balance Retraining’ website which were presented to the first FG. The second figure is the page or pages that were presented for discussion at the second FG. These were created on PowerPoint using the initial analysis of the feedback from the initial FG. The final figure for each page is the final design created from the design decisions. The adaptations made with each page will be highlight in the figures and text below. In all figures below, green arrows show the changes made from comments made about the original page in the first FG. Orange arrows show comments about the first designs presented in FG2.

Some of the design decisions were elements or components that were common to all pages and therefore have been incorporated in all of the prototype pages and are discussed here. These included; having continuity of language and scores, using military style for graphics, language and presentation, reducing the amount of text and information on a page, using pastel colours and contrasting text, consistency in presentation and the use of borders for text. Others were specific to certain pages only and will be presented at the relevant pages.

6.3.1 Sign-up page

Within the FGs the introductory page of the website was frequently commented on. This was one of the example pages presented at both FGs and the participants proposed a number of ideas for improvements such as debating the title of the programme and the method for signing-in which incorporated security concerns for access to the programme.

This figure five shows the original design of the ‘Balance Retraining’ sign-in page at the top. Below is the first design of the sign-in page which was presented at the second FG.

Welcome to Balance Retraining

Using Balance Retraining

If you have already started using Balance Retraining just click the 'Login' button below.

If this is the first time you have visited Balance Retraining click the 'Sign up' button. Signing up will let you find out more about the training and set up your own account.

Click here to find out about the Balance Retraining Team

Privacy Statement and Information about Cookies

Important information about logging out from Balance Retraining

Click here for a printable introduction to Balance Retraining

By continuing to use Balance Retraining you are agreeing to the use of cookies. To read more about cookies click here.

Site content last reviewed: February 2017

Military Balance Retraining

New User

Official text at bottom required re: privacy statement Using cookies

Figure 5. Sign-in page from 'Balance Retraining and FG2

Figure six is the final design of the sign-up page with adaptations made from the design decisions.

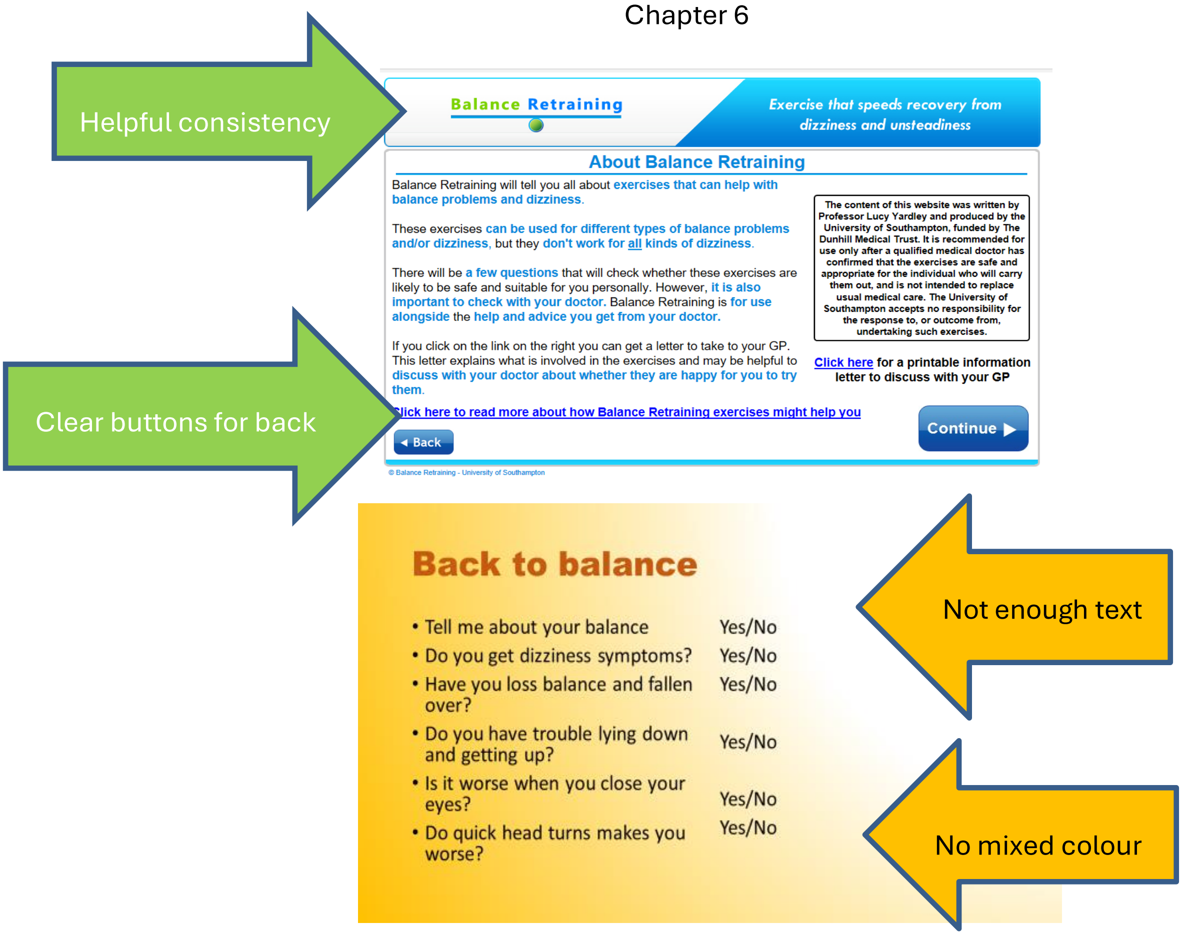
Exercise Balance

Figure 6. Newly designed sign-in page

The sign-up option was removed to leave just the login. The background colour remained pastel but given a more military relevant colour. The title was suggested by a participant in FG2 for having a link to balance and the military. A picture was added again with a military link but not specifically related to combat. Through these changes the design now considers the themes ‘a nod to the military’, ‘making the website easy for people with TBI’ and ‘the impact of TBI’. It also has followed details from the categories of visual presentation in considering font, colour and images. Programme features have been incorporated by login features and military concepts with the name, colour and images and finally communicating information by reducing the amount of text and considering language used.

6.3.2 First information Page

Figure seven shows an example of a ‘Balance Retraining’ information page at the top and below is the first design of an information page created from comments on the ‘Balance Retraining’ page in FG1.



About Balance Retraining

Balance Retraining will tell you all about exercises that can help with balance problems and dizziness.

These exercises can be used for different types of balance problems and/or dizziness, but they don't work for all kinds of dizziness.

There will be a few questions that will check whether these exercises are likely to be safe and suitable for you personally. However, it is also important to check with your doctor. Balance Retraining is for use alongside the help and advice you get from your doctor.

If you click on the link on the right you can get a letter to take to your GP. This letter explains what is involved in the exercises and may be helpful to discuss with your doctor about whether they are happy for you to try them.

The content of this website was written by Professor Lucy Yardley and produced by the University of Southampton, funded by The Dunhill Medical Trust. It is recommended for use only after a qualified medical doctor has confirmed that the exercises are safe and appropriate for the individual who will carry them out, and is not intended to replace usual medical care. The University of Southampton accepts no responsibility for the response to, or outcome from, undertaking such exercises.

Click here for a printable information letter to discuss with your GP

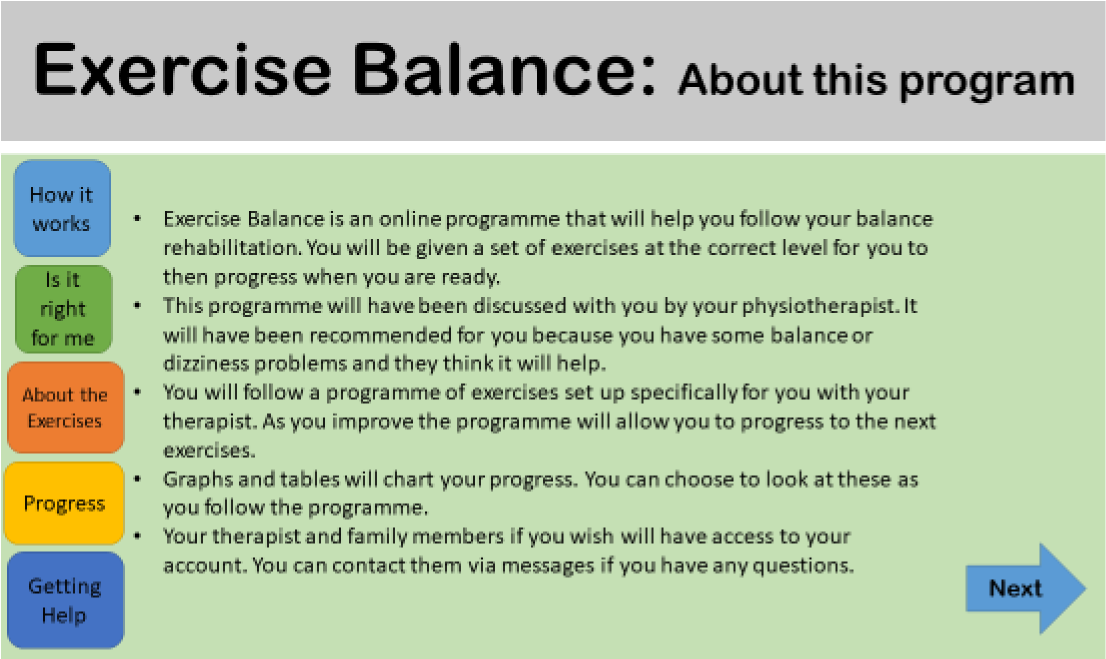
lick here to read more about how Balance Retraining exercises might help you

Back to balance

• Tell me about your balance	Yes/No
• Do you get dizziness symptoms?	Yes/No
• Have you loss balance and fallen over?	Yes/No
• Do you have trouble lying down and getting up?	Yes/No
• Is it worse when you close your eyes?	Yes/No
• Do quick head turns makes you worse?	Yes/No

Figure 7. Information page from 'Balance Retraining and FG2

Below is the final design of an information page with adaptations created from the design decisions.


Exercise Balance: About this program

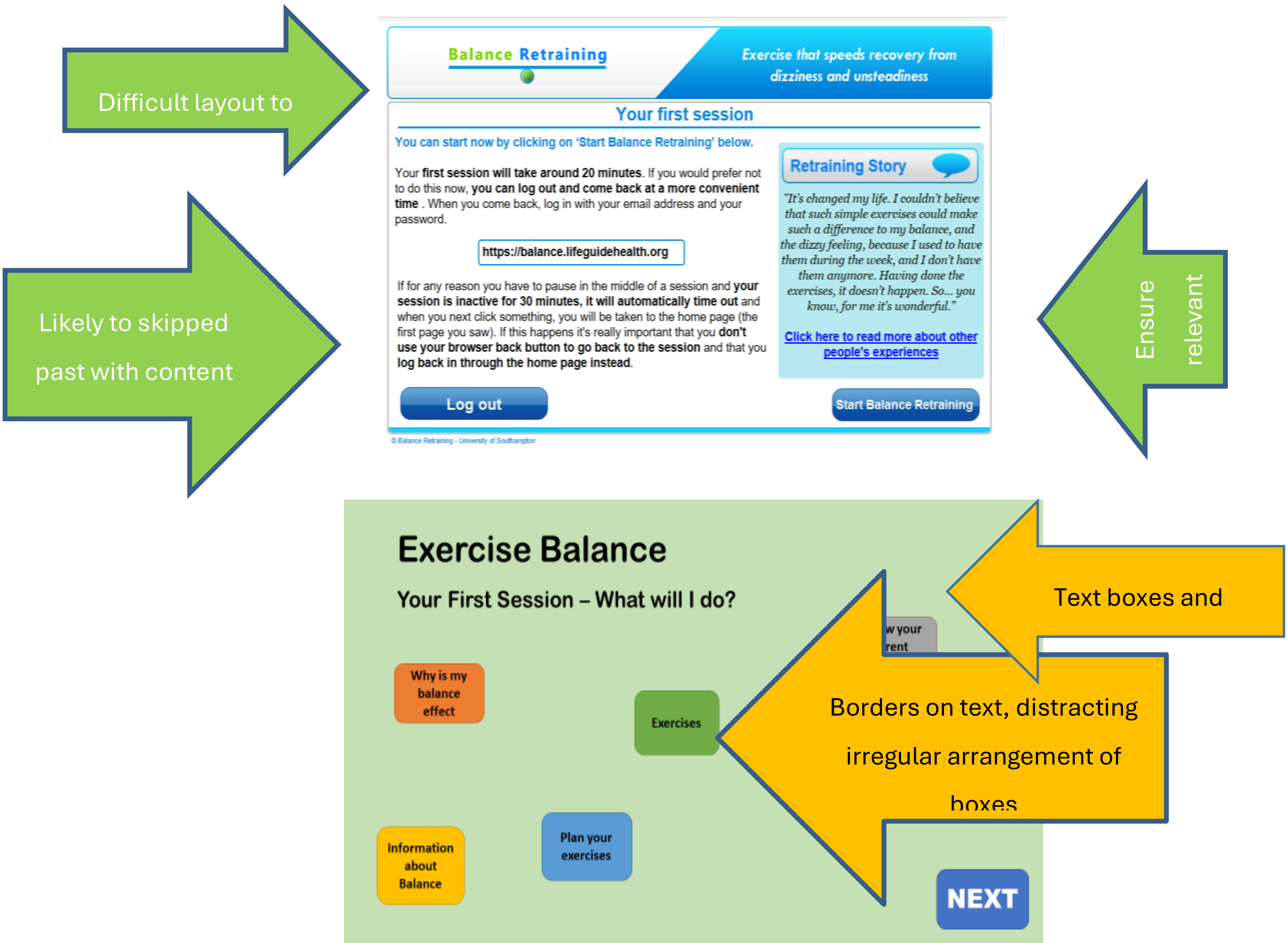
- Exercise Balance is an online programme that will help you follow your balance rehabilitation. You will be given a set of exercises at the correct level for you to then progress when you are ready.
- This programme will have been discussed with you by your physiotherapist. It will have been recommended for you because you have some balance or dizziness problems and they think it will help.
- You will follow a programme of exercises set up specifically for you with your therapist. As you improve the programme will allow you to progress to the next exercises.
- Graphs and tables will chart your progress. You can choose to look at these as you follow the programme.
- Your therapist and family members if you wish will have access to your account. You can contact them via messages if you have any questions.

Figure 8. Newly designed information page

For this page design it was suggested the text on the right would appear only as the patient clicks or hovers over the button on the left. The icons were rearranged to follow a straight line with a clear font and background colour. Consistency in page style was maintained from this page with the layout of the title, page colour and font and progress arrows being the same for each pages. This focused on themes of being easy to use for people with TBI following the communication and presentation categories.

6.3.3 Introduction Page

This figure shows the 'Balance Retraining' and first design pages for the first session with the initial 'Balance Retraining' page and main comments from the first FG followed by the first iteration of a newly designed page with comments from the second FG.



Difficult layout to

Likely to skipped past with content

Ensure relevant

Balance Retraining

Exercise that speeds recovery from dizziness and unsteadiness

Your first session

You can start now by clicking on 'Start Balance Retraining' below.

Your **first session will take around 20 minutes**. If you would prefer not to do this now, **you can log out and come back at a more convenient time** . When you come back, log in with your email address and your password.

https://balance.lifeguidehealth.org

If for any reason you have to pause in the middle of a session and **your session is inactive for 30 minutes, it will automatically time out** and when you next click something, you will be taken to the home page (the first page you saw). If this happens it's really important that you **don't use your browser back button to go back to the session** and that you **log back in through the home page instead**.

Retraining Story

"It's changed my life. I couldn't believe that such simple exercises could make such a difference to my balance, and the dizzy feeling, because I used to have them during the week, and I don't have them anymore. Having done the exercises, it doesn't happen. So... you know, for me it's wonderful."

Click here to read more about other people's experiences

Exercise Balance

Your First Session – What will I do?

Text boxes and

Borders on text, distracting irregular arrangement of boxes

Figure 9. Introduction page from 'Balance Retraining and FG2

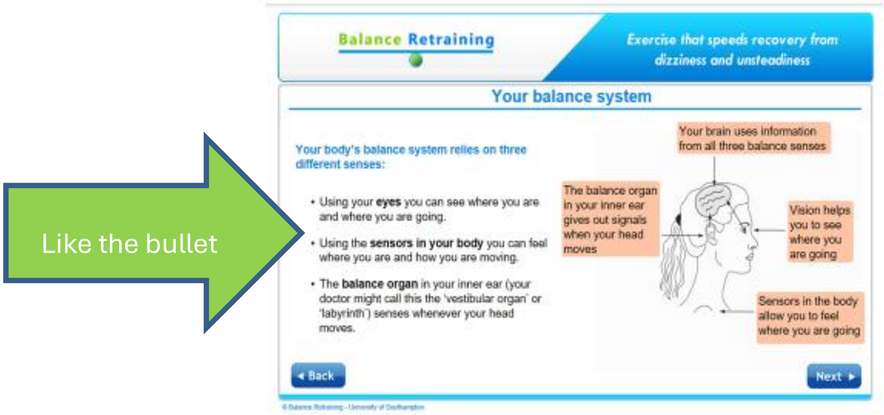
Figure 10. Newly designed introduction page

In the final design for this page, consistency has been introduced with each slide having the same lay out of military subtle colours in the background, incorporating the 'nod to the military' theme and standards concerning accessibility for users. To ensure this page was easy to use for people with TBI the use of minimal text and with dark font on lighter colours has been maintained. The buttons and places for users to click has been kept the same and arranged in a top-down alignment to make the pages easy to follow and again have consistency. To reduce the information on the page further and repeat the way the pages are navigated through, where possible, this page would open the text only when the icon on the left is hovered over or clicked on.

These changes have considered all of the five categories of website design from the IPA analysis and used the principles of understanding the user needs and making sure everyone can use the service from the service standards. Understanding from the themes of 'making it easy to use for people with TBI', 'people in the military being different to civilians' was used to guide the changes that were made.

6.3.4 Education Page

As with the previous page Figure ten shows the design stages for an education page.



Like the bullet

Balance Retraining

Exercise that speeds recovery from dizziness and unsteadiness

Your balance system

Your body's balance system relies on three different senses:

- Using your **eyes** you can see where you are and where you are going.
- Using the **sensors in your body** you can feel where you are and how you are moving.
- The **balance organ** in your inner ear (your doctor might call this the 'vestibular organ' or 'labyrinth') senses whenever your head moves.

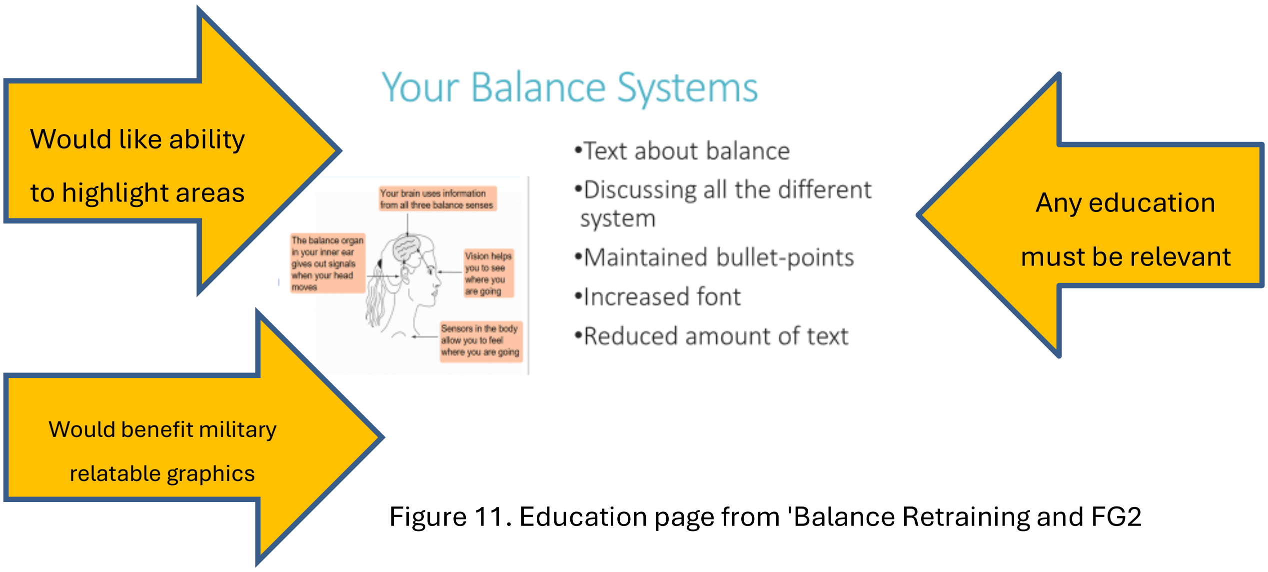
Your brain uses information from all three balance senses

The balance organ in your inner ear gives out signals when your head moves

Vision helps you to see where you are going

Sensors in the body allow you to feel where you are going

© Balance Retraining - University of Southampton



Would like ability to highlight areas

Your Balance Systems

- Text about balance
- Discussing all the different system
- Maintained bullet-points
- Increased font
- Reduced amount of text

Your brain uses information from all three balance senses

The balance organ in your inner ear gives out signals when your head moves

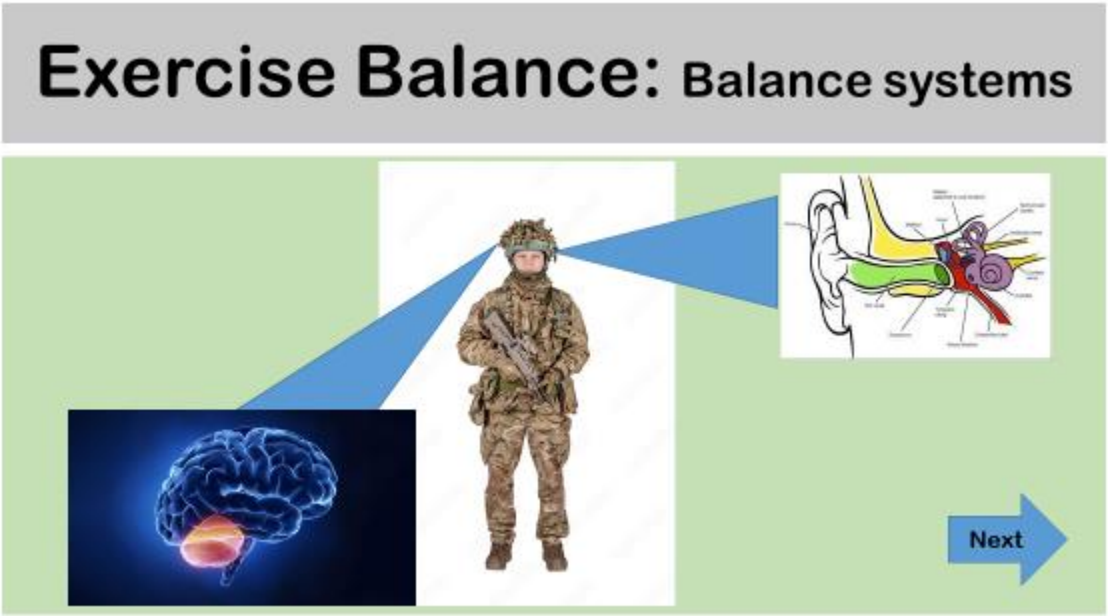
Vision helps you to see where you are going

Sensors in the body allow you to feel where you are going

Any education must be relevant

Would benefit military relatable graphics

Figure 11. Education page from 'Balance Retraining and FG2



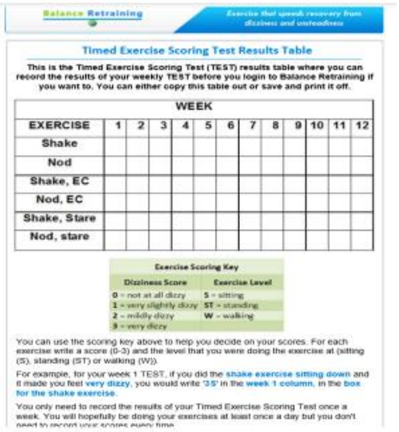
Exercise Balance: Balance systems

Figure 12. Newly designed education page

The use of education pages were primarily discussed in the second FG where the participants considered the options for encouraging engagement. Education was discussed by the participants to be a beneficial medium to encourage patient awareness alongside their families, but also an important tool in helping the patient understand why they were conducting their rehabilitation. When considering the specifics of education around the programme it was felt that facts and statistics would improve engagement and also stories from colleagues that have successfully completed the programme. It was felt that all education had to be specific to the patient with an ability to set up what education each patient received by the therapist. The use of the diagram in the ‘Balance Retraining’ was commented on well with the suggestion to high-light areas of the body. The education is now presented with more graphics and a military link. There would be an option to have the education sections as audio description or text that comes up as the user hovers over the different parts of the body then clearing from the screen as the user moves the curser to a different area.

6.3.5 Test page

The next example that has undergone redesign is the test page which invited a lot of discussion in the FGs. Figure thirteen below shows the ‘Balance Retraining’ example of a test page followed by the first design test page with annotated adaptations.



Balance Retraining

Exercise that speeds recovery from dizziness and unsteadiness

Timed Exercise Scoring Test Results Table

This is the Timed Exercise Scoring Test (TEST) results table where you can record the results of your weekly TEST before you login to Balance Retraining if you want to. You can either copy this table out or save and print it off.

	WEEK											
EXERCISE	1	2	3	4	5	6	7	8	9	10	11	12
Shake												
Nod												
Shake, EC												
Nod, EC												
Shake, Stare												
Nod, stare												

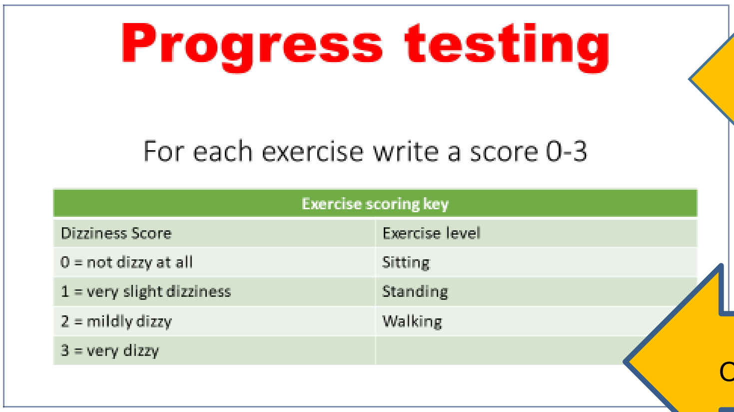
Exercise Scoring Key	
Dizziness Score	Exercise Level
0 = not at all dizzy	**S** = sitting
1 = very slightly dizzy	**ST** = standing
2 = mildly dizzy	**W** = walking
3 = very dizzy	

You can use the scoring key above to help you decide on your scores. For each exercise write a score (0-3) and the level that you were doing the exercise at (sitting (S), standing (ST) or walking (W)).

For example, for your week 1 TEST, if you did the **shake exercise sitting down** and it made you feel **very dizzy**, you would write '3S' in the **week 1 column**, in the **box for the shake exercise**.

You only need to record the results of your Timed Exercise Scoring Test once a week. You will hopefully be doing your exercises at least once a day but you don't need to record your scores every time.

Liked the colours



Progress testing

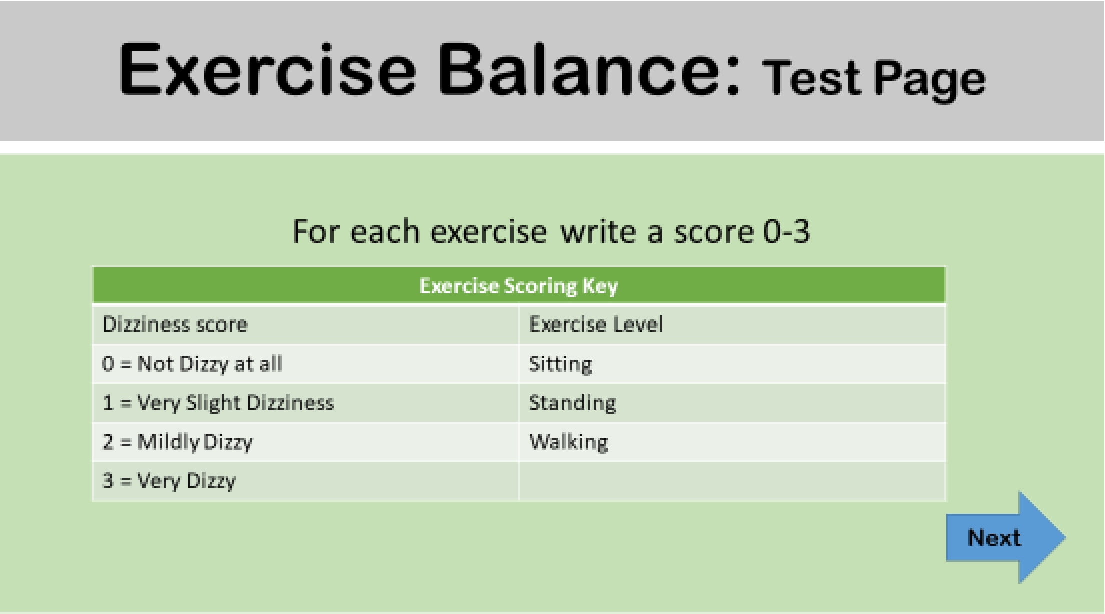
For each exercise write a score 0-3

Exercise scoring key	
Dizziness Score	Exercise level
0 = not dizzy at all	Sitting
1 = very slight dizziness	Standing
2 = mildly dizzy	Walking
3 = very dizzy	

Ensure consistency with

Careful language

Figure 13. Test page from 'Balance Retraining and FG2



Exercise Balance: Test Page

For each exercise write a score 0-3

Exercise Scoring Key	
Dizziness score	Exercise Level
0 = Not Dizzy at all	Sitting
1 = Very Slight Dizziness	Standing
2 = Mildly Dizzy	Walking
3 = Very Dizzy	

Figure 14. Newly designed test page

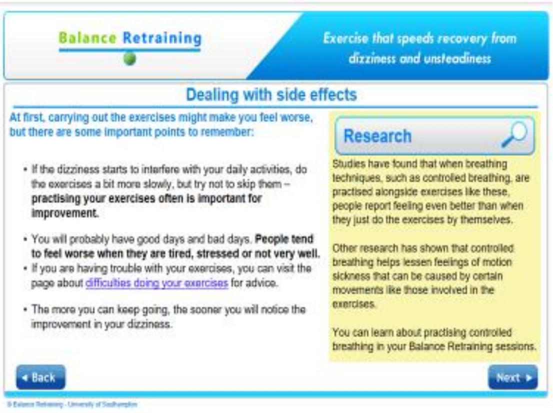
For the test page, the key considerations discussed by the participants were around the use of testing, how to present it, the outcome of a test and careful use of language to prevent unreliable results from tests due the language causing the patients to respond differently. This final design therefore has avoided using 1-10 and any extreme language as described by the participants such good/bad. This has followed the themes ‘It’s how you sell it to them’ and ‘a nod to military’ as patient traits around testing were related to the military’s competitive nature. This has used design decisions from the categories ‘getting patient buy-in’ and ‘communicating information’ as it was warned if a test or progress check is presented wrongly this could result in disengagement.

6.3.6 Side effects page

The final page to have been re-created is a page regarding the side effects of conducting the programme, considered in the remit of further information and education pages. Below is a presentation of the original ‘Balance Retraining’ page titled dealing with the side effects. The second page in page in figure 15 is the initial changes made following adaptions made. The title change is an example of where language has been changed to that which is more familiar to the

Unlikely to read

Only see words



Exercise that speeds recovery from dizziness and unsteadiness

Dealing with side effects

At first, carrying out the exercises might make you feel worse, but there are some important points to remember:

- If the dizziness starts to interfere with your daily activities, do the exercises a bit more slowly, but try not to skip them – **practising your exercises often is important for improvement.**
- You will probably have good days and bad days. **People tend to feel worse when they are tired, stressed or not very well.**
- If you are having trouble with your exercises, you can visit the page about difficulties doing your exercises for advice.
- The more you can keep going, the sooner you will notice the improvement in your dizziness.

Research

Studies have found that when breathing techniques, such as controlled breathing, are practised alongside exercises like these, people report feeling even better than when they just do the exercises by themselves.

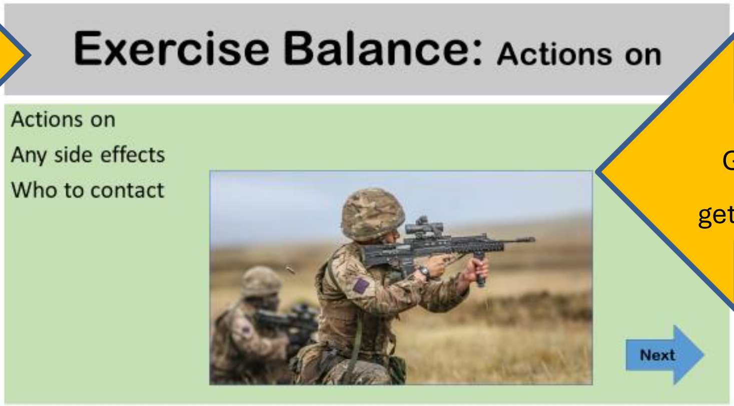
Other research has shown that controlled breathing helps lessen feelings of motion sickness that can be caused by certain movements like those involved in the exercises.

You can learn about practising controlled breathing in your Balance Retraining sessions.

military.

Avoid ‘actions

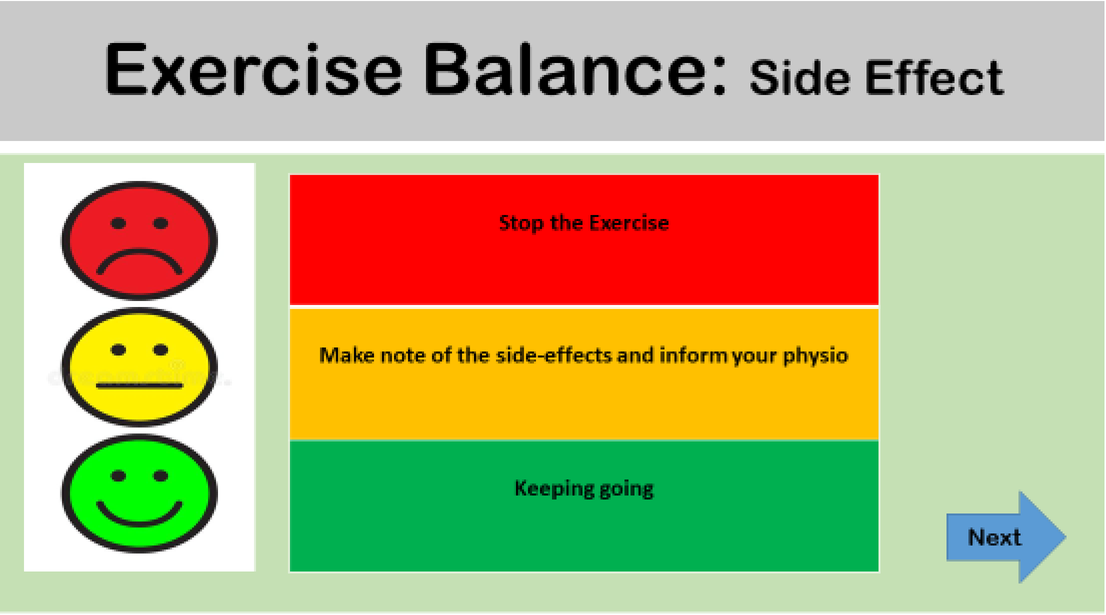
Good picture for getting attention but



Exercise Balance: Actions on

Actions on
Any side effects
Who to contact

Figure 15. Side effects page from 'Balance Retraining and FG2



Exercise Balance: Side Effect

🟥	Stop the Exercise
🟨	Make note of the side-effects and inform your physio
🟩	Keeping going

Figure 16. Newly designed side effects page

This page presents to the patient what to do when they experience side effects. A page with this content was considered very important by the participants. They regularly discussed issues around the safety of allowing independent use of a programme and this was one of their suggestions of how to implement it safely to ensure the patients would not continue exercises regardless of what side effects they might experience.

The way in which the information was presented in the 'Balance Retraining' pages was felt inappropriate for TBI patients due the amount of text and the language used. It was felt the patients would only see the words in bold and would not go in to read the information in full. Therefore, in the initial design an image was added to capture attention, the colours were changed and this was the first time this format was presented to the second FG. It was received well and therefore chosen as the selected format for the other pages seen previously. However, this image and the terminology of 'actions on' generated conversation around too much of a link to the military potentially losing some patient's engagement as it would be seen as only appropriate to those returning to military duties.

In the final design, the image was replaced for a traffic light system which was suggested as a recognisable training tool used by the military for learning skills and processes. Smiley faces were also suggested for those with learning difficulties as an adjunct to text. These elements have used the theme of the 'it's the way you sell it to them' and the categories of presentation and communication as well as many others previously discussed to alter the pages to correspond more with the service standards.

6.4 Chapter Summary

The process of analysing the data was conducted in two sequential phases when the initial data analysis generated a list of very specific comments directed at potential changes to the pages or website features. These were collated and analysed separately to create design decisions which then were used to inform the changes that should be made to create the examples of new website pages. These were created alongside the principles gained from service standards for producing a website service as well as referencing back to the themes generated in the IPA analysis.

These design decisions were then used to make changes to several of the original 'Balance Retraining' pages. This chapter has presented the newly designed pages alongside other pages presented at the FGs with an explanation of how the findings were combined with the service standards to support the creation of pages that align to an accepted standard which promotes quality services when they are being designed. The original findings were repeatedly revisited to ensure the changes hailed from the analysis of the FGs.

Chapter 7 Discussion

7.1 Introduction

This study aimed to design an online balance rehabilitation programme for military personnel with TBI. The objective was to conduct FGs using the existing ‘Balance Retraining’ programme and use the findings to make changes to the ‘Balance Retraining’ pages so that it met the needs of people in the military with TBI. The FGs aimed to discover the experiences of HCPs working with this population. IPA was used to analyse the FG data and inform design changes for prototype website pages.

This chapter will present the discussion around the main findings from the FGs and current research in the field, with an emphasis on the unique needs of military personnel. It will then describe how these findings were used to inform the design of prototype website-pages alongside discussion on the importance of technology design for rehabilitation purposes. There will be a section on the reflexive work that was conducted during this study and its impact on the findings. This chapter will then include the study strengths and limitations, further work and conclusions.

7.2 Main Findings

This section will concentrate on the following discussion points which derived from the findings;

1. The impact of traumatic brain injury. TBI is a complex and multi-faceted disorder.
2. Each TBI patient is unique. The complexity of TBI leads to an understanding that each patient is an individual, with individual needs requiring an individualised approach for their rehabilitation.
3. The importance of the multi-disciplinary team. To meet these individual needs this research has shown the importance of the specialist MDT approach which will be discussed in detail.
4. The difference of being in the military. The final discussion point will explore how these patients have been found to be different and have different requirements in their rehabilitation because they are in the military.

7.2.1 The impact of traumatic brain injury

The sequelae of traumatic brain injury results in a complex, multi-faceted condition (Pavlovic et al 2019, Libeson et al. 2022). This section will discuss in detail the complexity of patient cases the FGs described with comparison to current literature and the relevance of this detail to the design of the prototype website pages. A review of the literature prior to the study found that management of physical impairments following TBI can be negatively impacted by neurobehavioral and cognitive difficulties that can be associate with TBI. These include executive function difficulties, impulsiveness, anhedonia, obsessive behaviour, decreased attention, concentration, motivation, and insight difficulties (Arciniegas et al. 2002; Bailie et al. 2015; Lewis et al. 2015; Zacks et al. 2016). These findings were supported by the participants of this study.

The findings from the FGs add further evidence to the opinion that TBI is a complex condition. The participants expressed a need to ensure this was taken into consideration when designing website pages. This study found that the current 'Balance Retraining' programme did not have features that would suit the needs of the patient population the FG participants work with; therefore, changes would need to be made.

The first theme centred on the participants' experiences of the impact a TBI can have on a person's condition, their rehabilitation journey and the person as a whole. The participants described how TBI is a very complex, multi-faceted condition. The participants described having to 'put on different hats' for each patient to interact with all the different behavioural factors they were faced with and having to use multiple tools to allow a communication style that the patient would comprehend. This correlates with evidence from another study that has considered clinicians' perceptions of the complexity of TBI.

Jeyaraj et al. (2013) conducted FGs and interviews with clinicians working in TBI outpatient settings. The participants were from three different rehabilitation institutions, but similarly to this study, the participants were made up of different disciplines. The participants were asked specifically about the complexity of TBI and described patients as having a sequelae of physical and psychological symptoms. No detail given as to the population that these HCPs work with, other than their rehabilitation programme covers different urban, suburban and rural areas. It therefore cannot be known if this was the opinions of HCPs working in the private or public sector, or with civilian or military personnel. This paper gives more detail around the factors making TBI management complex. While this was led by the questioning and aims for this paper, there is still strong correlation in the findings of the complexity HCPs experience when working with TBI patients. Findings of the FGs from DMRC discusses how that complexity is amplified due to their patients being military personnel and goes onto detail how the website design needs to cater for that complexity.

It was important when designing the website to consider how this complexity would affect balance rehabilitation. Most patients experience a medley of symptoms because of their TBI. This will often impact the rehabilitation of balance, and the symptoms can compound each other. The participants gave examples of patients being too fatigued for physical rehabilitation if they have been through a day of other interventions and an assistant psychologist explained how some psychological symptoms can make a patient feel dizzy. These findings are supported by Horn et al. (2015) where a correlation was seen in TBI injury characteristics to patient outcomes and length of stay. They found that injury characteristics was a bigger indicator of outcome, over therapy input, or medications used. This compounds the importance of considering the complexity of a patients' condition which was clearly something the HCPs in the FGs felt was significant.

The findings from the FGs described how the multitude of symptoms following a TBI will have a marked impact on the person and their ability to successfully rehabilitate. Improving balance for someone with TBI will be more difficult than for those without TBI. Managing a balance problem, therefore, cannot be considered on its own. All the other components of TBI must be taken into consideration when designing a balance programme. The complexities of TBI can in turn impact the rehabilitation of balance due to patients struggling with confidence, anxiety, concentration, fatigue, memory and behaviour. This concurs with evidence from Seel et al (2015) who found that severity of TBI, presence of PTA and agitated behaviour were all predictors of the effort that patients put into their rehabilitation. For this study, awareness of these factors informed the format and content of the intervention being designed for individuals in this group to ensure the balance rehabilitation aspects took the TBI complexities into account.

From the FG findings, we can see that the complexity of TBI impacts the requirements on rehabilitation. One of the issues described is the need for education due to the difficulty in understanding their condition; because the condition is so complex and, due to the cognitive issues the patient may be experiencing. Hart et al. (2018) explored how TBI is a difficult condition to understand, but when the person with TBI may have a lack of insight into their condition this creates an additional requirement for support and input from the treating team. This would be key when considering the features of the website and content of the pages to ensure they cover an element of education, and it is delivered in a way the recipient will be able to comprehend.

This study supports previous findings about the complexity of TBI outcomes and further highlights how rehabilitation approaches need to be individualised with particular reference to designing this balance intervention by ensuring that the website pages have the ability to be individualised to meet the unique needs of each individual based upon their injury. This in turn has a marked impact on the patient and rehabilitation required to support their recovery. This strongly supports the use of rehabilitation technology that is specific for TBI patients. The complexity of TBI needs to be considered when designing interventions so that they meet the needs of this population.

7.2.2 Every traumatic brain injury patient is unique

The FG findings present that each TBI patient is unique and to meet the needs of each individual, the website will need to provide multiple options. The participants described how each patient with a TBI presents differently and therefore requires an individualised approach to their rehabilitation. Each patient presents with a spectrum of physical, psychological, cognitive and executive function issues. This has been shown in previous literature. Libeson et al. (2022) conducted interviews with TBI patients to determine factors effecting vocational outcomes. This paper described a multitude of factors effecting each patient, with unique physical and cognitive sequelae of TBI and therefore individualised vocational rehabilitation was recommended.

The individuality of patients at NRT was described not only about their symptoms resulting from their TBI, but also different pre-morbid physical abilities regardless of their injury. The FG participants suggested that when creating a website for the population they work with, it would require multiple options in all aspects of the website design from presentation to content.

The participants described how the variation in presentation impacted the rehabilitation each of their patients at DMRC undertakes and requires an individualised approach to the patient's management plan. This encompassed all elements of each patient's rehabilitation with the entire therapy approach needing to be specific to each of these needs. The HCPs discussed how this involved not just the specific balance exercises, but for example, the way those exercises were communicated. An individualised approach is supported in a recent paper by Karunarathna et al. (2024) which celebrates 'tailoring treatment strategies to the specific needs and clinical presentation of the TBI patient'.

Block et al. (2023) also highlighted the need for patient-centred care. Patient-centred care or person-centred care has been described to often improve patient satisfaction but not necessarily improve outcomes (Pilnick 2022). The FG participants discussed more an individualised approach. This recommendation is also cited in a study by Jaganathan & Sullivan (2020) who discuss the requirement for a flexible, individualised approach in treating patients with persistent post-concussion symptoms following mild TBI.

The findings from the FGs in the current study, by drawing on the lived-experience of the HCPs have discovered what the treating team felt was important in the management of TBI and therefore adds further weight to the conclusion that an individualised approach is beneficial.

7.2.3 The importance of the multidisciplinary team

Findings from the FGs repeatedly presented data regarding the MDT approach, resulting in the theme about an MDT being fundamental to providing the specialist care these patients need. This concurs with the SIGN Guidelines for brain injury rehabilitation in adults (2013) and the British Society of Rehabilitation Medicine National clinical guidelines for rehabilitation following acquired brain injury (2003) that recommend rehabilitation should be delivered by specialist MDTs. Participants explained how each discipline's expertise and input is essential for an effective MDT. An example, supporting patient's engagement with physical rehabilitation was reliant on working alongside other team members such an assistant psychologist or SLT.

As well as an MDT approach the participants also highlighted the importance of their professional speciality in neurological rehabilitation and TBI. This is a finding shared by Jeyaraj et al. (2013) who's FG findings of clinicians working with TBI patients also felt that interdisciplinary working was essential with the specialist skills and training required to manage complex patients. Participants from DMRC shared the value of their specialism and the importance of ensuring all those working with the NRT service users held the necessary skills and knowledge. Participants shared their feelings of wanting to be able to extend access to their services following discharge to DMRC due to concerns that access to specialist care could be limited. Current literature exists highlighting the opinion of HCPs and the need for specialists in the management of TBI. The participants expressed how working with this patient group can be challenging, a view supported by Kivunja (2018) who suggests that nurses felt a specialist skill set and specialist training was necessary for managing the challenging of behaviour in TBI as they reported working with TBI as challenging and required skills and competency for communication, observation, and pain management.

To manage these challenges, the participants of this study suggested that being part of a specialist MDT was essential to meet all the patients' needs and some of those needs could be missed without an MDT assessment. Bolukbas (2024) surveyed HCP's regarding the management of audio-vestibular consequences in TBI patients. This paper surveyed multiple locations and countries receiving responses from over 70 participants. Its findings showed lower than anticipated report of audio-vestibular impairments when compared to the findings of the systematic review. This paper surveyed numbers of responses and tabulated the answers to open questions, they were not thematically analysed therefore creating findings of a very different nature to this study. However, it concluded that non-expert HCPs may not be aware of the negative impact of audio-vestibular impairments and therefore may frequently go undetected or treated. This paper adds to the evidence that a specialist MDT is beneficial which correlates to the findings of the DMRC FGs. The qualitative nature of the analysis of the FGs provided findings that expressed the value and importance of the specialism to the MDT, and this was regarding the patients' injury and the MDT TBI specialism and their specialism in the vocational management of military patients.

There are multiple examples of qualitative work exploring the experiences of TBI patients undergoing care, and their potential frustrations of rehabilitation (Kivunja et al. 2018, Graf et al. 2017) however, fewer studies exist exploring the experiences of HCP working with TBI in rehabilitation. Block et al. (2023) conducted FGs with HCPs who had experience of working with TBI. These HCPs were a mix of AHPs and nurses recruited from the acute and subacute setting and all with experience of working with TBI. This paper focused on barriers and enablers to managing specifically challenging behaviours after TBI. The data was analysed with reflexive thematic analysis and reported findings concerning the different aspects of managing challenging behaviours. The themes from this support findings from the study already mentioned such as incorporating person-centred care. This paper supports the findings of the study FGs by highlighting the experienced staff as an enabler. This correlates with quantitative work by Dham-Datta (2015) which shows positive vocational outcomes for military TBI patients that have undergone MDT inpatient management.

The findings from the FGs in this study add to current literature as another example of how TBI is a challenging and complex condition to manage and there is a requirement for a specialist MDT to meet all the TBI needs. From these FGs we can present the unique prospectus of HCPs where they have sat down with the team as whole and really got to grips with the depth and understanding of how that team work together. This has given deeper insight to requirement of an individualised, specialist team approach and its requirement from the clinicians' opinion. We have findings from shared experiences and in a different population working with Armed Forces personnel with TBI which will be discussed in the next section.

7.2.4 The difference of being in the military

A key finding from the study FGs is that, having a TBI in the military is different. The participants described how their patients have a different mind-set being more competitive and pushing themselves more with their rehabilitation. Also, the physical challenges that they might be preparing to return to were more testing and to be conducted in very demanding environments. Any website design would need aspects relevant to military personnel to support them with engagement with the programme. The final key point highlighted by the findings was just how different the participants found it was working with patients who were serving military personnel. Participants suggested that the differences related to the following: different levels of engagement and motivation, the physical demands on military patients and the fact that they could not opt out of difficult scenarios and it is their patient's job to go to very physically challenging environments. Cernich et.al. (2015) writes about the requirement of those undertaking rehabilitation for military personnel to have an understanding of the cultural differences and the ethos of those that serve in the military. They describe how they face unique stressors and challenges that go over and above those of a routine workplace. This was summed up well by one of the participants stated simply how 'at the end of the day you are preparing them to return to war'.

Clinicians working with civilian patients with TBI have reported that certain factors affect the complexity of each case they are managing (Jeyaraj 2013). These include factors linking to the person, including examples of high-achievers, high-risk lifestyles or those with a history of aggression. Factors linking to the environment were marked life changes or unstable environment. When you consider these factors, they are relevant to the military population, which potentially underlines a reason why these patients are different and require a different approach, due to the type of person that would opt to join the military and the environment they then find themselves in results in the a multiple factors that Jeyaraj (2013) found to create complex TBI cases. When the participants from DMRC describe an awareness of how military patients are different, this could be some of the reasons why.

It was clear from the FGs that the team take pride in their speciality and are passionate about ensuring their patients are receiving the care they need throughout their rehabilitation journey beyond their direct care at DMRC. The team alluded to additional pressures they experienced to ensure they got the rehabilitation right. They cited that their patients could be medically discharged from the military if rehabilitation didn't achieve the required standards. Whether a patient was preparing to remain in the military or leave, this would have a marked variation on the rehabilitation plan.

These pressures on HCPs working with military populations have been described in other papers. Lindberg et al. (2021) discusses the differences in US military patients when their services for TBI patients were delivered through civilian sources. This editorial was published in response to difficulties being experienced when using civilian medical services to treat military personnel. This paper highlights the different ethos and mentality of a person in the military and the influence of military culture on the mentality of the individuals. It explains how important an understanding of this will be when managing military patients. This strongly correlates with the findings of the FGs and the way military patients require a different approach because of this.

The FG findings presented further evidence of the potential issues UK Military personnel with TBI may experience while undertaking rehabilitation. The participants described an increased need with military TBI patients to be educated about their condition. This included the patient and all those around them such as families and their chain of command. The SIGN Guidelines (2013) provide some evidence to support the recommendation of providing patients with advice and reassurance around symptoms and returning to normal activities as part of an educational programme. It then extended this to educating family, however, this only supported by recommended practice and no published evidence for this was given. Other publications have discussed the need for TBI patients to receive education (Sahyouni et al. 2017) but have not highlighted the nuances of military personnel having an increased need for this. The participants raised concerns on how a lack of understanding of TBI could lead to a patients' and their chain of command not comprehending the limitations an individual will face when returning to work. Because a lot of the TBI symptoms cannot be seen they can be harder to understand. In a military setting, the participants described how this could result in pressures placed on patients to perform and have dangerous consequences in conflict situations.

Prior to sustaining a TBI, military patients were described as having an exceptionally high level of physical ability. The participants saw the comparison from pre-injury to post-injury could be particularly challenging for their patient group given the difference could be greater than civilians when their TBI resulted in very debilitating physical impairments. This itself then leads to additional frustrations of the patients with their condition and is another sensitivity for the treating team to consider.

The author accepts there are a number of physically and mentally challenging civilian roles which carry danger and risk to life. However, the participants, many of whom were in the position to compare working with military and civilian patients clearly felt that working with their population was different. When the patient group you work with has a fundamental role to return to conflict, peace-keeping, world disasters they need to be able to perform physically and mentally with a balance that can allow an accurate shot of a rifle whilst under physical pressure, and the cognitive capacity to decide whether to shoot or not while under mental pressure. This is what makes rehabilitation of a TBI for a person in the military carry unique challenges.

7.2.5 Summary

What the FGs did reveal is just how unique this patient group are. With the ability for most of the participants to compare their current patients with the civilian population they were highlighting a medley of differences which they found pertinent to their management. These differences meant thinking of innovative ways of working on a regular basis to meet the needs of their patients, who, as such a unique group, guidelines have to be adapted. The variations, such as the need for high-level balance because the need to carry heavy loads while manoeuvring, moving across uneven surfaces (often in the dark) and over multiple terrains. The FG findings describe a complex condition with unique needs that required a specialist management from an MDT who have an understanding of how different it is to work with military personnel. This reasoning created a lot of support from the FGs for a bespoke intervention being designed to support these patients with individualised needs, and different demands on programmes to help them engage with rehabilitation. Taking this understanding and using it to create a bespoke balance programme for this unique population will then be discussed in the next section.

7.3 Using the findings to create prototype website pages

Chapter six gave the detailed specifics of how the findings from the FGs were used to generate the potential adaptations to the existing 'Balance Retraining' website and initial designs for website pages. This section will consider how these findings reflect current literature.

From the FG findings, 5 categories were generated as a guide to what adaptations to the webpages should be, these included:

Visual presentation – ensure the web pages are presented in a way that the TBI military population will be able to follow and engage with the website.

Military concepts – The presentation and content of the pages needed to be relevant and recognisable to military personnel.

Programme features – the website and programme content needed significant alterations to assist the therapist to work with the patient to enable their rehabilitation.

Communicating information – The content of the pages had to consider the needs of learners and communicate in a manner that would meet the needs of the target user.

Get patient buy in – The website concepts consider how to engage this specific patient population and keep them using the rehabilitation programme.

Following the analysis process and collating all the data, the newly designed prototype pages were created. This displayed very different presentation to the pages compared with the original ‘Balance Retraining’ pages. When considering the findings of the FG and description of a complexities of TBI and differences in a military population you can understand the requirement for this. ‘Balance Retraining’ was designed for people with balance and dizziness symptoms who are over fifty years old. The findings of the FGs have detailed the difference the target population hold and how their needs will result in alternative features and presentation of a website.

Looking more specifically at website design, when comparing the FG findings to current literature there are similarities in the requirement for a website to consider its’ content and the presentation of information. Manivannan et al. (2021) reviewed the quality of a number of websites that present information on TBI for its’ population and their carers. This paper assessed various aspects of websites’ quality and readability. This paper concluded that while there are websites of good quality that meet the recommended reading age, there are a number of websites that do not. The concepts in some of the categories, especially of ‘getting patient buy in’ is supported by evidence from Sahyouni et al. (2017) which found that providing patient and family TBI education was more successful when the material used was via an interactive medium on a tablet when compared to a hard-copy pamphlet.

There already exists an awareness of the need to support the development of assistive technologies to support rehabilitation and other areas of healthcare (Boger et al. 2016, Smith et al. 2018). *Devices for dignity* is an initiative as part of the National Institute for Health Research set up to develop new medical technologies to address the functional limitations that might be met by some conditions (Tindale 2015). It focuses on developing technologies for patients linking the innovation on research with the producers of the technologies and designing technologies which recognise that patients will have different needs. This is part of the movement towards user-centred technologies which recognises the need for assistive technological interventions to be developed with the user’s needs at the forefront of the design (Harris 2017).

The current literature also concurs, that TBI patients have different needs from a website to those without, however, the author is unable to source other studies making the required recommendations that military TBI patients would need. The findings presented here are to the best of the authors’ knowledge the first which discuss the next stage in what is required for adapting a website to meet the needs of a person following a TBI, particularly one in the military.

7.4 Reflections on the participants and focus groups

Reflexivity is an important component of qualitative research to enable a researcher to develop an understanding of their effect on the data, positionality and assumptions (Findlay and Ballinger 2006). When conducting IPA, it is important to have an awareness of the impact of factors such positionality, the researcher's orientation and any potential bias will have on the data (Smith et al. 2009, Palmer 2010). Reflexive work has enabled me to highlight these factors and their impact. In this section I will explore the effect the chosen methods had on the data and the eventual outcome of the study.

The requirement to have at least half of the group from the key disciplines considered to have the appropriate qualifications to contribute was achieved, with three participants in the exploratory group of six being physiotherapists. The other participants were exercise rehabilitation instructors and psychology assistants. In the design specific FG seven participants were OTs, physiotherapists or neurological psychologists with the one additional participant being a psychology assistant and not considered a key discipline. On reflection, all professions' contributions were highly valuable and valid, therefore these clinical professions could also have been considered key disciplines as described in Chapter 4.

The only key discipline that was not successfully recruited was a SLT. There was no representation from nurses, doctors and social workers. This will have potentially narrowed the breadth of data collected and the impact of this cannot be known. The lack of a SLT has potentially limited the information gathered regarding communication. This is a key element of conducting rehabilitation with patients support their understanding of, and being understood in all elements of their life. The other participants were able comment on the communication needs of their TBI patients, getting the communication of information for this website correct will be important in making it successful. This will be recognised as a limitation in this study and communication factors of the newly designed website would need be considered in any potential future work on the website design.

The design of the study aimed to, where possible, have the same participants to both FGs. Recruitment for both FGs was conducted together as one procedure with potential participants then confirming their availability to attend either or both FGs. Due to individual time constraints and other commitments only four of the participants could attend both FGs. This appeared to allow for carryover from the exploratory FG into the design specific FG. The introduction from the researcher gave all new participants in the second FG, a background from the first FG and laid out the aims for the second FG. There was very little repetition of the discussion from the first FG, and the researcher was able to facilitate the direction of discussion. The inclusion of more participants also enabled data to be collected from 10 different individuals rather than just the six. This has the potential to broaden the views and opinions shared by a higher number of professionals and therefore bring to the discussion a wider set of experiences. Overall, it was a necessity to have different individuals attending the two groups as it was not feasible for everyone to attend both.

7.4.1 Success of the recruitment process

The recruitment process was successful. Potential participants were able to make direct contact in person or via email. Potential participants were then given a hard copy of the participant information sheet with the consent form attached which was returned prior to the FG. Details for the FGs were emailed to those that returned the form and all individuals were able to attend on the day. I believe conducting the FG in work hours, onsite, made access to the group as easy to attend as possible helping prevent any last-minute cancelations.

The recruitment process was voluntary which potentially results in individuals attending that would be interested in the study, feel they had something to contribute and felt comfortable talking in a group. This led to the possibility of self-selection bias with a sample representation only including those with the above attributes and results in the potential of the data set not being representative of the wider opinion of the NRT (Green and Thorogood 2018). However, the study did not aim to represent the entire NRT but to capture their experiences and this allowed those to attend that felt comfortable in sharing their experiences.

There was the possibility of some participants attending for other reasons that potentially would not have wanted to participate, for example wanting to impress superiors. As this was a group of participants known to each other it was not possible to keep participation entirely confidential and someone could have felt pressured by staffroom conversations. I am aware that this was potentially the case with two individuals for whom I was part of their supervisory team. This could have been the case for other individuals, if their managers were attending, could they have felt pressured to attend by other external factors that were nothing to do with the study? Using a different group of HCPs for the sample may have prevented this but that was not possible. It was made clear to all participants when they enquired about attending that there was no pressure to do so. I did overhear some individuals discussing whether they would attend or not, one clearly not comfortable with talking in groups and said that they would not attend. I felt that this was positive, whilst they may have had valuable experience and knowledge to share, this individual felt able to not volunteer.

There is also the potential that individuals wanted to attend to help the researcher who, for some, was a colleague and friend. I have reflected on this and its’ effect on the data. Would some individuals want to give me the answers they think I wanted to hear rather than their own genuine beliefs? I wasn't at this point presenting my own work, but the work of 'Balance Retraining' so the participants shouldn't have felt too uncomfortable sharing negative opinions of the example slides. To prevent a potential steer of the participants to be overly supportive rather than genuine, my question choice and input during the FG had to ensure the FG realised my intent to gain all input. This was discussed at the beginning of the FG and I found myself asking them questions to clarify points. The group would naturally give examples often of a scenario to extend a point.

7.4.2 Were the selection criteria appropriate?

All individuals that expressed an interest in participating met the selection criteria. The participants gave valid and useful comments, and it was not felt that anyone did not have enough experience to comment. It was helpful for the participants to have the experience of working in both civilian and military environments to then be able to compare military healthcare to civilian healthcare. Any therapist qualified in the civilian system would be able to do this however for some, it may not have been recent experience if they had worked with the military for many years. There were those in the group that had qualified in the military and would have never treated a civilian however they provided valued depth on the military concept. The selection criteria should have considered the nature of participant's experience, ensuring a mix of civilian and military experience to allow comparison of the needs of these two groups.

It has been considered that recruitment from only one centre could potentially narrow the discussion however this would allow access to a broad spectrum of disciplines in one location and these clinicians would have experience of working with military patients who were the target user for the programme.

Two of the participants had experience in setting up websites for clinical purposes. This led to valuable contributions to the design specific FG. This added to the depth of the conversations and drew on the expertise of the participants. I wouldn't have been able to have met the participant numbers if I have insisted on this experience as well as the other selection criteria, but it did have a positive impact on the data.

7.5 Reflection on conducting the FGs and my influence on the data

7.5.1 Length and location of focus groups.

The participant information sheet stated that sessions would take between 1-2 hours and would not go over 2 hours. Some of the participants commented on how interesting they found participating in the sessions and overall, they all appeared engaged and contributed throughout therefore it is felt that the sessions were the correct length.

In the first session one of the participants had to leave after one and half hours for clinical commitments. This was one of the potential issues of the running the FGs on the same site where people work, that it could be open to less time being afforded for it in someone's day. However, there was the risk of less people being able to participate if the session had been carried out elsewhere as this would have taken even more time. Conducting the FGs in the workplace also aimed to create a comfortable environment for the participant to share their experiences. The importance of creating the correct ambience and a comfortable setting has been previously stated (Hollis et al. 2002) and often a public setting has been suggested (Kreuger et al. 2002). The participants would need to feel their comments would be confidential and not heard in a public place while talking about potentially sensitive military topics.

7.5.2 Facilitation of the FG and the use of the schedule.

The pre-prepared FG schedules were used throughout both sessions. The FG naturally moved beyond the schedule as the group got involved in the discussion. Individuals posed their own questions and discussion moved in different directions. The FG produced entirely new concepts that hadn't been considered in preparation of the schedules. As the group naturally flowed with their own discussion the topic grew depth beyond my own preconceived ideas where I had been focusing on the process of the study protocol and the development of the new programme, the FG participants were able to concentrate fully on their contributions to the questions and the discussion. Having the schedule available to refer to and used effectively as a check list meant that all areas were covered. The use of a schedule lead to my own preconceived ideas being presented to the FG but it was an essential tool to give structure, especially as a novice researcher and prevent questions being missed.

I feel this worked to reduce my own influence on the data and create new areas for discussion that carried very little of my own preconceived ideas. Using reflexive practice, I have been able to recognise better the extent to what assumptions my own experiences resulted in. I had underestimated the impact the participants felt the military factors would have on the patient's rehabilitation because for the last ten years I had only worked in a military environment and wasn't anticipating the differences so clearly. This was also true when considering my position as a military officer. It became apparent during the discussions that my expectations of what motivation and engagement would be like in a patient were very different to those civilians working in the team. I was often surprised as they described highly motivated individuals because what became clear was that in my position, I was comparing our patients to uninjured military personnel, whereas they were comparing our patients to injured civilians and this perspective created a very different picture of who we were creating this programme for.

The facilitator of the FGs was a member of the NRT leading to a risk of insider bias (Corbin Dwyer and Buckle 2009; West et al. 2013), however, this was an essential aspect of the research design. It was essential for the FGs to be facilitated by the researcher to ensure that the discussion covered the necessary areas and incorporated the right context for the development of the website. There was not an option to recruit participants from a different centre where the researcher was not a member of the team as DMRC is the only location and team that treats these patients beyond the acute hospital. The patient group being discussed are unique, in that this website is being designed for UK military patients. There is only one facility that undertakes all stages of TBI rehabilitation for these patients, therefore an alternative centre for participants would not be as specific. Also, the practical limitations of this study meant that recruitment from one location would allow facilitation of the FGs without travel being required by participants and thereby reducing the requirements on their time.

Many of the themes from the FGs correlated with findings from current literature, for example the complexity of TBI or requirement for an MDT. The papers these themes correlated with had asked specific questions about these themes in their surveys and FGs, where in this study, more general questions were asked around the experience of working with TBI and the themes came from those. The theme regarding the impact of being military personnel had no questions in the schedule relating to that. If further work were conducted, with research questions specifically aimed at the impact of the patients being military would this create more findings in this area?

7.5.3 Novice researcher

I was very aware, when starting the first FG that this was the only FG I had facilitated other than the pilot with my supervisors. I received some very useful feedback from the pilot and was also able to reflect on this myself while carrying out some practise data analysis. I learnt to give more pauses and was introduced to techniques to encourage all members of the group to speak. Having more experience would have potentially led to a different set of data. I learnt more again from personally transcribing the data set. There were points where the group could have been better facilitated to ensure only one person was speaking at a time. I have potentially lost some statements where it has been difficult to comprehend what three people are saying at one time. Also, I found there were times where I was interrupting too hastily, wanting to clarify a participants’ point. With more time between the FGs I would have had chance to learn from this. I would give participants more time to make their points, not move on too quickly and be more aware of when individuals have spoken over the top of each other.

7.5.4 My influence on the data

Being a member of the Armed Forces, a member of the NRT and the researcher of the study who then also conducted the FGs it was clear to me that my influence on the data would be marked, bringing my own preconceived ideas, moulding the data through the study design and the potential impact of my presence during the FGs. While there were some military personnel taking part in the FGs, I was the most senior, with more operational experience. On reflection I am able to see the potential that I felt I was the only person there who really felt they knew what it was like to deploy to extreme environments, in dangerous situations and immense mental load. This could have made me respond differently during the FGs and could have led to an interpretation of the data that leant towards more extreme examples to highlight the differences. However, as previously discussed, this is my norm, and therefore potentially my perceptions had tendencies to reduce the difference.

This is a study I have given great consideration to. I had my own ideas as to what the answers to the research questions would be and more directly what I expected the participants to say in the FGs. This is where the use of IPA enabled my ontological and epistemological stance. With the interpretative, hermeneutic elements and the positive involvement of my own interpretation of the data and my own lived-experiences (Smith et al. 2012).

Measures were taken to minimise my effect which have been discussed, such as how I presented myself at the FGs, the recruitment procedure and the use of a schedule with open questions. However, there will always be an impact on the data. I found at times I would seek for clarification more when an answer wasn’t something I expected. This would then have generated more discussion around that area, however, from the data analysis I have found that even when I gave more prompts if this wasn’t the opinions of the group it hasn’t come out as a theme. Potentially the FG participants were very confident individuals with clear views that were not easily influenced.

7.5.5 Power differentials

There was a mix of disciplines and seniority at both groups. All were qualified and experienced clinicians however some of the participants were team-leads and had line-management responsibility for other participants. This could have been beneficial, to have a broad aspect of opinions and experience and there was a range of age in the group as well. There were additional comments of some members who had clearly learnt their profession in more technology based clinical setting. I didn’t stipulate it in the selection criteria, having a range of age and experience level did appear to generate broader discussion. Those with experience of working with technology within their clinical work were able to bring very useful perspective on the challenges and opportunities when creating websites for people with TBI. This created very practical suggestions which those without this experience wouldn't have been aware which should be considered in future work.

One of the notable power differentials was that of military rank. I was the most senior military personnel present and worked directly with the other members of the group that were military. This has however created a rare opportunity, as most qualitative researchers working with military populations face the issue of being considered an outsider and have to overcome barriers of trust and clearances (Deschaux-Beaume 2012). As previously discussed, I presented myself in my role as a student and wore civilian attire, however, the fact that I was more senior can never be removed and it has been recognised in other qualitative work with military personnel that it is impossible to do this without the awareness and permission of a participant's chain of command (Wright 2018). This will have affected the data through potentially influencing an individual's decision to attend either positively or negatively. It could have impacted what those individuals were comfortable to say creating the potential for participant bias. They may not have wanted to have been too negative about the potential new website however lots of both positive and negative comments were made. This was mitigated through the invite to share all opinions and thoughts.

7.5.6 The influence of military and civilian participants

Both civilian and military clinicians attended. These were individuals that worked together on a daily basis, as part of a joint team therefore the balance of the group, I don't believe was affected by this as this was the norm for them all. I also feel this resulted in a reflection of reality for the participants.

What I did find, is how essential this was with regards to the contributions made by the group. Having military personnel present meant that more attributes of the intended audience for the website were presented. They were able to add depth and context to the comments and suggestions. Whilst all the civilians there had worked with the military, it was only ever as a civilian clinician and never as a serving member of the military. The military personnel were able to bring forward their own experiences of being in the military and their extra level of understanding of the mentality of the patients that would be using the programme.

In addition to this it was also essential to have individuals that had experience of working with civilians and the population that 'Balance Retraining' was designed for so that suitable comparisons could be made. Many members of the FG were able to discuss numerous contrasts between the patient groups which would then directly assist in what changes needed to be made to the website.

7.5.7 The use of focus groups

Focus groups were chosen as the qualitative tool for this study due to their ability to allow difference of opinion to be discussed throughout a group (Findlay and Ballinger 2006). As a novice researcher with no experience in conducting any form of qualitative research I relied on my reading around topics and support from supervisors to conduct FGs that would generate meaningful data.

The use of FGs as the method for exploring the first research question was an appropriate tool. When considering the group, experienced HCPs from different disciplines and different backgrounds, I predicted that there would be a mix of opinions that would need to be debated in an open forum and this was the reality. Also, considering the subject of the FG, I felt there would be lots of potential discussion and therefore FGs would be an appropriate mode. Because of the need to get specific detail for the programme design, I wanted to draw out lots of different opinions from the participants' multiple realities and be able to gain very specific data. I felt through leading the FG with additional questions and prompts I was able to do this. I was able to encourage differing opinions and listen to in depth discussion. The group were able to bring out their own opinions and totally new thoughts and discussion points which I had not previously considered and through I believe I gained a genuine phenomenological account of the HCPs experiences which is often a concern raised in the use of FGs over interviews in IPA (Smith et al. 2009). One to one interviews would not have enabled this type of discussion, contradicting opinions would have been left unresolved and the participants also posed their own questions to the discussion, further reducing my personal impact on the data. Interviews however could have reduced the impact of power differentials with the FGs. Maybe participants would have felt more comfortable expressing views and being involved if interviews were held individually.

Focus groups provided an appropriate method when considering the nature of topic. This was not an overly personal subject. Whilst participants discussed their own experiences, practises, and views this never went on to a subject that was not comprised of their thoughts on work. It is recognised practise to conduct peer review and share professional views with colleagues. Therefore, a group environment was deemed the appropriate qualitative method and I feel produced a data set that went into depth around areas and the questions.

7.5.8 Summary of reflections

Using reflexive work throughout the study enabled me to consider my influence on the data and gain a much greater understand of how my position could alter my perceptions and interpretations of the data. With the use of IPA and the interpretative, hermeneutic elements this was essential in allowing me to recognise my influence on the data but to then use this as a key part of the interpretation of the data and my experiences alongside the phenomenology of the participants. This was particularly pertinent in exploring my positionality as a serving member of the Armed Forces conducting research alongside military and civilian colleagues. Overall, I feel the chosen methodology and methods resulted in a valuable data set with meaningful analysis which led to findings that are able to inform the answer to the research questions.

7.6 Strengths and Limitations

This section will consider the strengths and limitations of the study, to help influence changes in the future to further work. This study has been successful in gaining access to the lived-experience of a group of HCPs that work with a unique patient population. One of the enablers for this was the researcher themselves being part of the team involved. This was facilitated by the use of IPA which permitted an emic epistemological stance and allowed for my integral position to the team I was researching. The experience and enthusiasm of the participants generated a rich data set creating themes beyond the speculation of the author. The recruitment of both civilian and military participants added to the experiences the group were able to share and the experience some had with creating technology-based interventions also added great value.

There were elements of the study that despite all efforts did not go according to the planned methods. The first of this was the inability to recruit from all disciplines of the MDT. The most prominent of these was SLT. It cannot be known the effect this has had on the data, however as mentioned in the reflections, other members of the MDT were able to comment on elements of communication. It does however lead to the potential that specific suggestions around communication have not been capture in the findings and therefore the conclusion of this study.

The second limitation was an unplanned change to the methods. Due a relocation of DMRC, there was a restriction in the time that FG participants were going to be available. The first FG was conducted, and the plan was to conduct full analysis of explorative FG prior to conducting the design specific FG. After the first FG, the move was due to take place within a matter of weeks resulting a significant number of staff members leaving or being unavailable due to time constraints. Therefore, a rapid, less detailed initial analysis was conducted, enough to generate the example PowerPoint presentation slides to present to the next FG. Again, the exact impact of this on the data and subsequent findings cannot be known. Potentially more information to formulate the example pages could have been gained from a more detailed analysis prior to the second focus group.

Another limitation of the study was the level of experience of the researcher, as a novice in conducting FGs and analysing the data. This was the first study conducted by the researcher and their first involvement with facilitating FGs or conducting IPA. As such the researcher found times where transcribing the data was difficult as multiple voices were hard to decipher and perhaps a more experience facilitator would have known to prevent this happening or ask people to repeat comments. A more experienced researcher would have skills to encourage a depth of conversation, prevent individuals talking over each other and have the experience in analysing the data to expose the most meaningful findings.

Finally, a key limitation of the study is that it stops short of creating a website which has then gone on to be tested with the target audience and therefore confirming the efficacy of the findings and creating an intervention for use in the clinical setting.

7.7 Future work

It is the intention of the author to publish elements of this work and present abstracts. Further this there is a requirement for continuation of the work into a functioning website.

7.7.1 Publication Plan

Following completion of the thesis it is the authors intention to submit the study abstract to the Defence Medical Services Rehabilitation Conference (UK) in December 2025 and British Physicians of Sports and Rehabilitation Medicine in September 2026. This is with the aim of highlighting the study’s findings of the differences in approach required when working with military personnel compared with civilians.

To the best of the authors knowledge this study has created novel findings discussing the nuance of rehabilitating serving military personnel and recommends a different approach compared to civilian populations is required. Some work exists describing the challenges of producing qualitative work with military personnel (Wright 2018). This includes a text describing the difficulties of seeking approval to speak with military personnel and then to gain their trust and encourage them to speak openly with confidence. This author was themselves a service member of the military which is believed to have prevented a number of potential barriers and given the opportunity for a unique exploration of the experiences of HCPs working with military personnel. Publications would aim to use the findings of this study to present the importance considering the differences between military and civilian populations. The relevance of this becomes pertinent when considering the guidelines for treating TBI are based on the management of civilian patients. This work could support the production of more appropriate guidance specific to military populations.

This qualitative work is thought to present the most impact from this study and the author aims to publish a title ‘The perceptions of HCP on the rehabilitation needs of military TBI patients compared with civilian patients. Journals for potential submission include: the British medical journal of military medicine, journal of military and veterans’ health, Journal of Head Trauma Rehabilitation.

When conducting the literature review it was recognised that currently there isn’t a systematic review of the incidence or prevalence of TBI in military populations. If work of this nature was published it would benefit the Armed Forces in the management of TBI in their populations

7.7.2 Next Steps

This study aimed to conduct some of the preliminary work for creating and testing a web-based programme. This progressed as far as the stages of prototype website pages being designed. Subsequent research should focus on creating a prototype website using the findings from this study to then generate a full prototype intervention and its’ subsequent testing.

These preliminary study stages utilised HCPs as the study participants. The use of patient and public involvement in TBI research has a number of benefits for qualitative research given the heterogeneity of the population (Whitehouse et.al 2021). Given the aims of the next steps of any further work is to gain an understanding of how best to design the web-pages to meet the needs of military TBI patients, it will be essential to have their feedback and opinions on the work.

It will be important in subsequent stages of the project to the utilise participants from the target population for the website. Think-aloud studies could be used to test the programme with the target population of TBI patients in the military. Think-aloud studies would involve gaining feedback from a participant while they navigate a prototype website. Think-aloud studies would be a possible method of analysing feedback from TBI patients to test to design features and iteratively make adaptations (Zhoa et al. 2012). They have been successfully used with populations with mild cognitive impairments (Schmitter-Edgecombe & Creamer 2010) and TBI (Schmitter-Edgecombe & Bales 2005). The analysis from the think-aloud studies would create any necessary additional changes to generate a prototype website. Testing of this prototype website could then be achieved via a series of case studies and feasibility study using the newly developed website as part of a rehabilitation programme. These stages of the research would be conducted with military personnel with TBI with the aim of generating a tested web-based programme for TBI patients in the military.

7.8 Conclusions

This study aimed to discover the design requirements for an online balance rehabilitation programme for military personnel with TBI. The objective was to conduct FGs with HCPs with experience of working with the target population, to gain their opinion on the existing ‘Balance Retraining’ programme. The FGs aimed to discover the HCPs views on what changes would be necessary to the current programme for it to meet the needs of military personnel with a TBI. IPA was used to analyse the FG data and inform design changes for a prototype website.

The research questions were as follows;

RQ1: What are the challenges and opportunities experienced by healthcare professionals when rehabilitating balance in UK military personnel following TBI?

RQ2: What are the opinions of health professionals on the use of ‘Balance Retraining’ with military TBI patients?

RQ3: What changes are necessary for the current ‘Balance Retraining’ programme to be used by people in the military with TBI?

In answering these research questions the FG findings concluded that:

TBI is a complex condition, making the rehabilitation of balance challenging and these findings concur with current studies. These complexities must be considered when designing interventions for people with TBI. The HCPs highlighted how each presentation of TBI is unique and this requires an individualised approach. To achieve this individualised approach the website would need to have multiple options that could be set by the HCPs so that the programme could be bespoke for each person that uses it.

The participant's view is that a specialist MDT is essential, and this concurs with current literature, however, the participants in this study feel their patients have an additional set of requirements due to being in the military. Being military personnel is seen as adding to the complexity of the presentation and recovery process and outcomes for the individual. The rehabilitation concluded in these patients being described by the HCPs as being ‘prepared to go back war’ and the participants felt this had a significant impact on the approach their whole team takes because they are working with military patients.

An online rehabilitation programme for balance was received very positively. When considering the ‘Balance Retraining’ programme, the participants were very positive about using a programme like this with military TBI patients for improving balance. There were a number of changes and suggestions made to alter the programme to help it meet the needs of their patients compared to the current target user (of people over 50 with balance problems). Changes included: presentation of text, the use of bullet points rather than bodies of text. The participants suggested consistency of presentation between pages and colours that were supportive for those with difficulties reading. For communication the participants wanted non-technical language, continuity of language and minimal steps and stages to navigate and for programme features the participants needed the programme to enable options, aide-memoires, exercise banks, feedback and monitoring capabilities and goals to support patient buy-in. Other suggestions for helping patients to engage were motivational statements, clear content, bespoke information that relevant to each patient and progress pages. All of this should be done with ‘a nod to the military’, presentation, graphics, programme name and features having a military concept that is recognisable for the service user.

Appendix A Poster Advertising the Study

Would you like to take part in a study to develop balance training for brain injury patients?

Do you work as a clinician in the DMRC NRT with more than one year's experience in working with Traumatic Brain Injury?

Dr Ellis, Neuro Rehabilitation Consultant, would like to invite you to take part in

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Study Details

This study is aiming to develop a web-based programme to help

this study with DMRC Headley Court Neuro Rehab Team.

What will be involved?

You will be asked to attend two focus groups, which will last approximately 2 hours. In these focus groups, you will be invited to share your opinions and experience on elements of managing patients with Traumatic brain injury. Your opinions are needed to help the programme meet our patients' needs.

Who are we looking for?

Clinicians of ALL professions with experience of working with TBI within the military.

What do I do if I am interested in getting involved?

Please contact Hannah Marshall via email

Hannah.marshall421@mod.gov.uk

Appendix B Participant Information Sheet

Participant information sheet

Development of Balance Retraining for Brain Injury

My name is Hannah Marshall and I am supported by my PhD supervisors; Jane Burridge, Ann-Marie Hughes and Juliette Truman. Hannah is a military physiotherapist conducting research studies, Jane and Ann-Marie are physiotherapy researchers, and Juliette is an occupational therapist researcher. We specialise in acquired brain injury rehabilitation at the University of Southampton. We are writing to invite you to take part in a research study.

It is important for you to understand why the research is being carried out and what it will involve before you decide. Please take time to read the following information carefully. If something is not clear, or you would like further information, please do not hesitate to contact us on the telephone number given at the end of this information sheet.

What is the purpose of this study?

Traumatic brain injury (TBI) is the leading cause of death and disability in young people (Basso et al. 2007). Balance problems are a particularly common physical impairment following TBI (Jourdan et al. 2016) and military veterans that have sustained a mild TBI have been shown to have reduced dynamic and static postural stability (Pan et al. 2015). The combination of reduced balance with the cognitive difficulties associated with TBI results in a high risk of falls following TBI (Mculloch et al. 2010) and long-term impared balance has been reported in up to 43% of patients following TBI (Basford et al. 2003, Jourdan et al 2016).

In addition to physical impairments, survivors of TBI can often experience behavioural, cognitive and executive function difficulties (Zacks et al. 2016). These can make management of physical symptoms more challenging. Levels of adherence to rehabilitation following TBI have been documented as being low (Vermiere et al. 2001) and there is a documented reduction in levels of activity for TBI patients at the point of discharge back to the community (Hamilton et al.2015).

Conventional management of TBI involves specialist multi-disciplinary rehabilitation with a focus on repetitive task-orientated training being recommended for recovery of physical function (Turner-Stokes et al. 2011).

Balance Retraining is a web-based intervention for balance in people over fifty years old. The programme aims to improve adherence to balance training. It is essential to have a thorough understanding of the target population and how best to overcome any difficulties in order to determine how a website should be presented to allow TBI patients to navigate pages. It is anticipated that the needs of people with TBI will be different to those currently targeted by Balance Retraining. The aim of this project is to modify Balance Retraining for use with TBI patients with impaired balance. In order to achieve this aim it will be necessary to discover the bespoke needs of the TBI population so that the intervention will cater for their specific needs.

Why am I being considered for this study?

You are being considered because you are a therapist with experience working with brain injury and you work at DMRC Headley Court.

Do I have to take part?

You do not have to agree to take part in the study. There is nothing to do if you do not wish to participate and you do not have to give a reason. If you decide to take part you will be asked to sign a consent form.

What happens if I change my mind later on?

If you decide later to withdraw, you can do so at any time and do not have to give a reason. This will not affect your legal rights.

What will happen if I take part?

If you decide that you are interested in participating in the study, the Research Assistant will ask you to sign a consent form to confirm that you are happy to participate. You will participate in two focus groups with other health care care professionals who work with brain injury. What you say will be tape-recorded.

Where and when will this take place?

The focus groups will take place at DMRC Headley Court during working hours. The study will be running in 2017 and 2018.

How long will the study last?

There focus group will not have a fixed time, however we expect them to last anywhere between 1-2 hours.

What are the possible benefits of taking part?

There are no direct benefits associated with taking part. You may however be interested in contributing to the design of the system.

What are the side effects of taking part?

No side-effects are expected from taking part.

What happens if I suffer any harm?

The MoD operates a ‘No-fault Compensation Scheme’ (see details attached). This allows for claims for injury or illness suffered as a result of participation in an MoD approved study. However, there is no prospect of you suffering any harm as a result of your participation in this study.

What if something goes wrong?

If you have a concern or a complaint about this study you should contact Gp Capt Alex Bennett, Professor of Academic Department for Military Rehabilitation (ADMR), DMRC Headley Court, Espom, KT18 6JW.

Who is organising the research & reviewing the study?

The study is being run by the Academic Department for Military Rehabilitation and is registered with University of Southampton. It has been reviewed by the Ministry of Defence Ethics Committee.

What will happen to the results of the research?

At the end of the research, the data collected will be securely stored for 20 years. The results will be presented at conferences and may be published in research papers for scientific journals. We hope this will help to inform clinicians of the results and improve the treatment of patients. If you would like a copy of the published results at the end of the study please let us know.

Will my taking part in this study be kept confidential?

All information which is collected about you during the course of the research will be kept strictly confidential. Only researchers from the team will have access to your data. Any information about you which is used in research reports or publications will have your name and address removed so that you cannot be recognised from it.

Contact for further information:

If you would like more information please contact Hannah Marshall on (01372) 378271 ext 7402 or email on hannah.marshall421@mod.uk. For general advice about taking part in research studies, please contact Mr Russ Coppack, Clinical research manager of the ADMR : DMRC-ClinicalResearchManager@mod.uk.

Thank you for taking the time to read this information.

Appendix C Consent form for participants in research studies

Title of Study :

Designing a the web-based intervention for the Rehabilitation of Balance Impairments following Traumatic Brain Injury.

MoDREC Reference : 844/MODREC/2018

Please Initial or Tick Boxes

1. **The nature, aims and risks of the research have been explained to me. I have read and understood the Information for Participants and understand what is expected of me. All my questions have been answered fully to my satisfaction.** ☐
2. **I understand that if I decide at any time during the research that I no longer wish to participate in this project, I can notify the researchers involved and be withdrawn from it immediately without having to give a reason. I also understand that I may be withdrawn from it at any time, and that in neither case will this be held against me in subsequent dealings with the Ministry of Defence.** ☐
3. **I consent to the processing of my personal information for the purposes of this research study. I understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.** ☐
4. **I agree to volunteer as a participant for the study described in the information sheet and give full consent.** ☐
5. **This consent is specific to the particular study described in the Information for Participants attached and shall not be taken to imply my consent to participate in any subsequent study or deviation from that detailed here.** ☐
6. **I understand that in the event of my sustaining injury, illness or death as a direct result of participating as a volunteer in Ministry of Defence research, I or my dependants may enter a claim with the Ministry of Defence for compensation under the provisions of the no-fault compensation scheme, details of which are attached.** ☐
7. **I understand the compensation arrangements that have been provided.** ☐

I give consent for audio-recording to be taken and stored securely in accordance with the Data Protection Act 1998

Participant's Statement :

I ....

agree that the research project named above has been explained to me to my satisfaction and I agree to take part in the study. I have read both the notes written above and the Information for Participants about the project, and understand what the research study involves.

Signed : Date :

Witness Name :

Signature :

Date :

Investigator's Statement :

I ....

confirm that I have carefully explained the nature, demands and any foreseeable risks (where applicable) of the proposed research to the Participant.

Signed : Date :

Authorising Signatures

The information supplied above is to the best of my knowledge and belief accurate. I clearly understand my obligations and the rights of research participants, particularly concerning recruitment of participants and obtaining valid consent.

Signature of Chief Investigator

…………………………………………………… Date :

Name and Contact Details of Independent Medical Officer (*if appropriate*) :

Name and Contact Details of Chief Investigator :

Appendix D Exploratory Focus Group Schedule

Introduction

Welcome

Hello and welcome to our session. Thank you very much for being here today and volunteering your precious time.

The topic

As part of my MPhil Studies at the University of Southampton I am aiming to develop an online balance training programme for your patients with TBI. I am going to use a pre-existing website that is designed for older people with balance and dizziness problems. However, I anticipate that the TBI patients treated here will have different needs and complete some different rehabilitation for balance than older people. The aim is to create an online programme that is user friendly for this group of patients and this is why I am holding focus groups with you. You are all healthcare professionals that have worked with TBI I am hoping to find out from you your thoughts on the challenges and opportunities of working with this patient group when rehabilitating their balance. I will then show you some of the Balance Retraining pages to gain your feedback on whether you think it would work with your patients.

Guidelines

There are no right or wrong answers just different points of view and I am interested in all of them. Please feel free to share your opinions even if they differ from others. I am interested in all comments negative and positive.

We will be tape recording the session so that I don't miss any information and we will both be taking notes however all notes and recordings will be kept confidential. We will use first names today in our discussion however, I will not use names in the analysis and your information will be kept confidential. Can I ask that where possible we keep to one person talking at a time to assist in analysis of the discussion. I will be facilitating the session, I apologise if it appears that I am interrupting, at any point, I will just be making sure we stay on track

Please can I ask that phones are not used during the session.

As a reminder, everything that is said in this room is confidential and is to be kept that way.

Does anyone have any questions before we start?

Before we start for the benefit of the tape can I ask you all to say your name please?

Questions

Tell me about your particular TBI patient group and working with their balance?

- What do you do to make sessions more enjoyable?

- What things make it challenging to complete balance rehabilitation with patients?

What challenges do you find with getting TBI patients to engage with their rehabilitation?

What measures do you take to improve engagement with therapy?

Do you find there are any barriers to communicating their physical rehabilitation?

- Are prompts and aids are used?

What types of work do your patients do independently for balance and how is this structured?

What if any continued balance therapy do patients require when they leave DMRC Headley court?

- How do they conduct this? Independent/with other therapists.

Demo the Balance Retraining – Present these questions to the group prior to the demo and invite input throughout the demo.

In the next focus group we will go into detail regarding the design of the website and what features it should have, however in preparation for that I will take your comments from today to create some example pages to discuss further.

What are your thoughts on using an online balance programme with your patient group?

What are the strong points?

What are the weak points?

What changes would you make?

Do you think your TBI patients would be able to follow the programme?

Closing

Thank you for your input today

I will now analyse the information you have given me today and use it to produce some example pages for a new website.

We will then discuss those at the next session.

Thank you for time.

Appendix E Design Specific Focus Group Schedule

Introduction

Welcome

Thanks again for giving up your time for this discussion group. As a reminder and for the benefits of those that were not able to attend the first session we are aiming to create an online balance programme for your patients with TBI. I will be basing this from a website already exists however this is designed for an older population without TBI.

In the first focus group discussed working with your TBI patients, the demands, and strengths and we discussed what rehabilitation is done for their balance. We then went onto review the some example pages from the current website to get some initial ideas.

Today I will go through some basic idea for pages that have been created using some of the information from our last group discussion. We will discuss these and then go through the specific design features of the programme. This will aim to make the programme as user friendly as possible for the patients.

Guidelines

There are no right or wrong answers just different points of view and I am interested in all of them. Please feel free to share your opinions even if they differ from others. I am interested in all comments negative and positive.

We will be recording the session throughout so that I don’t want to miss any information and we will both be taking notes however all notes and recording will be kept confidential. We will use first names today in our discussion however, I will not use names in the analysis and your information will be kept confidential. Can I ask that where possible we keep to one person talking at a time to assist in analysis of the discussion. I will be facilitating the session, I apologise if it appears that I am interrupting, at any point, I will just be making sure we stay on track.

Please can I ask that phones are not used during the session.

As a reminder, everything that is said in this room is confidential and is to be kept that way.

Any questions before we start.

For the benefit of the recording please can I ask that you go round the room and say your name.

Present Example pages – present them via a display which they remains available.

Questions

What are your thoughts on the example pages?

How should the pages be presented? eg particular font/graphics, how much information should be on the pages?

What is the best way of communicating the information? Eg voice, written, video

What features do you think would work well for an online intervention?

Would it be helpful to have comments from carers, HCP?

Would it be useful to have education pages with brain injury education on the pages?

What exercises should be on there?

What is the best way to present the exercises?

Should there be options for this?

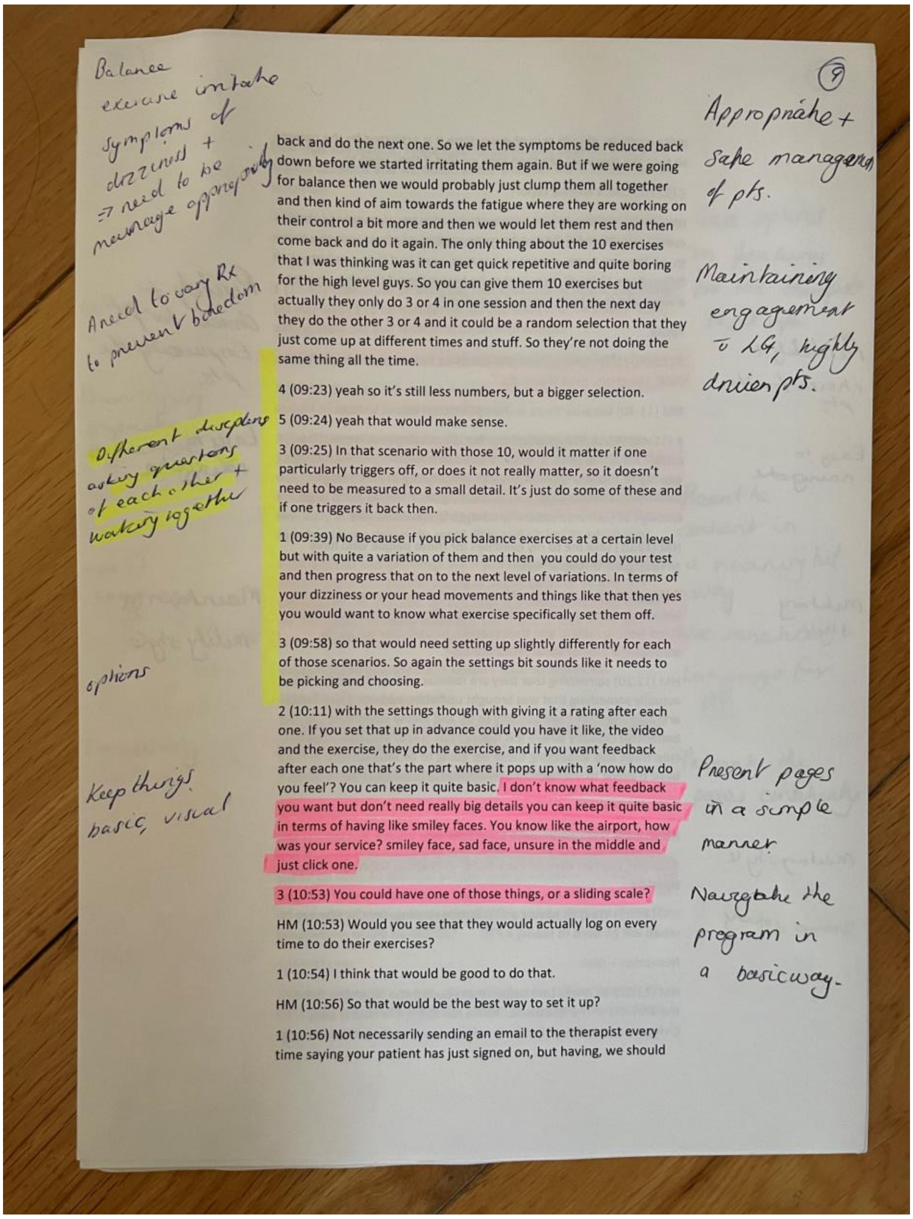
What do you think we should call the programme?

At what phases of a patient’s rehabilitation should the programme be used?

Closing

Thank you for your input today. I will be using all of this to develop the new balance intervention.

Appendix F Transcript with Analysis comments



⑨

Balance exercise initiate symptoms of dizziness + ⇒ need to be manage appropriately

Appropriate + safe management of pts.

back and do the next one. So we let the symptoms be reduced back down before we started irritating them again. But if we were going for balance then we would probably just clump them all together and then kind of aim towards the fatigue where they are working on their control a bit more and then we would let them rest and then come back and do it again. The only thing about the 10 exercises that I was thinking was it can get quick repetitive and quite boring for the high level guys. So you can give them 10 exercises but actually they only do 3 or 4 in one session and then the next day they do the other 3 or 4 and it could be a random selection that they just come up at different times and stuff. So they're not doing the same thing all the time.

A need to vary Rx to prevent boredom

Maintaining engagement c̄ LG, highly driven pts.

4 (09:23) yeah so it's still less numbers, but a bigger selection.

5 (09:24) yeah that would make sense.

Different disciplines asking questions of each other + working together

3 (09:25) In that scenario with those 10, would it matter if one particularly triggers off, or does it not really matter, so it doesn't need to be measured to a small detail. It's just do some of these and if one triggers it back then.

1 (09:39) No Because if you pick balance exercises at a certain level but with quite a variation of them and then you could do your test and then progress that on to the next level of variations. In terms of your dizziness or your head movements and things like that then yes you would want to know what exercise specifically set them off.

options

3 (09:58) so that would need setting up slightly differently for each of those scenarios. So again the settings bit sounds like it needs to be picking and choosing.

Keep things basic, visual

Present pages in a simple manner.

2 (10:11) with the settings though with giving it a rating after each one. If you set that up in advance could you have it like, the video and the exercise, they do the exercise, and if you want feedback after each one that's the part where it pops up with a 'now how do you feel'? You can keep it quite basic. I don't know what feedback you want but don't need really big details you can keep it quite basic in terms of having like smiley faces. You know like the airport, how was your service? smiley face, sad face, unsure in the middle and just click one.

3 (10:53) You could have one of those things, or a sliding scale?

Navigate the program in a basic way.

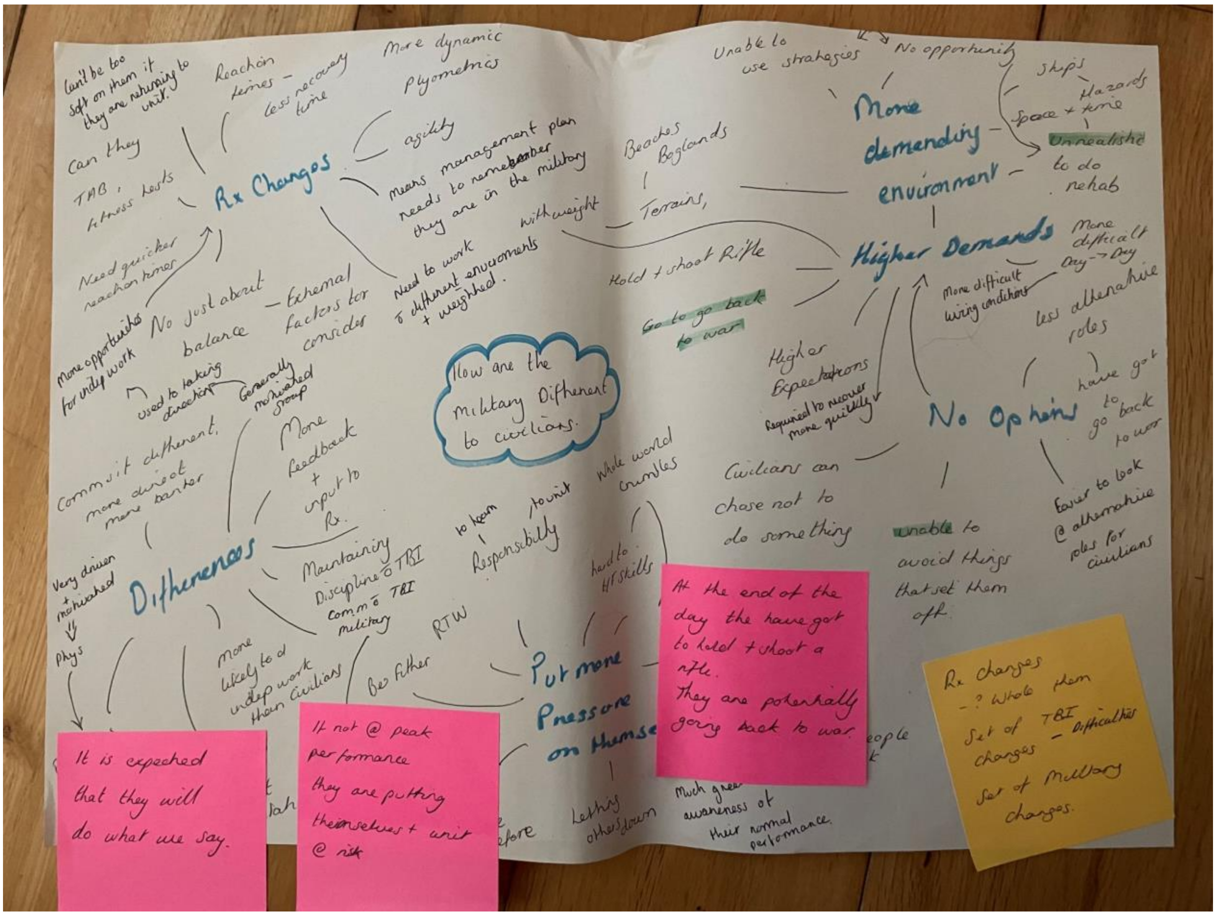
HM (10:53) Would you see that they would actually log on every time to do their exercises?

1 (10:54) I think that would be good to do that.

HM (10:56) So that would be the best way to set it up?

1 (10:56) Not necessarily sending an email to the therapist every time saying your patient has just signed on, but having, we should

Appendix G Theme development



Appendix H Example from document of theme development

Emergent Theme	Code	Quote
Each BI patient in the military will present differently and to meet these (the needs of this varied group) needs requires an individualised management approach which is challenging for the rehab team. Pressures on the therapist/meeting the needs of the patient/ understanding the needs of the patient/requirement for the therapists and the program to be flexible.	1. There is a pressure to get them back. 2. Long length of stay is another factor that challenges the therapists as their engagement decreases 3. External pressures on therapists, other patients waiting, from the patients unit. 4. Requirement to supervise more than without BI, placing higher demand on a program being correct and pts completing it properly 5. These patients need more, a holistic approach and cognitive support 6. Challenging the therapists – need for imagination and keeping engagement 7. Different approaches needed to help motivation – rec therapy 8. The therapist have to make difficult decisions 9. Maybe they feel they are taking more risks with these patients. The therapists feel they take risks knowing they potentially push too far but want to make gains. 10. Communication and feedback with BI – as if the therapists struggle and feel helpless 11. Showing achievement by making things meaningful.	1)FG 1 Pg 1 (04:37) Tina – They come at us with different levels of balance to start with but ideally we need to get them all back to very high levels of balance. 2) FG 1 Pg 2 (06:33) Maggie- and then he can be here for a very long time , weeks, months, in some cases years so to keep it novel and interesting it's quite a challenge I think sometimes. 5) FG 1 Pg 8 26:39 Maggie -That is what you lose out on. It ends up very much about strength or very much about sort of very specific physical issues and it doesn't bring that holistic, cognitive. 14) FG1 Pg 14 (44:54) I think on the other hand as well it is still important to keep the MDT involved for the higher level guys as well that can do most of this stuff, and would be able to pass a fitness test and things but were still picking them apart because we need them to be at their best because we need them to be in firing positions and on different unstable grounds and things like that. 17) FG1 Pg 15 (48:18) Rob - like almost taking the first 5 minutes of the session to get on their level so rather than getting straight into the session and saying oh we are going to do this, this and this, you might give them something straight away and actually they are feeling as Maggie was saying terrible and they might just want to offload something so you might want to that first sort of 5 minutes of the session. 17) he has to put on a different hat for different patients that he works with cos he knows that you, with some of the patients you have to be straight and direct, and they will crack on with it where as there are guys that have a bit of attitude or they are very easily disengaged or shall we say angry then actually you have to get them on side

	12. The need to get the patients understanding of why they are doing what they are doing as part of communication with TBI 13. The therapists really want the patients to achieve. 14. MDT – Therapists need an in depth understanding of the patient necessary for making progress and therapists need the patients to understand what they are doing 15. Patients struggle to understand their condition 16. Therapist have to adapt and need support from technologies. 17. Therapists need to review the patient and be flexible, changing their personality for each patient to make it work 18. The examples the participant is sharing seems that he takes great pride in the his ability to work with such a difficult group of pts. 19. It's belonging to the military and the military standards gives them extra drive and purpose, with BI this can have a varied response, discipline, time-keeping shaving which all puts added pressure on patients and team. 20. The challenge of going back to the 'real' military after BI rehab 21. The notion that you can Loose the patient – you really can get the communication or relationship with the patient wrong, maybe they are very unforgiving as a group of patients to work with, but then the pressure the therapists take on to get this right, so keen to meet the needs of the patients. 22. Doing the best for/protecting the patient. Wanting to do the right thing for the patient 23. The therapists really want to understand the patient's needs. 24. Adjustments need to be made in the way you communicate to people with BI for them to comprehend what you are saying	before the session starts and then think about vocal tone and how you go speaking and portraying what you're saying 21) FG1 Pg 16 (52:02) Steve - yeah cos you can lose them, you can lose them especially if you're specifically their therapist in that area. You can be the wrong way with them and then for the rest of the time that they are here they won't work with you, 100%, so its knowing about, it's not just knowing about what they understand, its knowing about what place they are in at that specific time. 21) FG1 Pg 24 (74:23) No I think if you put too much terminology in you will actually loose them 22) FG 1 pg 35 Beth (100:44) and you can stay in work, and you can just do that on the side. Tina (100:49) and that patient is not going to get the optimal out of their rehab, and get back to all they're supposed to do. Maggie (100:52) exactly, exactly and then get medically d/ced when they could have been rehabbed. 26) FG1 pg 31 (91:40) Rob so on the topic of feedback is there a feedback at the end where they might be able to say oh there was too much information or I found it difficult, I found the explanations difficult to understand. Because I think it's alright us saying this but it's probably best almost to come from the patients. 24) FG2 pg 18 Julia (30:27) but I do agree sometimes, a patient doesn't understand a particular word and you just say it differently and they are like 'oh of course' so ordinarily you would write that differently for them. 25) FG1 pg 23 (73:03) Tina - I think if were talking about the communication with our guys as well, is it needs to be, you can't have the wishy-washy test and like you were saying it could be some of this it could be some of that and they aren't actually getting any answer, with our guys it needs to be, we can be as specific as the majority of the time, your dizziness is caused by central issues or peripheral issues. 27) FG1 Pg 1 (05:50) Beth – If they've all got a range of like cognitive independence as well so like some of them you can set up wits tasks and as long as they were explained properly and you knew they were doing it with the correct techniques you cold leave them to get on with it, whereas with others you wouldn't be able to leave them 29) FG 1 Pg 1 (04:37) Tina – They come at us with different levels of balance to start with but ideally we need to get them all back to very high levels of balance.

	25. You need to consider the language you are using with this population 26. Being in the military, expectations of given instruction, but with BI it changes. The therapist needs to be flexible to the variation in the pts needs.	

Appendix I Example section of Website comments table

Service Standard	Code	Detail of participants comments
Solve a whole problem for users *Services that do not work well with other related services make it hard for users to do what they need to. For example, working out which of several similar schemes they're eligible for or choosing the right form to fill in out of several near-identical options.*	1. Helping with communication of patient and therapist 2. The service on a whole will need the therapist to sit down with the patient and set it up. A settings page at the start with options that the therapist sets. 3. How to measure progress with a subjective online score 4. Future stories might be beneficial coming from relevant patients. 5. The graphs and feedback on progress and scores were liked 6. The service on a whole will need the therapist to sit down with the patient and set it up. A settings page at the start with options that the therapist sets. There is an overlying tone that the therapists needs to feel they can control the website and what the patients will be doing. 7. Comments section as an aide memoire would be helpful for the patients 8. There should be a website trigger to the therapist if the patient isn't engaging 9. Have options for free text 10. A bank of exercises and test questions would be useful 11. There needs to be a separate patient and therapist log in, with the ability to limit the access to the patient's settings. 12. Use motivational stories and quotes 13. It will need a time with it so they will know how long it will last. 14. Questions for a test should be relevant to the patient 15. There need to be options for communication with the patients: emails, phone call.	FG2 Pg 18 Tina (29:07) and also as a therapist it would be handy to have my own bank as well. So you could have all of your stuff and then if would be nice to have the option to add in individualised ones for a certain patient. But then as a therapist it would be quite nice to have a set, an area where I can save whatever stuff I have put on. So I can then use that for another patient. Julia (29:35) So like a general bank and then your personal drive, kind of thing. Researcher OK Rachel (29:44) so you can build more to your resource. Tina (29:45) So then as I get better at it, I'm a lot more efficient at just shoving my exercises in. Researcher (29:49) So actually quick access for the therapists as well, to be able to set up the correct exercises quickly. Tina (30:00) It would also be handy to have your exercises, but be able to edit them as well. So it could be that we might for a certain patient, might, describe it slightly differently and so it would be easier to just put the terminology slightly different. And there should be some check in at some point by a real life person I guess to check because then were covered. In terms of clinical risk, as

	16. Options dependent on the patient issue, ref the education needed 17. Feature to make the program work efficiently. 18. Could have data collection in the program to monitor patient engagement 19. Options for therapists and They want the ability to set up an Outpatient session 20. Have different difficulty levels of the exercises 21. Options to set colours – text / background 22. Traffic light system 23. Options for instructions for the exercises, print outs of exercises 24. Give options on features for the therapists to set up. 25. Options for pictures would be good 26. There is a need for a set up session with education and bespoke settings 27. Have somewhere for patients to leave feedback and some written notes. 28. The graphs and feedback on progress and scores were liked	long as we've had a quick telephone call at the X month point or something. Fg2 Pg 27 Helen (49:00) That is how the mTBI website is set up, so we can see the patients view from our log in but on our log in we have all the patients so then when they do their data, it flags, we get alerts and allsorts and the patients get their graphs so they can see their progress and we see their graphs but we also get alerted with positives and negative but it is two separate log ins. Jemma (49.23) Would it be worth knowing how long they have logged on for? So they're not just logged in it's the length of time they have spent on the website. Fg2 pg 23 Tina (41:05) but then they would be more of your higher level patients where you wouldn't have to play with the settings too much. You wouldn't have to worry about all of the finicky detail. And from a physio point of view the exercise bank would be quite prescriptive. So there would kind of your go to right, we'll just do boom boom boom boom boom, here you go try this for the next two weeks. I'll give you a call see how you're getting on and then we'll see where it goes from there.
Provide a joined up experience across all channels *Work towards creating a service that meets users' needs across all channels, including online, phone, paper and face to face*	1. Options for instructions for the exercises, print outs of exercises 2. An option for working off-line would be useful, maybe as an APP. 3. There need to be options for communication with the patients: emails, phone call.	

Appendix J Categories with quotes and codes

Visual presentation	Use bullet points, boxes for text and obvious prompts Bold text draws the attention The colour of the pages if important Use particular colours for the screen that are easy to read off Consider the font size and colour The colour of the background, Non-white colours are good Using a border is good Pastel colours work well but bright colours can distract Use contrasting colours to make things clear Make any buttons to be clicked very clear eg next buttons. Use universal and recognisable symbols and this will increase ease of access	Fg2 Pg 2 Tina (04:42) Having the background colours of white like the non-white colour is good Claire - things having a border is useful Tina - They don't have borders so it doesn't stand out so much whereas on this one, and sometimes it's just different coloured borders. Claire – and pastel colours are nicer to look at. Tina - Yeah because the bright colours can take the attraction away from what you actually want and also it is a bit harsher on the eyes. Claire - Colours which made more of a contrast, so the dark on the light pastel was good
	Ensure consistency throughout with features like menu buttons, the same colours, have things in the order	FG2 pg 11Kate (15:02) The same scale the whole way through. FG2 pg 28 Helen (52:48) Could that be like tabs at the top of every single page? So you have got the constant tabs, so at any point you can go. So it is consistent layout.
	Don't have writing over graphics and avoid pictures with glare Pictures are good but shouldn't be distracting	Fg2 pg 4 (15:12) don't have writing as just text over pictures. That particular picture the sun was

		coming through with was quite glary
	Minimal text on each page	FG 1 Pg 19 (61:00) Tina- quite busy Maggie – Loads of lines Rachel (62:58) probably way too much on one page
Military Concepts	Make elements relevant to military tasks	FG2 Pg 10 Jemma (12:05) I'm just thinking with the videos it might be worth do we approach, learn to use the EDIP explain, demonstrate, and giving them time to imitate and then practice so that they are going through the kind of usual instructor type
	Use recognisable links to the military Text and pictures should be related to the military	Fg2 Pg 21 Kate (36:31) Always using a familiarity, like parade is a familiar thing, PT is a familiar thing it's like certain routine, like you give people orders or admin instruction, that's fine, but you're not in their face saying this is military. But it's kind of using the same phrases that they would use. FG 1 Pg 19 (63:33) Beth then they have bought into to, you've got the buy in to the stories. And you would have to be picky about what stories you use, because if it isn't related to military work then they are like.

	There are useful tools the military use to help Service Personnel learn drills, the patients will be used to these and these tools could be used as something the patients are already familiar with, such as using the traffic light system	FG1 Pg 24 (74:30) Beth - you could potentially link into stuff that, like if you look at the Battlefield casualty books how you could almost do it like that. That stuff in red you need to read, colour code it like that
Programme Features	Could have data collection in the program to monitor patient engagement. There should be a website trigger to the therapist if the patient isn't engaging. There needs to be a separate patient and therapist log in, with the ability to limit the patient accessing settings.	1. Fg2 Pg 27 Helen (49:00) That is how the mTBI website is set up, so we can see the patients view from our log in but on our log in we have all the patients so then when they do their data, it flags, we get alerts and allsorts and the patients get their graphs so they can see their progress and we see their graphs but we also get alerted with positives and negative but it is two separate log ins. Fg 2 pg 25 Jemma (49.23) Would it be worth knowing how long they have logged on for? So they're not just logged in it's the length of time they have spent on the website.
	Therapists would find a bank of exercises useful and help the program run efficiently	FG2 Pg 18 Tina (29:07) it would be handy to have my own bank as well. So you could have all of your stuff and then if would be nice to have the option to add in individualised ones for a certain patient. But then as a therapist it would be quite nice to have a set, an area where I can save whatever stuff I have put on. So I can then

		use that for another patient. So then I'm a lot more efficient at just shoving my exercises in.
	There need to be options for communication with the patients: emails, phone call. The program needs the ability for interaction and feedback with the patient	Fg2 pg Helen And there should be some check-in at some point by a real life person I guess to check because then were covered. In terms of clinical risk, as long as we've had a quick telephone call at the X month point or something.
	The service on a whole will needs the therapist to sit down with the patient and set it up. A settings page at the start with options that the therapist sets. There is a need for a set up session with education and bespoke settings as different patients would require different education. Options to set colours – text / background for differently depending on the patient needs Options for instructions for the exercises, print outs of exercises to meet each patient's needs.	FG2 Pg 11 Tina (13:48) That could be what the therapist sets up at the beginning. Do you want it to be numbered, do you want it to be smiley faces, sliding scale. Do you want it to be written words?
	Higher level patients will have different needs and less detail and options required to speed up the process of set up, the program needs an effective easy set up.	Fg2 pg 23 Tina (41:05) your higher level patients where you wouldn't have to play with the settings too much. You wouldn't have to worry about all of the finicky detail. And

	Have different difficulty levels of the exercises	from a physio point of view the exercise bank would be quite prescriptive. Here you go try this for the next two weeks.
Communicating Information	Clears prompts, instructions to follow with minimal stages to progress through. Continuity in language, scores, between pages so if a test is being conducted the scores are the same across the different tests to prevent confusion Using familiar language and examples throughout the program	FG1 Pg 23 (70:52) Tina - an option right at the beginning that goes 'go to exercises' go to education'. And they can always back to the education whenever you want to Julia (14:49) But making sure that consistently throughout 5 is either the best or the worst and not one time. FG1 Pg 24 (74:23) No I think if you put too much terminology in you will actually loose them
	Clear language, simple and relates to the patient, also specific to their needs. Needs to have an impact with the page, clear for what they are supposed to get with each page. Decrease the amount of information on each page and keep pages minimal. Not too much text.	Fg 2 Pg 21 Claire (37:04) I was going to say it need to be ronseal doesn't it, does exactly what it says on the tin. FG1 Pg 23 (71:02) Maggie I find that particular page, a bit unhelpful as well. Like if I had issues, then that doesn't actually give me many answers. It could be many different medical problems, see your doctor, it could be your balance organ, it might be vestibular, vertigo, could a virus, ear infection. I haven't actually go an answer really.
	Consider visual learners and visual prompts	FG2 Pg 11 Jemma (13:55) Because we do see dyslexia quite a lot, so

		having those sought of options would be really good.
Getting Patient Buy-In	The graphs and feedback on progress and scores were liked and maintain motivation to continue the program/rehab Questions for a test should be relevant to the patient How to measure progress was important to the participants with a subjective online score	FG2 Pg 14 Jemma (22:09) On the education side is there something about the evidence of doing the balance retraining so that to aid motivation so that 50% of people did it and balance improved in 38% or something. FG2 Pg 16 Jemma (25:05) and making those motivating statements personal in relation to the progress and those scores and how long they have been doing it would be good.
	Use motivational stories and quotes	FG 2 Pg 15 Helen (24:20) motivating statements would be really good actually and it could come also bespoke to their scores, so like brilliant you've reduced your symptoms by like 50% or 25% compared with when you started just to show or keep them going. The research shows that any kind of motivating pop ups might be really good.
	Pts get bored, there's lots of repetition Options dependent on the patient issue, ref the education needed	FG1 pg 19 (63:04) Beth - and I'm not sure stuff like the retraining information on the side, whether

	Things need to have an impact on each page to get their focus	that would have much of an impact on our guys. They just want to know it's going to work.
	Future stories describing the use of the program might be beneficial coming from relevant patients.	FG 1 Pg 19 (63:33) Beth then they have bought into to, you've got the buy in to the stories. And you would have to be picky about what stories you use, because if it isn't related to military work then they are like.

Glossary of Terms

Traumatic Brain Injury	An injury to the brain caused by an external force. It can be characterised by severity or mechanism of the injury.
Rehabilitation	The process of restoring physical abilities and relearning skills. It involves patients learning to cope and adapt to changes they experience after injury or illness.
Somatosensory impairment	The affect of one's ability to effectively process sensory information received by the skins sensory receptors.
Military Personnel	The total of all active and inactive member of the armed forces
Neuroplasticity	The ability of the brain to form and reorganise synaptic connections, especially in response to learning or experience following an injury.
Vestibular dysfunction	A disease, condition or injury interferes with you bodies inner ear balance system
Interpretative Phenomenological Analysis	A qualitative form of psychology research with an idiographic focus
British Armed Forces	the unified military forces responsible for the defence of the United Kingdom, its overseas territories and crown dependencies.

List of References

Armed forces health surveillance branch (2016) Traumatic brain injury. Department of Defence Standard Surveillance Case Definition for TBI, (Accessed 15 July)

Anderson M. (2015) Technology Device ownership: 2015 PEW Research Center

Arciniegas, D. Held, K. and Wagner, P. (2002) Cognitive impairment following traumatic brain injury. *Current Treatment Options in Neurology,* 4(1), pp. 43-57

Bailie, J.M. Boyd, C. Cole, W.R. Ivins, B. Lewis, S. Neff, J. and Schwab, K. (2015) The experience, expression, and control of anger following traumatic brain injury in a military sample. *Journal of Head Trauma Rehabilitation,* 30(1), pp. 12-20

Bartlett R. and Milligan C. (2015) What is Diary Method. Research Methods series. Bloomsbury publishing London

Basford, J.R. Chou, L.S. Kaufman, K.R. Brey, R.H. Walker, A. Malec, J.F. Moessner, A.M. and Brown A.W. (2003) An assessment of gait and balance deficits after traumatic brain injury. *Archives of Physical Medicine Rehabilitation,* 84(3), pp. 343-9

Berg, K. Wood-Dauphinee, S. and Williams J. (1995) The Balance Scale: reliability assessment with elderly residents and patients with an acute stroke. *Scandinavian Journal of Rehabilitation Medicine,* (27), pp. 27-36.

Boger, J. Jackson, P. Mulvenna, M. Sixsmith, J. Sixsmith, A. Mihailidis, A. Martin, S. (2016) Principles for fostering the transdisciplinary development of assistive technologies. *Disability and Rehabilitation: Assistive Technology*, *12*(5), pp. 480–490.

Block, H. Bellon, M. Hunter, S.C. George, S. (2023) Barriers and enablers to managing challenging behaviours after traumatic brain injury in the acute hospital setting: a qualitative study. *BMC Health services research*, 23:1266

Bölükbaş, K. Edwards, L. Baguley, D.M. and Fackrell, K. (2024) Clinical experiences, current approaches, opinions and awareness of healthcare professionals regarding the audio-vestibular consequences of individuals with traumatic brain injury: a cross-sectional online survey study. *British Medical Journal open*, *14*(7), p.e078017

Braun, V. and Clarke V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), pp. 77-101

Braun V. and Clarke V. (2013) Successful Qualitative research: a guide for beginners. London: Sage. ISBN 9781847875815 Available from: http://eprints.uwe.ac.uk/21156

Braun, V. and Clarke V. (2014) What can "thematic analysis" offer health and wellbeing researchers? *International Journal of Qualitative Studies on Health and Well-being,* 9(1), pp. 26152

Breceda, E. and Dromerick A. (2013) Motor rehabilitation in stroke and traumatic brain injury: stimulating and intense. *Current Opinion in Neurology,* 26, pp. 595-601

Bright, F. Kayes, N. Worrall, L. and Mcpherson K. (2015) A conceptual review of engagement in healthcare: Relevance to rehabilitation. *Disability Rehabilitation,* 37(8), pp. 643-54

Burns R. 2000 Introduction to research methods 4th Edition. London: Sage Publishing

Cernich, A.N., Belanger, H.G., Pramuka, M. and Brim, W.L., 2015. Rehabilitation in military and veteran populations: The impact of military culture. *Multicultural Neurorehabilitation: Clinical Prinicipals for Rehabilitation Professionals*. Springer New York

Chandrasekhar S.S. (2013) The assessment of balance and dizziness in the TBI patient. *Neuro Rehabilitation,* 32, pp. 445-454

Charmaz K. (1996) The Search for Meanings: Grounded theory. London: Sage Publishing.

Charmaz, K. (2006) Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis. London: Sage

Charmaz K. (2009) The power and potential of grounded theory. *Medical Sociology online,* 6(3), pp. 1-14

Corbin Dwyer, S. and Buckle J. (2009) The space between: On being an insider-outsider in qualitative research. *International journal of Qualitative Methods,* 8(1), pp. 54-63

Cole, E. (2013) Patient-centered design of cognitive assistive technology for traumatic brain injury telerehabilitation. Synthesis lectures on assistive, rehabilitative and health-preserving technologies, 2(1), pp. 1-159

D'cruz, K. Unsworth, C. Roberts, K. Morarty, J. Turner-Stokes, L. Wellington-Boyd, A Matchado, J. and Lannin N.A. (2016) Engaging patients with moderate to severe acquired brain injury in goal setting. *International Journal Of Therapy & Rehabilitation,* 23(1), pp.20

Deschaux-Beaume, D. (2012) Investigating the military field: Qualitative research strategy and interviewing in the defence networks. *Current Sociology*, *60*(1), pp.101-117.

Dey, I. (1999) Grounding Grounded Theory: Guidelines for Qualitative Inquiry. London: Academic Press.

Dharm-Datta, S. Gough, M.R.C. Porter, P.J. Duncan-Anderson, J. Olivier, E. Mcgilloway, E. and Etherington J. (2015) Successful outcomes following neurorehabilitation in military traumatic brain injury patients in the United Kingdom. *The Journal Of Trauma And Acute Care Surgery,* 79(4 Suppl 2), pp. S197-S203

Dowds, M.M. Lee, P.H. Sheer, J.B. O'neil-Pirozzi, T.M. Xenopoulos-Oddsson, A. Goldstein, R. Zainea, K.L. and Glenn M.B. (2011) Electronic Reminding Technology Following Traumatic Brain Injury: Effects on Timely Task Completion. *Journal of Head Trauma Rehabilitation,* 26(5), pp. 339-347

Drijkoningen, D. Caeyenberghs, K. Leunissen, I. Vander Linden, C. Leemans, A. Sunaert, S. Duysens, J. and Swinnen S.P. (2015) Training-induced improvements in postural control are accompanied by alterations in cerebellar white matter in brain injured patients. *Neuroimage: Clinical,* 7, pp. 240-51

Essery, R. Geraghty, A.W. Kirby, S. and Yardley L. (2017) Predictors of adherence to home-based physical therapies: a systematic review. *Disability Rehabilitation,* 39(6), pp. 519-534

Essery, R. Kirby, S. Geraghty, A.W.A. Andersson, G. Carlbring, P. Bronstein, A. Little, P. and Yardley L. (2015) The Development of Balance Retraining: An Online Intervention for Dizziness in Adults Aged 50 Years and Older. *American Journal of Audiology,* 24(3), pp. 276

Finch, E. French, A. Ou, R.J. and Fleming, J. (2016) Participation in communication activities following traumatic brain injury: A time use diary study. *Brain Injury,* 30 (7), pp. 883-890

Finlay, L. Ballinger, C. (2006) Qualitative research for allied health professionals. Challenging choices. Chichester: Whurr Publishers Limited.

Firsing, S.L. (2014) A mixed methods study to develop an instrument to assess family quality of life among caregivers of adults with traumatic brain injury. Unpublished 74 thesis ProQuest Information & Learning University

Fleming, J.M. Shum, D. Strong, J. and Lightbody, S. (2009) Prospective memory rehabilitation for adults with traumatic brain injury: A compensatory training programme. *Brain Injury,* 19(1), pp.1-10

Freeman T. (2006) 'Best practice' in focus group research: making sense of different views. *Journal of Advanced Nursing,* 56(5), pp. 491-7

Fregly, R. and Graybriel, A. (1966) An ataxia test battery not requiring the use of rails. A Joint Report Naval aerospace medical institute and National Aeronautics and space Administration.

Frieden, T. and Collins, F. (2013) Report to congress on traumatic brain injury in the United States: Understanding the Public Health Problem among Current and Former Military Personnel. *Department of Defence, Veterans Association Leadership Panel: Centre for Disease control*

Geraghty, A.W.A. Essery, R. Kirby, S. Stuart, B. Turner, D. Little, P. Bronstein, A. Andersson, G. Carlbring, P. Yardley, L. (2017) Internet-based vestibular rehabilitation for older adults with chronic dizziness: A randomized controlled trial in primary care. *Annals of family medicine,* 15(3), pp. 209-216

Gill, P. Stewart, K. Treasure, E. and Chadwick, B. (2008) Methods of data collection in qualitative research: interviews and focus groups. *British Dental Journal,* 204(6), pp. 291-5

Glaser, B.G. (1992) Emergence vs Forcing: Basics of Grounded Theory Analysis. Mill Valley, CA: The Sociology Press.

Giorgi, A. (1997). The theory, practice, and evaluation of the phenomenological method as a qualitative research procedure. *Journal of phenomenological psychology,* 28(2), pp. 235-260

Giorgi, A. (2012). The descriptive phenomenological psychological method. *Journal of Phenomenological psychology,* 43(1), pp. 3-12

Green, J. and Thorogood, N. (2018) Qualitative methods for health research. Sage: London

Hamilton, M. Williams, G. Bryant, A. Clark, R. and Spelman, T. (2015) Which factors influence the activity levels of individuals with traumatic brain injury when they are first discharged home from hospital? *Brain Injury,* 29(13/14), pp. 1572-1580

Hammond, F.M. Davis, C. Cook, J.R. Philbrick, P. and Hirsch, M.A. (2016) A Conceptual Model of Irritability Following Traumatic Brain Injury: A Qualitative, Participatory Research Study. *Journal of Head Trauma Rehabilitation,* 31(2), pp. E1-11

Harris N (2017) The Design and Development of Assistive Technology. *IEEE Potentials*, 36(1), pp. 24-28

Hart, T. Whyte, J. Kozlowski, A.J. Poulsen, I. Kristensen, K. Nordenbo, A. and Heinemann, A.W. (2014) Functional recovery after severe traumatic brain injury: An individual growth curve approach. *Archives of Physical Medicine and Rehabilitation,* 95(11), pp. 2103-2110

Hassett, L.M. Tate, R.L. Moseley, A.M. and Gillett L.E. (2011) Injury severity, age and pre-injury exercise history predict adherence to a home-based exercise programme in adults with traumatic brain injury. *Brain Injury,* 25(7/8), pp. 698

Hawley, C.A. de Burgh, T.H. Russell, R.J. and Mead, A. (2015) Traumatic Brain Injury Recorded in the UK Joint Theatre Trauma Registry Among the UK Armed Forces. *Journal of Head Trauma Rehabilitation,* 30(1), pp. E47-E56

Heidegger, M. (1962) Being and time. New York: Harper. (Original work published 1927)

Hellstrom, T. Kaufman, T. Andelic, N. Westyle, L. Soberg, H.L. Sigurdardottir, S. Helseth, E. Andreassen, O.A. (2017) Predicting Outcome 12 Months after Mild Traumatic Brain Injury in Patients Admitted to a Neurosurgery Service. *Frontiers in Neurology,* 8(2), pp. 125

Hjørland, B. Hartel, J. (2003). Afterword: Ontological, Epistemological and Sociological Dimensions of Domains. *Knowledge Organization,* 30(3/4), pp. 239-245

Hoencamp, R. Huizinga, E.P, Van Dongen, T.T. Idenburg, F.J. Ramasamy, A. Leenen, L.P. and Hamming J.F. (2014) Impact of explosive devices in modern armed conflicts: in-depth analysis of Dutch battle casualties in southern Afghanistan. *World Journal of Surgery,* 38(10), pp. 2551-7

Hollis, V. Openshaw, S. and Goble, R. (2002) Conducting focus groups: Purpose and practicalities. *British Journal of Occupational Therapy*, 65(1), pp. 2-8

Horrigan-Kelly, M. Millar, M. Dowling, M. (2016) Understanding the key tenets of Heidegger's philosophy for interpretive phenomenological research. *International Journal of Qualitative Methods, pp. 1-8*

Horn, S.D. Corrigan, J.D. Beaulieu, C.L. Bogner, J. Barrett, R.S. Giuffrida, C.G. Ryser, D.K. Cooper, K. Carroll, D.M. Deutscher, D. (2015) Traumatic Brain Injury Patient, Injury, Therapy, and Ancillary Treatments Associated With Outcomes at Discharge and 9 Months Post discharge. *Archives of Physical Medicine and Rehabilitation*, 96(8), pp. S304 - S329

Huijgen, B. Vollenbroek-Hutten, M. Zampolini, M. Opisso, E. Bernabeu, M. Van Nieuwenhoven, J. Ilsbroukx, S. Magni, R. Giacomozzi, C. Marcellari, V. Scattareggia Marchese, S. and Hermens, H. (2008) Feasibility of a home-based telerehabilitation system compared to usual care: arm/hand function in patients with stroke, traumatic brain injury and multiple sclerosis. *Journal of Telemedicine and Telecare,* 14, pp. 249–256

Humphreys, I. Wood, R.L. Phillips, C.J. and Macey, S. (2013) The costs of traumatic brain injury: a literature review. *Clinicoeconomics and Outcomes Research,* 5, pp. 281-7

Ivins, B.J. (2010) Hospitalization associated with traumatic brain injury in the active duty US Army: 2000-2006. *NeuroRehabilitation*, 26(3), pp.199-212.

Jacobsson, L. and Lexell, J. (2016) Life satisfaction after traumatic brain injury: comparison of ratings with the Life Satisfaction Questionnaire (LiSat-11) and the Satisfaction With Life Scale (SWLS). *Health and quality of life outcomes,* 14, pp. 10

Jaeger, M. Deiana, G. Nash, S. Bar, J-Y. Cotton, F. Dailler, F. Fischer, C. Rode, G. Boisson, D. Luaute, J. (2014) Prognostic factors of long-term outcome in cases of severe traumatic brain injury. *Annals of Physical Medicine,* (57), pp. 436-451

Jaganathan, K.S. and Sullivan, K.A. (2020) Moving towards individualised and interdisciplinary approaches to treat persistent post-concussion symptoms. *EClinicalMedicine*, 18.

Jeyaraj, J.A. Clendenning, A. Bellemare-Lapierre, V. Iqbal, S. Lemoine, M.C. Edwards, D. and Korner-Bitensky, N., 2013. Clinicians' perceptions of factors contributing to complexity and intensity of care of outpatients with traumatic brain injury. *Brain Injury*, *27*(12), pp.1338-1347

Joint Service Publication 536, Ministry of Defence Policy for research involving human participants. Accessed 12 July 2016

Jourdan, C. Bayen, E. Pradat-Diehl, P. Ghout, I. Darnoux, E. Azerad, S. Vallat-Azouvi, C. Charanton J, Aegerter P, Ruet A and Azouvi P (2016) A comprehensive picture of 4-year outcome of severe brain injuries. Results from the PariS-TBI study. *Annals of Physical and Rehabilitation Medicine,* 59(2), pp. 100-106

Karunarathna, I. Kusumarathna, K. Jayathilaka, P. Rathnayake, B. Bandara, S., Abeykoon, M. Priyalath, N. Gunarathna, I., Disanayake, D. Kurukulasooriya, P. and Samarasinghe, A. (2024) Optimizing Traumatic Brain Injury Management: A Multidisciplinary Approach and Lessons Learned from a Complex Case. *Uva Clinical Lab. Retrieved from ResearchGate*.

Kirk-Wade, A.2024 UK Defence personnel statistics. House of commons Library Number 7930

Kleffelgaard, I. Soberg, H.L. Bruusgaard, K.A. Tamber, A.L. and Langhammer, B. (2016) Vestibular Rehabilitation After Traumatic Brain Injury: Case Series. *Physical Therapy,* 96(6), pp. 839-49

Kleynen, M. Moser, A. Haarsma, F.A. Beurskens, A.J. and Braun, S.M. (2016) Physiotherapists use a great variety of motor learning options in neurological rehabilitation, from which they choose through an iterative process: a retrospective think-aloud study. *Disability and Rehabilitation*, pp. 1-9

Klonoff, P. (2010) Psychotherapy after Brain Injury: Principles and Techniques. Guildford press: New York

Kivunja, S. River, J. and Gullick, J. (2018) Experiences of giving and receiving care in traumatic brain injury: An integrative review. *Journal of clinical nursing*, *27*(7-8), pp.1304-1328.

Kohl, L.F. Crutzen, R. and De Vries, N.K. (2013) Online prevention aimed at lifestyle behaviors: a systematic review of reviews. *Journal of Medical Internet Research*, 15(7), pp. e146

Kolias, A.G. Guilfoyle, M.R. Helmy, A. Allanson, J. Hutchinson, P.J. (2013) Traumatic brain injury in adults. *Practical Neurology,* 13, pp. 228–235

Krueger, R.A. and Casey, M.A., (2002) *Designing and conducting focus group interviews* (Vol. 18).

Larkin, M. Shaw, R. & Flowers, P. (2019). Multiperspectival designs and processes in interpretative phenomenological analysis research. *Qualitative Research in Psychology,* 16(2), pp. 182–198

Laverty, S.M. (2003) Hermeneutic phenomenology and phenomenology: A comparison of historical and methodological considerations. *International Journal of Qualitative Methods,* 2(3), pp. 21-35

Lei-Rivera, L. Sutera, J. Galatioto, J.A. Hujsak, B.D. and Gurley, J.M. (2013) Special tools for the assessment of balance and dizziness in individuals with mild traumatic brain injury. *NeuroRehabilitation,* 32, pp. 463-472.

Lequerica, A.H. Rapport, L.J. Whitman, R.D. Millis, S.R. Vangel, Jr. S.J. Hanks, R.A. and Axelrod, B.N. (2006) Psychometric Properties of the Rehabilitation Therapy Engagement Scale When Used Among Individuals With Acquired Brain Injury. *Rehabilitation Psychology,* 51(4), pp. 331-337

Lewis, J.D. Krueger, F. Raymont, V. Knutson, K.M. Wassermann, E.M. Grafman, J. Solomon, J. Barbey, A.K. and Poore, J.C. (2015) Anhedonia in combat veterans with penetrating head injury. *Brain Imaging and Behavior*, 9(3), pp. 456-460

Libeson, L. Ross, P. Downing, M. and Ponsford, J. (2022). The experience of employers of individuals with traumatic brain injury. *Neuropsychological Rehabilitation*, *32*(10), pp.2580-2602.

Lindberg, M.A. Sloley, S.S. Ivins, B.J. Marion, D.W. and Martin, E.M.M. (2021) Military TBI—What civilian primary care providers should know. *Journal of family medicine and primary care*, 10(12), pp.4391-4397.

Love, B. Vetere, A. Davis, P. (2020) Should Interpretative Phenomenological Analysis (IPA) be Used With Focus Groups? Navigating the Bumpy Road of “Iterative Loops,” Idiographic Journeys, and “Phenomenological Bridges”. *International Journal of Qualitative Methods*, 19, pp.1-17

Malec, J.F. Brown, A.W. Leibson, C.L. Flaada, T. Mandrekar, J.N. Diehl, N.N. and Perkins, P.K. (2007) The Mayo Classification System for Traumatic Brain Injury Severity. *The Journal of Neurotrauma,* 24(9), pp. 1417-1424

Manivannan, S. Baskaran, R. Fisher, J. Tasker, I. and Zaben, M. (2021) Current status of websites offering information to patients with traumatic brain injury and caregivers: time for reform?. *World neurosurgery*, *153*, pp.e419-e427.

Marsh, D. Stoker, G. (2002) *Theory and Methods in Political Science*. Basingstoke: Pallgrave McMillan

Maskell, F. Chiarelli, P. and Isles, R. (2009) Dizziness after traumatic brain injury: Overview and measurement in the clinical setting. *Brain Injury,* 20(3), pp. 293-305

Maskell F, Chiarelli, P. and Isles, R. (2007) Dizziness after traumatic brain injury: Results from an interview study. *Brain Injury* 21(7), pp. 741-52

Matthews, G. Campbell, S.E. Falconer, S. Joyner, L.A. Huggins, J. Gilliland, K. Grier, R. and Warm, J.S. (2002) Fundamental dimensions of subjective state in performance settings: Task engagement, distress, and worry. *Emotion,* 2(4), pp. 315-340

Mccluskey, A. Johnson, M. and Tate, R. (2007) The Process of Care Management Following Brain Injury: A Grounded Theory Study. *Brain Impairment,* 8(3), pp. 293

Mcculloch, K. Buxton, E. Hackney, J. and Lowers, S. (2010) Balance, Attention, and Dual-Task Performance During Walking After Brain Injury: Associations With Falls History. *Journal of Head Trauma Rehabilitation,* 25(3), pp. 155–163

Mcleod, A. Wills, A. and Etherington, J. (2004) Employment retention after moderate-severe traumatic brain injury (TBI) in the British Army 1989-98. *Occupational & Environmental Medicine,* 61(5), pp. 414-418

Meagher, C. Burridge, J. Hughes, A-M. Ewings, S. Goncalves, A-C. Alt, C.H.S. Pollet, S. and Yardley, L. (2015) Feasibility randomised control trial of LifeCIT, a web-based support programme for Constraint Induced Therapy (CIT) following stroke compared with usual care. *Physical Therapy*, pp.1-24

Melia, K.M. (1996) Rediscovering Glaser, Qualitative Health Research (Special Issue: Advances in Grounded Theory), 6(3): 368–78.

Morrison, L. Joseph, J. Andreou, P. and Yardley, L. (2010) Application of the lifeGuide: a think-aloud study of users' experiences of the 'internet doctor'. 5th International Conference on e-Social Science

Mustafa, A.G. and Alshboul, O.A. (2013) Pathophysiology of traumatic brain injury. *Neurosciences,* 18(3), pp. 222-34

Nakase-Richardson, R. Mcnamee, S. Howe, L. Massengale, J. Peterson, M. Barnett, S Harris, O. Mccarthy, M. Tran, J. Scott, S. and Cifu, D. (2013) Descriptive characteristics and rehabilitation outcomes in active duty military personnel and veterans with disorders of consciousness with combat- and noncombat-related brain injury. *Archives Of Physical Medicine And Rehabilitation,* 94(10), pp. 1861-1869

Nguyen, R. Fiest, K.M. McChesney, J. Kwon, C.S. Jette, N. Frolkis, A.D. Atta, C. Mah, S. Dhaliwal, H. Reid, A. Pringsheim, T. Dykeman, J. Gallagher, C. (2016) The International Incidence of Traumatic Brain Injury: A Systematic Review and Meta-Analysis. *Canadian Journal of Neurological Sciences,* 43, pp. 774-785

Newstead, A.H. Hinman, M.R. Tomberlin, J.A. (2005) Reliability of the Berg Balance Scale and balance amster limits of stability tests for individuals with brain injury. *Journal of Neurological physical therapy,* 29(1), pp. 18-23

Nizza, I. Farr, J. Smith, J.A. (2021) Achieving excellence in interpretative phenomenological analysis (IPA): four markers of high quality. *Qualitative Research in Psychology*, ISSN 1478-0887

Palmer, M. Larkin, M. De Visser, R. Fadden, G. (2010) Developing an interpretative phenomenological approach to focus group data. *Qualitative Research in Psychology,* 7, pp. 99–121.

Pan, T. Liao, K. Roenigk, K. Daly, J.J. and Walker, M.F. (2015) Static and dynamic postural stability in veterans with combat-related mild traumatic brain injury. *Gait & Posture,* 42(4), pp. 550-557

Parsonage, M. (2016) Traumatic Brain Injury and offending: An economic analysis. *Centre for Mental Health*

Pavliscsak, H. Little, J.R. Poropatich, R.K. Mcveigh, F.L. Tong, J. Tillman, J.S. Smith, C.H. and Fonda, S.J. (2016) Assessment of patient engagement with a mobile application among service members in transition. *Journal of the American Medical Informatics Association*, 23(1), pp. 110-8

Pavlovic, D. Pekic, S. Stojanovic, M. Popovic, V. 2019 Traumatic brain injury: neuropathological, neurocognitive and neurobehavioural sequelae. *Pituitary,* 22, pp. 270-282

Pegg, P.O. Jr. (2003) The impact of patient-centered information on patients' treatment adherence, satisfaction, and outcomes in traumatic brain injury rehabilitation. Unpublished Ph.D. thesis Virginia Commonwealth University University

Peters, D.M. Jain, S. Liuzzo, D.M. Middleton, A. Greene, J. Blanck, E. Sun, S. Raman, R. and Fritz, S.L. (2014) Individuals With Chronic Traumatic Brain Injury Improve Walking Speed and Mobility With Intensive Mobility Training. *Archives of Physical Medicine and Rehabilitation,* 95(8), pp. 1454-1460

Pietrzak, E. Pullman, S. and Mcguire, A. (2014) Using Virtual Reality and Videogames for Traumatic Brain Injury Rehabilitation: A Structured Literature Review. *Games for Health Journal, 3*(4), pp. 202-214

Pilnick, A. (2022) What Is Patient Centred Care? In *Reconsidering Patient Centred care:* Emerald Publishing Limited: Leeds

Prins, M. Greco, T. Alexander, D. and Giza, C.C. (2013). The pathophysiology of traumatic brain injury at a glance. *Disease Models & Mechanisms,* 6(6), pp.1307-1315

Punch K. (2014) Introduction to Social Research. Quantitative and Qualitative approaches 3rd Edition London: Sage publications limited

Reeves, S. Peller, J. Goldman, J. and Kitto, S. (2013) Ethnography in qualitative educational research: AMEE Guide No. 80, *Medical Teacher,* 35(8), pp. e1365-e1379

Regasa LE, Michael Thomas D, Gill RS, Marion DW and Ivins BJ (2016) Military deployment may increase the risk for traumatic brain injury following deployment. *Journal of Head Trauma Rehabilitation,* 31(1), pp. E28-E35

Risdall J. (2011) Traumatic brain injury. *Philosophical Transactions of the Royal Society* 366, pp. 241-250

Sahyouni, R. Mahmoodi, A. Mahmoodi, A. Huang, M. Tran, D.K. and Chen, J.W. (2017) Interactive eBooks in educating patients and their families about head injury regardless of age.*Clinical neurology and neurosurgery*, *156*, pp.41-47.

Sale, J.M. Lohfeld, L.H. Brazil, K. (2002) Revisiting the quantitative-qualitative debate: implications for mixed methods research. *Quality & Quantity,* 36(1), pp. 43-53

Sartor-Glittenberg C. and Brickner L. (2014) A multidimensional physical therapy program for individuals with cerebellar ataxia secondary to traumatic brain injury: a case series. *Physiotherapy Theory and Practice,* 30(2), pp. 138-148

Scherer MR, Weightman MM, Radomski MV, Davidson LF and Mcculloch KL (2013) Returning Service Members to Duty Following Mild Traumatic Brain Injury: Exploring the Use of Dual-Task and Multitask Assessment Methods.

Schmitter-Edgecombe M. and Bales J.W. (2005) Understanding text after severe closed-head injury: Assessing inferences and memory operations with a think-aloud procedure. *Brain and Language*, 94, pp. 331-346

Schmitter-Edgecombe M. and Creamer S. (2010) Assessment of strategic processing during narrative comprehension in individuals with mild cognitive impairment. *Journal of International Neuropsychological Society,* 16(4), pp. 661-71

Schulz-Heik, R.J. Poole, J.H. Salerno, R.M. Harris, O. Dahdah, M.N. Sullivan, C. Date, E.S. and Schwab, K. (2016) Long-term outcomes after moderate-to-severe traumatic brain injury among military veterans: Successes and challenges. *Brain Injury,* 30(3), pp. 271-279

Scottish Intercolligiate Guidelines Network (2013) Brain injury rehabilitation in adults. Edinburgh

Seel, R.T. Corrigan, J.D. Dijkers, M.P. Barrett, R.S. Bogner, J. Smout, R.J. Garmoe, W. and Horn, S.D. (2015) Patient Effort in Traumatic Brain Injury Inpatient Rehabilitation: Course and Associations With Age, Brain Injury Severity, and Time Postinjury. *Archives of Physical Medicine & Rehabilitation,* 96(8), pp. S235-S244

Service Manual – Service Standard (2022). Available at http:www.Service-manual/service-standard@gov.uk (accessed: 18 Aug 2022)

Simcox, S. Mattingly, M. and Marrero, I. (2015) Understanding TBI in our nation's military and veterans: Its occurrence, identification and treatment, and legal ramifications. UMKC Law Review 24(2), pp. 373

Smith J.A. (2011) Evaluating the contribution of interpretative phenomenological analysis. *Health Psychology Review,* 5(1), 9-27

Smith, J.A. Flowers, P Larkin, M (2012) Interpretative Phenomenological Analysis. Theory, method and research. London: Sage

Smith, J.E. Kehoe, A. Harrisson, S.E. Russell, R. and Midwinter, M. (2014) Outcome of penetrating intracranial injuries in a military setting. *Brain Injury*, 45(5), pp. 874-878

Smith, R. O. Scherer, M. J. Cooper, R. Bell, D. Hobbs, D. A. Pettersson, C. Bauer, S. (2018) Assistive technology products: a position paper from the first global research, innovation, and education on assistive technology (GREAT) summit. *Disability and Rehabilitation: Assistive Technology*, *13*(5), pp. 473–485.

Stensors, T. Kajamaa, A. Bennett, D (2020) How to...assess the quality of qualitative research. *The Clinical Teacher, 17, 596-599*

Strauss, A.L. and Corbin, J. (1998) Basics of Qualitative Research: Grounded Theory Procedures and Techniques, 2nd edn. London: Sage.

Taylor, B.C. Campbell, E.H. Nugent, S. Bidelspach, D.E. Kehle-Forbes, S.M. Sholten, J. Stroupe, K.T. Sayer, N.A. (2017) Three year trends in veterans health administration utilization and costs after traumatic brain injury screening among veterans with mild traumatic brain injury. *Journal of Neuro Trauma*, 34(17), pp. 2567-2574

Tindale, W.B. 2015. Devices for dignity—from there, to here and beyond. *Journal of Medical Engineering & Technology*, 39(7), pp.376-377.

Tomkins, L. Eatough, V. (2010) Reflecting on the Use of IPA with Focus Groups: Pitfalls and Potentials. *Qualitative Research in Psychology* ,7(3), pp. 244–262

Turner-Stokes L, Nair A, Sedki I, Disler P and Wade D (2011) Multi-disciplinary rehabilitation for acquired brain injury in adults of working age (Review). *Cochrane Database of Systematic Reviews* (12)

Ustinova KI, Chernikova LA, Dull A and Perkins J (2015) Physical therapy for correcting postural and coordination deficits in patients with mild-to-moderate traumatic brain injury. *Physiotherapy Theory and Practice*, 31(1), pp. 1-7

Vanderploeg RD, Schwab K, Walker WC, Fraser JA, Sigford BJ, Date ES, Scott SG, Curtiss G, Salazar AM and Warden DL (2008) Original article: Rehabilitation of Traumatic Brain Injury in Active Duty Military Personnel and Veterans: Defense and Veterans Brain Injury Center Randomized Controlled Trial of Two Rehabilitation Approaches. *Archives of Physical Medicine and Rehabilitation,* 89, 2227-2238

Vermiere, E. Hearnshaw, H. Van Royen, P. and Denekens J. (2001) Patient adherence to treatment: three decades of research. A comprehensive review. *Journal of clinical Pharmacy and Therapeutics,* 26, pp. 331-342

Walker WC (2007) Motor impairment after severe traumatic brain injury: A longitudinal multicenter study. *The Journal of Rehabilitation Research and Development,* 44(7), pp.975-982

Werner C. and Engelhard K. (2007) Pathophysiology of traumatic brain injury. *British Journal of Anaesthetics,* 99, pp. 4–9

West, C. Stewart, L. Foster, K. and Usher, K. (2013) Accidental insider: Living the PhD study. Collegian 20(1), pp. 61-65

Wilig C. (2013) Introducing Qualitative research in Psychology 3rd Edition Open University Press, Berkshire.

Wilson V. (2016) Research Methods: Focus Groups. Evidence based library and information Practice 11(1) S

Wong, J.C. Linnd, K.A.,Shinoharad, R.T. Mateena, F.J. (2016) Traumatic brain injury in Africa in 2050: a modeling study. *European Journal of Neurology,* 23, pp. 382–386

World Health Organization. Geneva, Switzerland (2006) Traumatic Brain Injury: Neurological Disorders: Public Health Challenges

World Health Organisation (2003) Adherence to long-term therapies: Evidence for action. World Health Organisation. http://iris.who.int/handle/10665/42682

Wright, J. (2018) Using a Qualitative Approach in Applied Military Personnel Research. *The Craft of Qualitative Research: A Handbook*, pp.107-1134.

Yardley, L. Morrison, L. Bradbury, K. and Muller, I. (2015) The person-based approach to intervention development: application to digital health-related behavior change interventions. *Journal of medical internet research*, 17(1), pp. e30

Younis, R. Younis, M. Hamidi, S. Musmar, M. and Mawson A.R. (2011) Causes of traumatic brain injury in patients admitted to Rafidia, Al-Ittihad and the specialized Arab hospitals, Palestine 2006--2007. *Brain Injury*, 25(3), pp. 282-291

Zacks, J.M.Kurby, C.A. Landazabal, C.S. Krueger, F. and Grafman J. (2016) Research report: Effects of penetrating traumatic brain injury on event segmentation and memory. *Cortex*,74, pp. 233-246

Zhao, T. McDonald, S. and Edwards, H.M. (2014) The impact of two different think-aloud instructions in a usability test: a case of just following orders? *Behaviour & Information Technology*, 33(2), pp.163-183.

Bibliography

Aligene K. and Lin E. (2013) Vestibular and balance treatment of the concussed athlete. *Neurorehabilitation* 32, pp. 543-553

Biggerstaff D. and Thompson A.R (2008) Interpretative phenomenological analysis (IPA): A qualitative methodology of choice in healthcare research. *Qualitative research in psychology*, 5(3), 214-224

Brend,D.S and Macintosh H.B. (2021) Mentalizing as mechanism: An interpretative phenomenological analysis of workplace social support in intimate partner violence practice. *Smith college studies in social work*, 91(1), pp. 29-54

Clark, R.R William , G. Fini, N. Moore, L. Byrant, A.L. (2012) Coordination of dynamic balance during gait training in people with acquired brain injury. *Achieves of physical medicine,* 93, pp.636-640

Fidan, E. Lewis, J. Kline, A.E. Garman, R.H. Alexander, H. Cheng, J.P. Bondi, C.O. Clark, R.S.B. Dezfulian, C. Kochanek, P.M. Kagan, V.E. Bayir, H. (2016) Repetitive mild traumatic brain injury in the developing brain: effects on long-term functional outcome and neuropathology. *Journal of Neurotrauma*, 33, pp. 641-651

Finlay L. (2006) 'Rigour', 'Ethical Integrity' or 'Artistry'? Reflexively reviewing criteria for evaluating qualitative research. *British Journal of occupational therapy, 69(7), pp. 319-326*

Flowers, P. and Knussen C (2001) Re-appraising HIV testing among scottish gay man: the impact of new HIV treatments. *Journal of health psychology*, 6(6),pp. 665-678

Geraghty, A.W.A. Kirby, S. Essery, R. Little, P. Bronstein, A. Turner, D. Stuart, B. Andersson, G. Carlbring, P. Yardley, L. (2017) Internet-based vestibular rehabilitation for adults aged 50 years and over: a protocol for a randomised controlled trial. *BMJ Open, 4:e005871*

Githaiga N.W. (2014) Methodological considerations in utilization of focus groups in an IPA study of bereaved parental cancer caregivers in Nairobi. *Qualitative research in psychology*, 11(4), pp. 400-419

Gottshall K.R and Sessoms P.H (2015) Improvements in dizziness and imbalance results from using a multidisciplinary and multi sensory approach to vestibular physical therapy- a case study. *Frontiers in systems neuroscience* 9, 106

Gurley, J.M. Hujsak, B.D. Kelly, J.L (2013) Vestibular rehabilitation following mild traumatic brain injury. *Neurorehabilitation,* 32, pp. 519-528

Guskiewicz K.M (2011) Balance assessment in the management of sport-related concussion. *Clinical sports medicine*, 30, 89-102

Howes, H. Benton, D. Edwards S (2004) Women's experience of brain injury: an interpretative phenomenological analysis. *Psychology and health*, 20(1), pp. 129-142

Hellweg S. and Sonke J. (2008) Physiotherapy after traumatic brain injury: A systematic review of the literature. *Brain injury*, 22(5), pp. 365-373

Love, B. Vetere, A, Davis, P. Handling '' hot potatoes'': ethical, legal, safeguarding, and political quandaries of research drug using offenders. *International journal of qualitative methods*, 18, pp. 1-9

McCulloch, K.L Buxton, E. Hackney, J. (2010) Balance, attention, and dual-task performance during walling after brain injury: associations with falls history. *Journal of head trauma rehabilitation,* 25(3), pp. 155-163

Osborn M. and Smith J.A. (1998) The personal experience of chronic benign lower back pain: An interpretative phenomenological analysis. *British journal of health psychology*, 3 pp. 65-83

Ouchi, K. George, N. Bowman, J. Block, SD. (2023) Empower Emergency Physicians to Make Patient-Centered Recommendations Regarding Code Status With Serious Illness Communication Training—Resident-Desired, Standard of Emergency Care in 2023. *Annals of Emergency Medicine*, 82 (5), pp. 594 - 597

Phillips, E. Montague, J. Archer, S. (2016) Worlds within worlds: a strategy for using interpretative phenomenological analysis with focus groups. Qualitative research in psychology, 13(4), pp. 289-302

Rabinowitz A.R. and Levin H.S (2014) Cognitive sequelae of traumatic brain injury. *Psychiatric clinician North America*, 37(1), pp. 1-11

Smith J.A and Osborn M. (2015) Interpretative phenomenological analysis as a useful methodology for research on the lived experience of pain. *British journal of pain*, 9(1), pp. 41-42

Tate, R.L. Godbee, K. Sigmundsdottir, L. (2013) A systematic review of assessment tools for adults used in traumatic brain injury research and their relationship to the ICF. *Neurorehabilitation*, 32, pp. 729-750

Truman, J. (2013) Performances in the workplace following traumatic brain injury; a dramaturgical metaphor to explain how return to work is supported. *Doctoral dissertation, University of Southampton.*

Tuffour, I. (2017) A critical overview of interpretative phenomenological analysis: a contemporary qualitative research approach. *Journal of healthcare communications*, 2(4) pp.1-5

Whitehouse, D. Piffer, F. Becker, T. Gravett, K. Stewart, A. Basi, K. Inmand, S. Bush, A. Jarritt, P. Stranks, A. Newcombe, V. (2021) Challenges, approaches and opportunities for patient and public involvement (PPI) in traumatic brain injury (TBI) research. *British Journal of Neurosurgery,* 35(5) pp. 651-652

Van Vugt, V.A. van der Wouden, J. bosmans J.E. Smallbrugge, M. van Diest, W. Essery, R. Yardley, L. vander Hort H.E. Maarsingh, O.R (2017) Guided and unguided internet-based vestibular rehabilitation versus usual care for dizzy adults of 50 years and older: a protocol for a three armed randomised trial. *BMJ Open*, 7:e015479

Yardley, L. Donovan-Hall, M, Smith, H.E. Bronagh M.W, Mullee, M. Bronstein A.M (2004) Effectiveness of primay care-based vestibular rehabilitation for chronic dizziness. *Annals of international medicine,* 141(8), pp. 598-605

Yardley L. (2007) Dilemmas in qualitative health research. *Psychology and health*, 15 (2), pp. 215-228

Yardley L (2017) Demonstrating the validity of qualitative research. *The journal of positive psychology*, 12(3), pp. 295-296