

Physiotherapists' Perspectives Towards Using Telehealth for Acute Concussion Care

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Abstract

A traumatic brain injury reflects a heterogeneous description. The mildest form has been referred to as that of a concussion, with recent steps being taken to reclassify this as mild traumatic brain injury (mTBI). Management has developed in tandem with the understanding of what mTBI, as have methods that physiotherapists (PTs) may use to provide care. The most recent catalyst to the use of in-person versus virtual healthcare was observed during the COVID-19 pandemic. Despite its use, very little is known regarding the perceptions of the PTs who engaged in this method of care, or whether virtual physiotherapy (VPT) may be continued. The purpose of this basic qualitative study was to explore PTs' perspectives around the use of VPT in their current practice in adult patients with acute mTBI. A framework that centered around the self-efficacy (SE) of the PT was applied. A single, semi-structured interview involving nine PTs who were experienced in using VPT with mTBI patients. A study-specific questionnaire was developed to explore the PTs' perceptions related to their SE, potential barriers, as well as factors affecting future use. The results indicated SE beliefs towards VPT use were related to patient and professional factors, technology, and perceived barriers. Barriers were reported at patient-, PT-, and technological-levels. Factors related to future use of VPT were noted as being both intrinsic and extrinsic. Physiotherapists developed their SE beliefs from a variety of intrinsic and extrinsic sources. This study presented a jumping off point to inform a knowledge gap in which more research is required to evaluate PT perspectives across a greater sample size and diverse population. Further study into the perspectives of other stakeholders may be beneficial to explore related to VPT application.

Keywords: virtual physiotherapy, self-efficacy, healthcare clinicians, healthcare education, mild traumatic brain injury, concussion

1. Introduction

1.1 Introduce the Problem

The problem is, while physiotherapists (PTs) are utilizing modes of virtual physiotherapy (VPT) in their current practice, it is unknown how VPT has impacted clinical decision-making or practice trends for the PT, when providing care to the acute concussion population. The term concussion is often used interchangeably with mild traumatic brain injury (mTBI) and has been viewed as a representation of the mildest forms of traumatic brain injury (TBI). Of the 1.7 billion people presenting to emergency departments annually in the United States (U.S.), over 1.3 billion are released with a mild diagnosis of TBI (Mullally, 2017). These symptoms often pose a diagnostic challenge to the practitioner and have direct treatment implications. Concussion represents a continuation of symptoms both in the mild categorization and beyond, with the mTBI categorization remaining prevalent. Further, the development of concern with repeated concussions resulting in chronic brain damage (Mullally, 2017) has increased the need for awareness of diagnostic and management strategies. While traditional recovery strategies have included standard medical care, rehabilitation, and cognitive services, there has been a growing of interest in using VPT to assess and manage various domains of concussion symptoms (Santos et al., 2020). This has included postural control evaluation through functional neurological assessment (Santos et al., 2020), and assessment of cognitive and behavioral function (Edwards et al., 2014).

In terms of virtual methods of healthcare to support VPT, virtual reality (VR), and augmented reality (AR) systems have been often referred to synonymously in the literature, with little to demarcate one method from the other. Virtual reality training use in the TBI population, including post-concussion, is in its infancy (Edwards et al., 2014; Santos et al., 2020; Zanier et al., 2018). There is some encouraging initial results (Pietrzak et al., 2014) as well as in special populations including military personnel in the U.S. (Edwards et al., 2014). Virtual reality training may improve compensatory and adaptive strategies following a TBI (Zanier et al., 2018) but it is unknown if VR is superior when compared to traditional therapy (Pietrzak et al., 2014). Although similarities exist between VR and AR, there is an increased importance placed on the cognitive perspective of the participant in AR training (Kim et al., 2018). Physiotherapists take on a variety of roles when treating individuals with concussion. Broglio et al. (2015) described the role of PTs within the framework of current and emerging physical rehabilitation guidelines. In conjunction with cognitive and physical rest, PTs may engage patients in vestibular and oculomotor retraining. The intention of such interventions may be framed around addressing concurrent symptoms of benign paroxysmal positional vertigo (BPPV), vestibular-ocular reflex impairment, visual motion abnormalities, balance impairment, cervical spine-related or exercise-induced dizziness, and visual deficits (Broglio et al., 2015).

1.2 Explore Importance of the Problem

Traumatic brain injury reflects a heterogeneous continuum of pathophysiological events. These events differ in terms of clinical signs and symptoms, although the classification of concussion pathology has evolved in recent decades. Approximately 1.3 billion patients in the U.S. are diagnosed with mTBI (Mullally, 2017). Of this percentage, the mildest form of TBI has been traditionally termed as a concussion (Mullally, 2017). An increased emphasis though has been placed on gravitating away from the term concussion and toward the use of the TBI classification based on severity (Salisbury et al., 2018).

Due to the heterogeneity in the presentation of concussions, a diagnostic challenge is posed for clinicians. This has often led to misdiagnosis and delayed management (Mullally, 2017). In tandem with concern about detecting and providing early management to individuals who have sustained multiple concussions, to reduce the likelihood of encephalopathy (Mullally, 2017), the focus has shifted to rapid diagnostic methods. While it is suggested that factors such as sex and age contribute to ongoing concussion risk, understanding an individual's concussion history is essential to providing patient-centered care (Broglio et al., 2015). More sophisticated methods to assess for concussion signs and symptoms have grown to include the use of VR on the front-line to assess various domains of interest (Rose et al., 2005). Technology-related advances, such as VR, may create both rapid and low-cost evaluation methods for mTBIs (Salisbury et al., 2018).

The interest in applying visual stimuli to produce neural adaptation and improvement in functional abilities in this population has drawn interest from technology-assisted methods (Zanier et al., 2018). The use VPT, such as VR and AR, has been recently suggested as advantageous in other neurological groups (Lee & Choi-Kwon, 2016), though the effectiveness and efficacy of such an intervention is limited at present. Within the concussion population, more recent interest has focused on VR and AR's use in the assessment process (Wright et al., 2017), with a gap in the literature around its potential use in treatment. Yet elsewhere in the health sciences, the use of VR and AR as modes of delivering VPT has been utilized across a variety of disciplines and techniques. At the patient level, the use of technology-assisted treatment methods has served to reduce maladaptive psychological factors including anxiety, pain, catastrophizing, and fear-avoidance behaviors.

1.3 Describe Relevant Scholarship

1.3.1 Overview of Traumatic Brain Injury and Concussion

Traumatic brain injury reflects a vast continuum of pathophysiological events, as well as varying clinical signs and symptoms. This continuum of signs and symptoms presents a diagnostic challenge for clinicians, often leading to misdiagnosis and delayed management (Mullally, 2017). Traditionally, management has included elements of standard care, reflecting physical and cognitive rest periods. More recently, targeted rehabilitation approaches have emerged in relation to evolving treatment literature. At present, treatment may include elements of physical and cognitive rest, but also may include vestibular, oculomotor, exertional, or pharmacological management (Broglio et al., 2015). Concerning a more active phase of targeted rehabilitation, interest has grown conceptually in the application of using VPT to assess various domains of concussion (Zanier et al., 2018). From a predictive perspective, it has been suggested that the ability to assess for and determine abnormal proprioception and balance early on in acute concussion can be predictive of post-concussive symptoms 3-weeks post-trauma (Subbian et al., 2014).

1.3.2 Application and Barriers to Virtual Virtual Physiotherapy

The continuity of care for individuals with neurological conditions has been extremely challenging for rural and remote regions and care settings (Tenforde et al., 2017). Virtual physiotherapy delivered within the neurological field may occur in the acute care setting, inpatient rehabilitation, outpatient neurorehabilitation, and outpatient musculoskeletal and sports medicine settings (Tendorde et al., 2017). In the acute care setting, the use of VPT has been implemented to assist in the acute ischemic stroke population to provide a cost-effective, rapid access means to VPTs remotely. This method of assessment and follow-up has been reported as producing outcomes that align with in-person neurological consultations (Tenforde et al., 2017). In the inpatient rehabilitation setting, VPT has largely taken the form of videoconferencing. Virtual physiotherapy has been implemented to help comply with various professional regulatory responsibilities and medical services access laws, allowing enhanced interprofessional care plan delivery. It has been recently applied across post-surgical, acute brain injury, TBI, burn, and spinal cord injury populations within the inpatient environment (Tenforde et al., 2017). As a step-down from inpatient environments, outpatient neurorehabilitation settings have been utilizing VPT.

The potential for utilizing virtual methods of healthcare delivery across the health sciences remains largely unknown. Australian studies for the use of virtual care in remote and rural regions have attempted to gauge the perceptions across the health sciences. Audiologists, dieticians, exercise physiologists, occupational therapists, PTs, podiatrists, social workers, and speech language pathologists have been evaluated in terms of their perceptions around virtual service delivery, as well as patient outcomes and preferences. Across 44 studies that were evaluated, common trends emerged. Both assessment and treatment outcomes were comparable between virtual and face-to-face interactions with healthcare providers (Iacono et al., 2016). Meanwhile other studies in Northern Canada have suggested a significant cost-savings to the healthcare system when using virtual methods to address concussion care (Ellis et al., 2019).

Furthermore, little is known at present as to both provider and patient satisfaction when utilizing virtual healthcare (Tenforde et al., 2017). From a technical standpoint, potential barriers may also relate to the type or placement of cameras to ensure appropriate capture during video interactions. Lack of dedicated equipment or space at some facilities may further affect the prevalence of virtual care use. Scheduling of patients and the time needed both during sessions and between appointments poses an additional consideration for clinicians. At present, the nature of providing virtual care and the etiquette associated with it is lacking in the training of many allied health professions (O'Hara & Jackson, 2017). In musculoskeletal realms of applying VPT, moderate to good reliability for using VPT has been demonstrated. One identified barrier has been the low to moderate concurrent validity of more advanced spinal, neurodynamic, and specialized orthopaedic testing (Mani et al., 2017), which are often components required in concussion evaluation. Despite these barriers, positive trends have been noted in regard to utilizing virtual healthcare, including VPT, across acute and chronic neurological populations particularly in remote and rural settings (O'Hara & Jackson, 2017; Tenforde et al., 2017).

1.3.3 Historical Regard for Concussion

Casper (2018) reported that although the interest in acute and long-term effects from head injuries has been investigated for centuries, major interests did not emerge until around 1870. The exploration of the association between concussion and neural encephalopathy was not offered until 1928, linking to more profound neurological consequences a relatively recent advancement in medical thinking (Casper, 2018). The regard for concussion has been shaped by various social, cultural, political, and medical influencers over the past century. Of considerable mention is the advent of interest in the nervous system in medicine, which has taken the consequences of concussion from a psychological realm to a more modern neuroanatomical basis (Casper, 2018). In tandem with this evolution in the medical industry, there has been an emergence of industrialization and workplace injuries related blast trauma. This form of trauma has been documented in the TBIs population from the various World Wars. This emergence has included sociocultural, political (Casper, 2018), and litigation influencers on how concussions are regarded in society. Following more incidents of trauma-induced pathologies, scientific interest has shifted towards an understanding of injury and the plasticity of the nervous system. Since the 1980s, the interest in concussion evolved to more sophisticated physiological and biomedical models of understanding. Though advancements in the understanding of pathology did not begin to emerge until the late 1990s (Casper, 2018; Williams & Danan, 2016).

1.3.4 Virtual Reality in Healthcare

The development of 3D visualization through VR and AR originated in the early 1990s (Sutherland et al., 2019). Initially, this began through educational endeavors in anatomy training and surgical planning and has progressed to immersive VR and AR applications at the patient level (Sutherland et al., 2019). Exposure-based therapies for

phobia have, for example, explored various methods of applying the virtual environment (VE) to patient exposure-based treatments (Baus & Bouchard, 2014). This has included conditioning exposure to treat acrophobia, arachnophobia, aviophobia, claustrophobia, and driving phobias in safe VEs (Baus & Bouchard, 2014). It has been suggested that with therapy applications, employing a VE may serve to reduce unwanted psychological factors such as anxiety, subjective discomfort, and catastrophizing and fear-avoidance behaviors, as well as improve a positive locus of control through improved SE (Baus & Bouchard, 2014). Although popularized along with the concept of VR in the 1990s, AR has been rooted in science spanning back to the 1960s (Baus & Bouchard, 2014). Augmented reality applications have permeated the automobile industry, through windshield augmented displays, as well as in education, medicine, architecture, maintenance, entertainment, and disaster management (Baus & Bouchard, 2014). In healthcare, AR application has evolved similarly to VR in the treatment of phobias and psychological disorders (Baus & Bouchard, 2014; Fida et al., 2018). Its use to modulate patient anxiety, catastrophizing, SE, and fear-avoidance has been applied across a variety of sensory stimuli in both desensitizing and sensitizing manners (Baus & Bouchard, 2014). In some scientific circles, AR has been regarded as a movement from VR to more realistic real-world applications through AR. Hence, AR itself is in its infancy in terms of clinical applications, though the concept of AR predates that of VR (Baus & Bouchard, 2014).

Currently, the role of VR in medicine has included sophisticated training environments for skill acquisition. The creation of various VEs relies on the ability of the software to perform positional tracking of the user's eyes or head, as well as to determine the position of the user's hands or handheld peripherals, such as controllers (Sutherland et al., 2019). The second required component in the creation of the VE is the visualization of virtual elements from the user perspective (Guha, 2017; Sutherland et al., 2019). The sophistication of these training environments ranges from the student to the specialist level and spans health science disciplines. These applications may be either mobile to the user or tethered (Meola et al., 2017; Sutherland et al., 2019).

Simulated training in cardiology, lumbar puncture techniques, and intravascular catheterization methods has been available for some time (Sutherland et al., 2019). Surgically, VR has created the potential for 3D printing of models of anatomy and pathology that are derived from medical imaging, and useful in surgical planning. This has helped to promote minimally invasive procedures through improved preoperative planning for laparoscopic surgeries and robot-assisted surgery, for example (Sutherland et al., 2019). In a recent systematic review, Meola et al. (2017) examined the evidence for the use of AR in neurosurgery in 18 studies. The mode of AR application varied between microscope, hand- or head-held cameras, direct patient view, endoscope, x-ray fluoroscopy, and head-mounted display to address neoplastic, neurovascular, hydrocephalus, and undetermined pathologies. The results of the review suggested that AR is both a reliable and versatile surgical tool when designing minimally invasive approaches in neurosurgery and across a variety of subspecialties.

1.4 State Hypotheses and Their Correspondence to Research Design

The purpose of this basic qualitative study was to explore PTs' perspectives towards the change in their practice, from the inclusion of VPT. Further insight was gained in regard to the potential applications and perceived barriers when utilizing VPT in the adult acute concussion population. Physiotherapists have been traditionally involved in a variety of roles when treating individuals with concussion (Broglia et al., 2015). Due to the heterogeneity in the presentation of concussions, a diagnostic challenge is posed for clinicians (Mullally, 2017). Sophisticated methods to assess for concussion signs and symptoms have grown to include the use of VPT on the front-line to assess various domains of interest (Rose et al., 2005). Advancement in the use of VPT in regard to providing treatment to patients with neurological injury has further occurred at a faster pace (Mumford et al., 2010; Zanier et al. 2016).

Virtual methods of providing healthcare, has been considered across the health sciences as having an emerging potential (Iacono et al., 2016) for reducing access to care barriers, which are often seen in remote and rural regions of Canada. Very little is known or recommended about VPT's potential role in the initial assessment process in lieu of in-person evaluations. Even less is known about the perceptions surrounding VPT implementation at the provider level when providing follow-up care. While PTs are utilizing modes of VPT in their current practice, it is unknown how VPT has impacted clinical decision-making or practice trends for the PT, when providing care to the acute adult concussion population.

2. Method

A basic qualitative research design allowed for an understanding of lived experiences, perceptions, and narrative events, which are not possible to glean from quantitative analysis (Creswell, 2012). This permitted an understanding of perceptions and uncovering of real-life trends through analysis of personal and theoretical assumptions, while promoting an understanding of those experiences (Wilson, 2015). Qualitative research follows structured and rigid designs, with identified methods in advance. Yet, the nature of the research requires that

planning, implementation, and revision of the research design is emergent as the data themes, or trends, are encountered (Cypress, 2017). Trustworthiness of the data, in order to ensure reliability and validity of the results, is still maintained through rigorous adherence to qualitative methods in this type of research (Cypress, 2017).

2.1 Research Questions

The following research questions supported this basic qualitative study:

RQ1. With the treatment of patients with mTBI via virtual PT, what are the impacts on the physiotherapists' SE?

RQ2. What potential barriers do PTs encounter when providing VPT care?

RQ3. What are the recommended changes needed to improve the effectiveness of VPT when treating patients with mTBI?

2.2 Participant Population and Sample

The rural and remote region selected for this study were that of Northwest Ontario (NWO) from the Local Health Integration Network's (LHIN's) catchment. The LHIN is a subdivided network that coordinates planning, and integration of local health funding in Ontario. The intention of the LHIN is to improve patient access and reduce barriers to healthcare. The North West LHIN is a division of the LHIN, affords a better understanding of population health at a regional remote and rural level. The North West LHIN places links with primary care providers in order to improve health of rural and remote residents. As access barriers and specific population health factors are evident in rural and remote regions, the North West LHINs has been further subdivided into sub-regions to reflect the local needs. These subdivisions include the: District of Kenora, District of Rainy River, District of Thunder Bay, City of Thunder Bay, and Northern. These areas have been subdivided based on input from local stakeholders, including primary care providers, healthcare providers, patients, and their families, while ensuring referral patterns and best practices were adhered to through a specific, local lens.

2.3 Research Design

A basic qualitative research design was used, as it intended to explore the perspectives of PTs who engaged in VPT as a novel way to conduct patient care. This design allowed for open-ended questioning for the participants. It was anticipated that this allowed them to share their experiences for utilizing VPT and would identify themes or trends related to their perceptions. Understanding these perspectives may assist PTs in developing further VPT methods to reduce barriers in remote and rural regions, when providing concussion care. Furthermore, understanding these perspectives may allow further insight into the clinical reasoning process employed by PTs when engaging in patient care.

2.3.1 Recruitment

Initial participant recruitment took place via email and telephone during the month of April, 2021. Prospective participants were identified by an Internet search of outpatient physiotherapy clinics, and publicly-funded health groups in NWO and Northern Ontario. The compiled list was cross-referenced with a clinician database for PTs that was maintained by the Northern Ontario School of Medicine University. In addition, a grey search for additional PTs who may be engaged in VPT occurred through the initially identified PTs. All eligible participants receive a detailed emailed document from the primary researcher. Informed consent was obtained from each participants' site prior to the start of the interview. Following completion of the informed consent, one-to-one interviews were used to gain information on the perspectives of PTs when engaging in VPT in the adult, acute concussion population. During the interview, demographic information, perceived confidence in providing VPT assessment and/or treatment to concussion patients, perceived SE when using VPT, perceived barriers, as well as necessary changes to VPT or clinical practice were reviewed.

3. Results

3.1 Analyses

Demographics for the participating PTs was collected by the primary researcher for later analysis. Qualitative data analysis notes words or phrases as data collection occurs, in order to describe emerging themes related to perspectives (Creswell, 2012). Initial steps towards analysis occurred with the primary researcher transcribing notes following each interview to prepare the data for coding (Creswell, 2012). Following transcription, each participants' interview was reviewed manually, making note of important or interesting concepts. Analysis of themes occurred manually on first pass. Following this, data was inputted into a computer-assisted qualitative analysis program. NVivo® for Mac (v. 1.5) allowed for a range of data collection, organization, analysis, and management of qualitative research data. This assisted in impartial coding and analysis of data and recurring

themes, which allowed direct comparison with the results that were obtained manually during the first pass. Coding prior to analysis is advocated in basic qualitative studies, such as this (Creswell, 2012). Themes were represented in this study using tables and narrative representation of findings. Once identified, these recurring themes were interpreted and linked to the current literature on the topic area.

3.2 Coding

All nine interviews were coded manually as the first phase of analysis during open coding. Following this, coding into NVivo® for Mac occurred for additional theme and subtheme consideration. From these themes, a third level of analysis was applied by mapping features that NVivo® for Mac (v 1.5) provided.

Open Coding

The interviews were analyzed in a single batch at the completion of data collection. The batch was coded and analyzed for themes or categories. Clarifying questions were not required following the completion of the nine interviews, and a second batch of interviews was not required. The first step of open-coding occurred through manual coding of the transcribed interviews.

NVivo® for Mac Thematic Coding

Transcripts were uploaded for computer analysis into NVivo® for Mac (v. 1.5), for further analysis. Each interview was coded again manually using the software and then compared to the initial manual coding process. Coding the nine interviews in NVivo® for Mac provided comparative analysis techniques to be then applied, ensuring alignment with basic qualitative methodology.

NVivo® for Mac Selective Coding

The next step of analysis was that of selective coding. Categories of emerging similarities in the open codes were found. Word-count queries were used as an additional method of discovering selective codes from the collected data. The *depth* analysis of the coding was defined as having two or more vignettes assigned to a code. In analyzing the depth of these codes, quantity of vignettes assigned to a code group or grouping of open codes was adhered to. Mapping software in NVivo® for Mac (v. 1.5) was applied and provided a mind-map from the vignettes and the open codes. This mind-map is reflected in the analysis of the data and includes the summary of the results for the open, selective, and theoretical coding process.

Comparative Review

With open and selective coding completed, theoretical coding from analysis of these relationships were produced. Mind-mapping software in NVivo® for Mac (v. 1.5) was utilized to assist with theoretical coding. When creating this mind-map, each interview vignette linked directly to a code. Each vignette was then reviewed for possible association with other codes. If there was a relationship, these relationships were connected manually. Constant comparison was employed to ensure that weight was not added to one interview over another to code creation. It was ensured in the analysis that each participant was asked the same form of questioning, and that this was consistent across vignettes. Individual, or dependent codes, were also identified.

3.3 Analysis of the Findings

Results for Research Question 1

Results were grouped into seven main categories to help address the question of how engaging in VPT may relate to SE on the part of the PT. The central categories, when ranked hierarchically by instances of references, demonstrated the following considered weight towards the PTs' perceptions of using VPT. These perceptions were noted as: treatment confidence (58 references), perceived SE (48 references), assessment confidence (42 references), past confidence (36 references), the clinical decision-making process (CDMP; 30 references), future use considerations (21 references), and change in practice (14 references). The overarching themes that emerged from these categories that related to SE transcended as *patient factors*, *PT factors*, *technology*, and *barriers* considerations. The various themes, and subthemes, that emerged have overlap between these central themes and categories, which required individual explorations in order to inform the question of SE beliefs. Confidence related to past experiences, the patient assessment, and patient treatment formed three of these categories. Perceived SE, practice change, the CDMP, and future considerations formed the additional four categories related to SE beliefs.

The results indicated that PTs partially drew on some of their SE beliefs when engaging in VPT from their past confidence. This included factors related to the COVID-19 pandemic, perceived barriers for VPT use in the population, past professional education related to technological factors, as well as their past experiences with patient-centred care. These patient-centred considerations were formed through their experiences with patient education and communication methods previously.

Both assessment and treatment confidence, as related influencers on SE beliefs, shared three common themes across the participants. These themes included: patient factors, PT factors, and technology. Despite more subthemes as being identified as impactful to assessment confidence, there were more direct references to treatment considerations on the part of the PT (58 vs. 42). The ability to engage confidently in a patient assessment with concussion patients related to the patients' symptomatology, diagnosis, technology / home setup, comfort level, and certain geographical barriers. What the current results also may suggest, are that these patient factors are directly related to the SE beliefs experienced by the PT when engaging in VPT in the concussion population. The ability to engage confidently in patient assessment was also felt to be contributed to by intrinsic PT factors.

Physiotherapist personal factors, as related to their assessment confidence, was the highest reported on by the participants, with 28 individual references made to PT assessment factors. These PT factors included: subjective information, objective information, outcome monitoring, clinical encounter organization, and care plan development. Pertaining to assessment confidence, PTs suggested that technological considerations were strongest in relation to how they were influenced by the platforms available to them, as well as how they could acquire data during the patient encounter. Treatment confidence formed a smaller theme for the respondents in this study, suggesting they drew more confidence and SE from the themes related to their assessment abilities with VPT. However, the treatment confidence category demonstrated there was more balanced consideration between patient factors (23 references) and PT factors (28 references), rather than related to assessment confidence factors, which were largely felt to be PT factor-related.

For treatment confidence, similar patient-, PT-, and technological-factors were reported. Patient factors related to the influence on concussion treatment confidence were reported as being related to symptomatology / complexity, as well as patient access. Factors related to the PT were more considered around their past practice patterns and experiential factors, as well as their professional education, and ability to monitor outcomes over time in response to treatment. The participants in this study made similar references to the ability to engage in symptom management, education, self-management, and exercise rehabilitation training.

When questioned specifically about their perceived SE as it related to using VPT with concussion patients, the participants identified the main themes that contributed to their perceived SE being related to barrier reduction, patient-centred care, education, and intrinsic professional factors. While 48 references were made across the themes, the majority of perceived SE was reported under the PT factors theme, having 27 direct references as being felt to be impactful. The impact of the barrier reduction theme related primarily to the ability of the technology used in VPT, as well as the ability to communicate effectively through it.

The PTs included in this study noted themes related to current practice change as being influential to their SE. These influencing themes were related to the issue of access to services, interdisciplinary care, stakeholder relationships, and their recent practice methods. The two most dominant themes related to access and practice methods, with 14 references balanced each between the two themes. Those interviewed felt that the ability to access services impacted their perceptions for using VPT. Physiotherapists felt positively that VPT allowed patients access to specialized concussion care in a timelier manner than traditional service models. This also opened up the ability to expand on the interdisciplinary nature of the patient care, and improve the patient-centred nature of the relationship.

Despite the fact that some PTs felt as though VPT may place providers into more isolated or solo rolls, in regard to practice change, VPT was viewed as a positive manner of improving a team approach to patient-centred care from a distance. The subtheme of geographical location, as it related to access, also emerged as an influencer towards PT perceptions. Physiotherapists generally felt that the ability of VPT to reduce geographical limitations and improve service provision was a positive feature. Caution though was noted, as PTs may need to be aware of certain patients or cultural groups which may have limited access to technology, and thus have negative impact by using VPT.

The interdisciplinary team perspective was a theme as it related to influencing PT perceptions. Considerations were given around the ability to engage in interdisciplinary care at the team as well as family levels. Although this study involved perceptions related to the adult concussion population, Signal et al. (2020) reported similar aligning perspectives towards a team-oriented, family-centred approach when applying VPT to the paediatric concussion population. Concepts of trust and knowledge-sharing in an interdisciplinary setting may be associated with improved provider SE (Chang et al., 2015), as well as team self-reflection (Signal et al., 2020) when providing VPT. Considerations were given by those authors around the physical environment that the patient would have to engage in therapy in, including safety concerns, and how their environment may impact service delivery. In this study, the PTs suggested that the family and team considerations actually may contribute to their regard for VPT and how it relates to their perceived ability to provide care through telehealth. Similarly, their individual practice methods formed a theme for consideration. Within their perceptions related to how their current practice methods could translate into the VPT environment, the PTs felt that this related mostly to their ability to offer best practice

considerations, specialized care to the concussion population, and finding avenues for incorporating traditional manual therapy methods into the virtual realm. The ability to translate their past practice patterns into the virtual environment was perceptually-linked to their positive regard for VPT.

As an underpinning consideration around the SE experienced by PTs when providing VPT in the adult concussion population, the CDMP was highlighted throughout. Clinical decision-making appeared to relate to the patient and PT overarching themes, as well as how technology may impact the ability to engage in the CDMP through VPT. When exploring the perceptions related to the PTs' CDMP, four themes emerged. These included consideration towards their CDMP regarding the assessment, treatment, the interdisciplinary model, and patient outcomes. The dominant theme that emerged was related to the assessment considerations on the CDMP, having been referenced 30 times.

While the interdisciplinary theme was the smallest theme noted under the CDMP category, patient outcomes considerations accounted for the second most prevalent theme under the CDMP of the PTs. Within the patient outcomes theme, outcomes monitoring and biopsychosocial considerations in the patient with concussion were deemed important for reasoning. As such, a trend towards consideration of patient outcomes, with a need for an interdisciplinary management model, can be considered an important feature in the CDMP. Lastly, although it was identified as a theme, patient-centred care was found to be a component of PT future considerations. The ability to provide specialized services, as well as improve access around concussion care, was felt to be important to the PTs and influential to their future considerations. Indeed, barrier exploration was suggested throughout as a means to influence future patterns for VPT and improve the perceptions of PTs.

Results for Research Question 2

The concept of barriers and planned barrier reduction were explored further in the second research question. All participants in the study were noted to be practicing from an urban location, although outreach to rural communities was common across all PTs. The three main themes that were identified as related to barriers associated with providing VPT included: professional factors (45 references), patient factors (28 references), and technology (17 references).

The professional factors that were identified by the participants related to eight subthemes. These subthemes for professional barriers included: assessment, clinical reasoning, environmental, fatigue, practice patterns, remuneration, resources, and working in a sole charge role. Some challenges were felt in terms of completing the concussion assessment around communicating with the patient, gathering objective and visual data, as well as assessing for neurological and vestibular considerations.

Physiotherapists occasionally expressed concerns regarding an increase in workload, work-related fatigue, and work-related satisfaction. These perspectives were shared by the participants in Albahrouh and Buabbas' (2021) qualitative study as well. Furthermore, in regard to educational training in VPT, and resource support for PTs, both the participants of Albahrouh and Buabbas' (2021) study and the perspectives of the nine PTs interviewed aligned in the professional factors theme. Additional barriers presented in these results suggested that the PTs interviewed felt that the limitation that VPT afforded towards their manual therapy and/or vestibular therapy training may pose a barrier to utilizing VPT in the concussion population.

The second barrier theme that was identified pertained to patient factors. The subthemes noted under patient factors included: access, comfort and/or expectations, as well as symptomatology and/or safety. Majority of patient barriers were related to access around the necessary technology and geographical or travel considerations on the part of the patient. Patient safety tended to pertain to patient environmental considerations, whereas patient symptomatology largely was referred to be impacted by the technology needed for VPT or the travel considerations to reach in-clinic services. It was not surprising given that this study was one that explored the perceptions of the provider that fewer references to patient barriers were identified. As such, further consideration of patient barriers may be explored through follow-up studies in the intended population.

Finally, although technology was referenced as a minor tertiary theme relating to perceived barriers, technological barriers were referenced on both the patient and professional side at various points. In relation to technology specifically, the two subthemes that were most strongly identified were related to broadband Internet access and limited interruptions to power. Both Caze II et al. (2020) and Albahrouh and Buabbas (2021) noted the stability of broadband internet and video quality as main considerations around technology as a barrier. Albahrouh and Buabbas (2021) expanded on this further noting the lack of user-friendly platforms, cost of equipment and limited technology support options for the PTs that they interviewed. These considerations were in alignment with the results of this study, as falling within the technology as a barrier theme.

Results for Research Question 3

The PTs interviewed in this study commented throughout on many of the barriers that they encountered as potential area of changes required in order to improve the effectiveness of VPT for concussion patients. When this was explored through direct questioning, 63.5% of responses related directly to potential changes, and the PTs primarily identified 5 themes related to potential changes. These included changes to: technology, scheduling considerations, best practice standardization, funding models, and environmental changes.

Technology was an overarching theme identified across when answering all 3 research questions. It also formed the first theme around the perspectives of PTs for ongoing changes, and was primarily divided into subthemes of video quality and the synchronous versus asynchronous manner of VPT. It was generally highlighted throughout responses that participants felt the need for high-quality video was required for observation during assessment, and when monitoring change over time. The ability to ensure high video quality related to both their perceptions around technology as a barrier, as well as the availability of broadband internet and power. Chen et al. (2021) agreed with this perspective, suggesting broadband internet was required in order to ensure adequate video connectivity when delivering telehealth to remote or rural regions. The stability of this connection may somewhat relate to the considerations around synchronicity that the PTs also communicated, speaking to Internet stability. However, asynchronicity is also presented as a potential barrier or facilitator with VPT by the respondents in this study.

Scheduling was also noted as a consideration for future changes. This theme was composed of both prioritization of the clinical encounter, as well as factors related to patient compliance as subthemes. Scheduling and managing patient time in the virtual environment is needed both during sessions as well as between appointments. Nearly half of the participants in the current study suggested a need for review of patient scheduling considerations in the future, with consideration towards prioritizing clinical time and procedures in advance of the clinical encounter. Chen et al. (2021) appeared to agree with this perspective, as it was suggested by those authors that adaptation of scheduling, time, and the clinical environment may serve patients better in the future. As it pertained to the current study, participants also felt that organization of the clinical encounter in advance would be conducive to barrier reduction in the future, and may improve patient compliance with the care plan.

Furthermore, best practice standardization formed a theme amongst PTs when questioned about future required changes. Best practice standardization was divided into subtheme considerations around objective examination, professional education, and current practice pattern considerations. Broglio et al. (2015) has noted previously that best practices have evolved across the vestibular and concussion populations over time. At present, there may be a gap that needs to be filled to determine which patients may benefit the most from a virtual approach, posing unique challenges for informing best practice recommendations in healthcare (Tenforde et al., 2017). Adapting the funding models, and stakeholder regard, for VPT was also identified as a theme under future considered changes. Adapting environmental characteristics, as they primarily related to technology, on the part of the patient and PT were also noted as themes towards future change. In the results of this study, the current funding models and stakeholder influences formed recurrent theme around future changes that are required. When explored in more depth, these appeared to relate to changes needed to acknowledge professional and/or ethical obligation to the patient, influence from licensing or regulatory bodies, support from third-party insurers, advocacy for VPT, and satisfaction from referral sources.

Previous to the COVID-19 pandemic, Tenforde et al. (2017) noted a compliance between professional regulatory responsibilities and medical service access laws around utilizing VPT in the U.S. Adoption of some limited VPT services were seen with TBI patients, and other patient groups, under an inpatient environment and step-down outpatient neurorehabilitation settings. In the orthopaedic outpatient setting, Turolla et al. (2020) previously noted a potential role for VPT.

In the study, medicolegal factors resonated with the PTs. While some PTs felt that their regulators in Ontario offered support in a reactionary manner for VPT, those responding did feel supported by them. Whether this support in regulation would continue was a concern that may require further examination elsewhere to ensure VPT is a sustainable service. Some interesting perspectives were gained from the PTs as a time of presenting conceptual change to the profession and regulators about the physical borders limiting practice between provinces in Canada, or internationally. It was suggested that a revision of thought may be required in order to address regulation of VPT on a grander scale, thinking less provincially and more globally. Professional standards may need to adapt accordingly to the new catchment potential for PTs who are engaged in VPT. The feeling of professional and ethical obligation to the patient again transcended the regulatory theme. Physiotherapists felt an inherent obligation to treat ahead of regulatory input during recent times. Despite this, no participant felt as if their regulator was a barrier to their practice of VPT, but more of a future unknown.

With these future considerations in mind, all participants in this study felt that they would continue to engage in VPT in the concussion population in-part through a hybrid-style model of care. No participant felt that they would continue VPT as a sole means to provide these services, but neither did any PT suggest that they would abandon its use in the future in this patient population or other elements of their practices. All participants chose to maintain a level of video contact through combined audio-visual means, although the platforms they used varied across the sample. Furthermore, all participants spoke of a learning curve that they experienced when engaging in VPT, which benefited from their past clinical experiences, but would be better informed through resource support to them for continued use of VPT.

4. Discussion

This basic qualitative study explored the perspectives of PTs who engaged in VPT with adult concussion patients in NWO. While other studies have sought to explore the perspectives associated with providing virtual telehealth prior to, and in the wake of, the COVID-19 global pandemic, no known studies were available to explore the perspectives of Canadian PTs who provided concussion management through VPT. This is a novel study, and may represent a jumping off point for additional research into both PT and patient perspectives when engaging in VPT for concussion care. As such, various limitations are noted with the current study. Sample size selection was small, with an expected return of 8-12 participants practicing in NWO. Given the realities of human resources in NWO, and the eventual limitations found for recruitment, expansion to other PTs in Northern Ontario, as well as Southern Ontario in order to satisfy recruitment projections. Despite this, the low number of participants may be regarded as generalizable to PTs engaging in VPT for concussion patients across NWO, but generalizability outside of NWO may be somewhat more guarded. This was also a convenient sample that was selected, which may increase bias. Furthermore, all participants were practicing from urban settings, which may limit the perspectives reported to non-rural or non-remote practicing PTs.

There was an acknowledged lack of previous research on the subject, which may introduce further error into these results. The majority of studies that were found relating to perceptions when engaging in VPT related to non-concussion patient populations, public-funded institutions, international clinician groups, and participant samples that included a variety of healthcare providers who were engaged in telehealth. As such, there was very limited background research related to the perceptions of PTs who may choose to engage in VPT for concussion patients. The studies that were found in this area were slanted towards the paediatric concussion population, whereas this study sought to explore perceptions in the adult concussion population.

The driving force behind the most recent practice shift, regardless of past confidence level, was noted by Jachak et al. (2020), as the “*great awakening*” in the PT profession. The pandemic has been regarded globally as a catalyst for change, and this was echoed by the considerations of the participants of this study. This was named noted in the outpatient PT community (Sirohi, 2020), which formed 100% of the sample participants. The lack of technological education in the past, as an impactor towards confidence and SE, aligned with Albahrouh and Buabbas’ (2021) findings which suggested this level of comfort was a consideration of PTs. The lack of past education on VPT applications was further reinforced by Khurshid et al. (2020) as a regulator of both confidence and confidence when practitioners engaged in the VPT environment.

These subthemes under the PT factor theme were supported by the experiences that Signal et al. (2020) reported from a neurorehabilitation environment. In their experiential research, the key component were related to setup, assessment, and treatment considerations. Under assessment considerations, alignment was found with this study in regard to subjective, objective, and outcome measure considerations by the PT. The organizational setup subtheme was supported by Signal et al. (2020), but also a main perceptual consideration of Caze II et al. (2020), who found that when implementing telehealth with paediatric concussion patients and their families.

More recently in healthcare, a shared decision-making (SDM) model has emerged, which engages the patient and is tailored to the specific values of the patient. This SDM model has been utilized in patient-centred and interdisciplinary instances for some time, with more recent applications through telehealth to rural patients. The main benefits of the SDM have included improving patient education, behavioural goal setting, and increased cohesion amongst members of the interdisciplinary healthcare team, which has been maintained through telehealth (Griffith et al., 2016). Pertaining to the research study, the PT participants largely made reference to the assessment theme under the CDMP as having various subthemes. Communication, manual therapy, meta-cognition and/or self-reflection, and the use of online tools were felt to be meaningful subthemes related to the CDMP around patient assessment. On the part of the manual orthopaedic PT, Jones et al. (2004) previously investigated strategies used when engaging in the CDMP. A direct relationship between knowledge and reasoning as highlighted by these authors. Generally, manual PTs engage in clinical reasoning strategies around diagnosis and management. Diagnostic reasoning may involve narrative reasoning, where appreciation and understanding of patient experiences and beliefs factor into pathoanatomical considerations. Management reasoning strategies tend to focus

on reasoning about the procedure, interactive reasoning, collaborative reasoning, reasoning about teaching, predictive reasoning, and ethical reasoning.

5. Conclusion

The findings of this study suggested that PTs drew upon SE beliefs towards their use of VPT in the concussion population from a variety of sources. Physiotherapist-specific factors, patient-specific factors, technological considerations, and perceived barriers primarily impacted the PTs' feeling of SE. Self-efficacy was felt to be regulated by factors related to past clinical confidence and skill transferability, confidence in concussion assessment, and confidence in concussion treatment using VPT. Direct perceptions related to their SE was suggested by the participants as being directly tied to a reduction of barriers, use of a patient-centred care model, their education, as well as other professional factors. The majority of participants suggested that their concussion practice has changed as a result of using VPT, with all seeing a role for VPT in the future as part of a hybrid-model of concussion care. Less than half of participants perceived a change related to their CDMP or could directly identify how their CDMP may relate to their SE around VPT use, yet there were dominant themes around the CDMP that emerged. As the CDMP often occurs on a meta-cognitive, or subconscious level, it is possible that participants experienced a shift in their CDMP and were not aware of it. As such, future research may look to explore the CDMP around using VPT in concussion assessment, treatment, interdisciplinary environments, and around patient outcomes. How the CDMP in this population may relate to PT perceptions of SE warrants further exploration as well.

Since this study did not directly engage a patient group for exploration of their perceived barriers when using VPT as part of their care, further research at this stakeholder level is recommended. Additionally, PTs did identify external stakeholder influences on their perceived barriers, which included third-party and regulator factors. Future research may look to engage these external stakeholders in order to gauge their primary considerations for PTs and patients when engaging in VPT. The future of VPT in the concussion population has been most recently catalyzed by the COVID-19 pandemic, creating a reactionary approach to establishing best practices or practice methods change. Physiotherapists identified a variety of perspectives associated with best practices and practice methods, which may be informed through future validation research and quantitative outcome monitoring through VPT, as well as refinement in how both manual therapy and vestibular rehabilitation is taught to PTs for their use in the virtual encounter. Use of quantitative methods of exploring practice change around best practice guidelines, may be possible. With this in mind, as PT and/or patient perspectives may be evaluated with such quantitative research in the future, the potential for exploring this topic with a mixed methodology may have expanded practice applications to the PT. Furthermore, expansion of the current study outside of NWO to gain national or international PT perspectives may improve the external validity of results outside of this convenient sample. As all participants identified the desire to continue a hybrid-model of VPT for their concussion patients, this may be a case of the research having to catch up to a new practice paradigm in order to both standardize its methods and to demonstrate positive patient change over time. An additional consideration may be in replicating the current study in a post-COVID environment to determine if the perspectives that were expressed changed in any way.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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Appendix A

Participant Demographics

Demographics	Participants
N	9
Age	
Mean (years)	43.2
Median (years)	40
Sex	
Male	6 (66.7%)
Female	3 (33.3%)
Race	
Caucasian	9 (100%)
Ethnicity	
Canadian	5 (55.6%)
Canadian-Italian	3 (33.3%)
Austrian	1 (11.1%)
Education level	
Bachelors	3 (33.3%)
Masters	6 (66.7%)
Years in practice	
Mean (years)	18.3
Median (years)	34
Multi-disciplinary practice	
Yes	7 (77.8%)
No	2 (22.2%)
Concussion certified	
Yes	6 (66.7%)
No	3 (33.3%)
Certification training	
SHIFT	4 (44.4%)
Advanced Vestibular	4 (44.4%)
R2P	2 (22.2%)
Other	4 (44.4%)
Location	
Urban	9 (100%)
Rural	0
Remote	0

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