Program Development for Interdisciplinary Telerehabilitation for Traumatic Brain Injury:

Expanding Clinical Treatment Options

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Introduction

In the United States, specialized healthcare centers in predominantly urban areas have emerged as key focal points for the treatment of complex medical conditions, such as brain injury, stroke, spinal cord injury, and polytrauma. However, the concentration in urban areas creates barriers to healthcare access, disproportionately affecting marginalized communities based on socioeconomics, race, ethnicity, and geographic location (Cyr et al., 2019). Factors such as limited transportation and sparse availability of knowledgeable providers in rural regions add to other challenges associated with access to specialized care (e.g., insurance coverage or financial means, ability to take time off from work, or other responsibilities to receive care). Among those significantly impacted are military service members and veterans (SM/Vs) with a history of traumatic brain injury (TBI), a population that experiences a higher mortality rate (Howard et al., 2022) and is particularly susceptible to adverse health outcomes such as increased risk for new mental health conditions and suicide following TBI (Brenner et al., 2023). The Wounded Warrior Project® (WWP) Warrior Survey conducted in 2022 underscores these challenges: 37% of SM/Vs registered with the organization self-reported experiencing TBI as a result of military service. Among these individuals with TBI, 60% presented with moderate to severe symptoms of two or more co-occurring mental health conditions, such as PTSD, depression, or anxiety, and 32% reported having suicidal thoughts in the past 12 months (Wounded Warrior Project, 2022).

Despite elevated risks, SM/Vs often encounter limited options for specialized care, exacerbating the challenges they face in their journeys toward recovery. More than two in five SM/Vs registered with WWP reported difficulty accessing care for injuries or health problems (44%). The top three barriers included difficulty scheduling appointments, delays or cancellations in treatment, and lack of availability in in the Department of Veterans Affairs (VA) specialty clinics (Wounded Warrior Project, 2022). The severity of and level of support needed to manage TBI symptoms can vary greatly. Among SM/Vs registered with WWP, 1 in 3 (33.5%) reported having low levels of instrumental support, characterized as having someone you can call for help with daily tasks and providing tangible, material, or functional aid (Wounded Warrior Project, 2022). This further highlights the potential benefit of accessible care options for SM/Vs.

Addressing these urgent issues is critical. A 2022 National Academies of Sciences, Engineering, and Medicine report called for immediate action, emphasizing that *“all people with TBI should have reliable and timely access to integrated, multidisciplinary, and specialized care to address physical, cognitive, and behavioral sequelae of TBI and comorbidities that influence quality of life*. “ The emergence of the COVID-19 pandemic further magnified these disparities, compelling the healthcare industry to adapt rapidly to ensure continuity of care while adhering to social distancing measures and quarantine protocols. This necessitated a swift pivot towards the development and expansion of telehealth services, which proved crucial in maintaining healthcare access during the pandemic and highlighted their potential to overcome longstanding barriers to care.

This report seeks to offer insights, guidance, and recommendations for developing and implementing telerehabilitation programs for TBI. It addresses the need for adapting traditional in-person services for remote or virtual delivery, while also delving into the myriad professional, clinical, legal, and logistical considerations vital for the successful deployment of such programs within

interdisciplinary brain injury rehabilitation frameworks. Ultimately, the aim of this report is to catalyze the expansion and enhancement of rehabilitation options for SM/Vs grappling with mild to moderate TBI, ensuring equitable access to quality care regardless of geographic location or socioeconomic status.

Existing Research on TBI, Rehabilitation, and Telehealth Service Delivery

TBI is a leading cause of disability and many individuals with TBI experience symptoms that impact cognitive, emotional, and/or physical functioning, and reduce quality of life (CDC, 2015; Hammond et al., 2019; Leddy et al., 2012). Incidence of TBI, particularly mild TBI (mTBI), is high in SM/Vs due to exposure to repeated blast and blunt injury mechanisms (Swanson et al., 2017).

Specialized treatment programs for SM/Vs are particularly important, given the high rates of both sustaining a TBI and experiencing a protracted recovery in military populations, as well as the prevalence of psychiatric and medical comorbidities (Cifu et al., 2013; Lew et al., 2009; Wojtowicz et al., 2017).Effective rehabilitation treatment programs for individuals with the chronic effects of TBI/mTBI typically occur in in-person multi- and interdisciplinary formats (Wallace, et al., 2022; DeGraba et al., 2020; Kontos et al., 2020; Janak et al., 2017; Lewis & Horn, 2015).

Utilization of telehealth service delivery to augment or replace in-person clinical services eliminates many barriers to accessing care (e.g., geographic constraints, logistical and stigma-based barriers, cost and time associated with transportation to appointments) while offering ease of access to service providers (Acierno et al., 2017; Humer et al., 2020; Johnstone et al., 2002; Juengst et al., 2021; Tsaousides et al., 2014). Indeed, among SM/Vs registered with WWP who reported TBI (37%), 80% were offered a telehealth appointment in the past 12 months, and of those offered, 90% utilized telehealth for physical and mental health care (Wounded Warrior Project, 2022). However, there is variability in how traditional in-person clinical services and programming can be readily adapted for remote delivery, such as the use of specialized rehabilitation equipment and factors that contribute to a positive, immersive treatment experience for SM/Vs (e.g., group therapy sessions, community outings, and general milieu and sense of camaraderie).

Research on the efficacy of treatment delivered via telehealth for populations with TBI, including SM/V populations, has been limited to investigations of specific disciplines of care (e.g., psychotherapy) or specific modalities of service delivery (e.g., telephone delivery or videoconference delivery) (Conklin et al. 2023b). Recent literature reviews and meta-analyses indicate that telehealth delivery of single interventions or services are generally acceptable to individuals with TBI and result in the improvement of symptoms (Ownsworth et al., 2018; Suarilah et al., 2022). However, empirical support for comprehensive interdisciplinary telehealth programs is lacking, and little has been published on implementing such care for TBI in either military or civilian populations (Conklin et al. 2023b).

Paucity of Comprehensive Interdisciplinary Telerehabilitation Programs

Despite the increased interest and the need for comprehensive interdisciplinary programs for TBI to be offered via remote or virtual delivery formats, few exist, likely due to several overlapping issues, including (1) lack of program development guidelines and recommendations; (2) lack of empirical evidence regarding the safety, feasibility, efficacy, and patient acceptability of such programs; (3) lack of knowledge or expertise in how to adapt in-person programming for remote service delivery; (4) lack of operational manpower to develop and implement telehealth or hybrid programming; and, (5) the array of legal, professional, and technical issues which represent barriers to implementation (e.g., HIPAA

considerations, software and internet access considerations, patient and clinician experiences, professional licensure and insurance considerations, etc.).

Telerehabilitation Program Development

Telehealth Taskforce Development

In March 2020, following public health recommendations associated with the COVID-19 pandemic, Shepherd Center temporarily discontinued multiple in-person clinical programs, including the SHARE Military Initiative (SHARE), an interdisciplinary TBI treatment program for SM/Vs. Clients who were enrolled in treatment were discharged and unable to complete their rehabilitation. Shepherd Center created an internal Telehealth Taskforce to develop and implement telerehabilitation programs, to facilitate remote delivery of clinical services to meet client needs within the pandemic context, and to collect information to support best practices for telehealth service delivery.

Utilizing FOCUS-PDSA for Quality Improvement

The Telehealth Taskforce utilized the **FOCUS-PDSA model** for continuous quality improvement of the telehealth program throughout its development and implementation. According to the model, the action plan is broken down into nine steps across two stages. The *first stage*, performed once, refers to the development of the action plan (i.e., **FOCUS**): (1) **F**ind a process to improve; (2) **O**rganize a team; (3) **C**larify current knowledge (i.e., how the current process is taking place); (4) **U**nderstand the variation (i.e., between the existing practices and steps in the process to model); and, (5) **S**elect the process changes (i.e., determine the improvement actions needed). The *second stage* is cyclical and ongoing and refers to continuous evaluation of the action plan as changes are implemented (i.e., **PDSA**): (1) **P**lan the changes; (2) **D**o the changes; (3) **S**tudy the effects of the changes; and, (4) **A**ct on what the analyses reveal.

Following this model, in the first stage, the Telehealth Taskforce planned to launch telehealth programming for outpatient therapy in response to the COVID-19 pandemic. The taskforce members consisted of interdisciplinary clinical staff, the program project coordinator, and the program manager at SHARE, along with the guidance of a healthcare quality improvement professional. Steps in the existing process for in-person intensive outpatient program (IOP) were delineated, and a process for adapting each step for telehealth delivery was identified. Potential barriers and limitations to program implementation and client participation were identified and discussed. Steps for implementing telehealth programming were selected based on professional, legal, and technical considerations (as described in the section below). The taskforce developed a new client admission process for virtual treatment and provided staff training, education, and resources, including a toolkit for which interventions can be provided remotely. The taskforce collected data throughout, including staff feedback and client satisfaction surveys. Changes to telehealth and hybrid clinical programming were made in response to this feedback over time.

Navigating Obstacles and Considerations for Program Development

Person-Centered Care

Person-centered care is the foundation of all clinical programming at SHARE, in which interdisciplinary rehabilitation treatment is guided by the participant's personalized goals. Consequently, priority was placed on implementing telerehabilitation programming capable of facilitating person-centered goal attainment. **Maximizing ease, accessibility, and overall patient**

experience remained a cornerstone of telerehabilitation program development efforts. Decisions regarding operations and treatment planning were based on retaining as many components of the person-centered approach as possible so that a comparable treatment experience could be delivered.

Telehealth Platform Selection

The key consideration for selecting a secure videoconferencing software platform was ease of client access. SHARE opted to use **Microsoft Teams** for telehealth rehabilitation service delivery as it allowed for **streamlined client care access** (i.e., enabled clients to utilize a single portal for all remote therapy sessions), thereby eliminating the need for clients to track and navigate countless similar web links and/or emails for the volume of appointments required for treatment participation. Other considerations included **HIPAA compliance** requirements for the telehealth software, **client accessibility** related to injury and symptom characteristics, **appropriateness for various therapy disciplines** that extend beyond conversation, and **ability to access the telehealth platform across devices** (e.g., mobile device, laptop, etc.).

Scheduling and Length of Treatment Sessions

Given common complaints of cognitive dysfunction and exacerbation of symptoms with screen time among SHARE participants, telerehabilitation scheduling was **intentionally staggered** and **limited to a maximum of 3 to 4 hours of therapy per day**. Whenever possible, original clinicians who initiated in-person care also provided telerehabilitation services to maximize continuity of care.

Licensure Across State Lines

Each therapy discipline, along with its respective governing body, has different rules regarding licensure, including continuing education requirements, out-of-state clinical privileges, and insurance coverage for telehealth service delivery. At the initiation of telerehabilitation programming, state and national regulations across rehabilitation disciplines (i.e., medical, behavioral health, and physical, occupational, and speech-language therapy providers) were reviewed to confirm clinicians' ability to provide telehealth treatment to clients within the state of Georgia. The program manager reviewed data to **identify the top five referring states** and ensured that **each therapy discipline had at least one clinician licensed in each of the top five states**. Telerehabilitation services were then extended to individuals from those five states, in addition to those residing in Georgia.

Process for Triaging Clients for Telehealth vs. In-Person Services

Once hospital policies permitted, the clinical team invited SM/Vs to come on site for **in-person clinical evaluations** while providing **rehabilitation interventions via telehealth delivery**. Once evaluations were completed, the interdisciplinary treatment team convened to discuss the results of testing, identified SM/Vs for whom telerehabilitation was appropriate, developed treatment plans that could be feasibly implemented in a telehealth delivery format, and case managers facilitated scheduling between clinicians and clients.

Documentation in Medical Records

The Telehealth Taskforce worked with Shepherd Center Information Systems (IS) to ensure that telehealth visits could be appropriately documented in the hospital's electronic medical record system. This involved the **creation of new appointment types** within each discipline to capture sessions occurring remotely, a process which evolved over time as additional disciplines incorporated telehealth sessions into their clinical programming across the hospital. The SHARE program manager tracked

changes to telehealth documentation methods and **maintained a data dashboard in Power BI** to monitor the number of clients served and number of appointments completed across delivery formats (i.e., in-person and virtually).

Clinician Training, Telehealth Toolbox, and Informed Consent

Clinicians across disciplines received **telehealth training** over two days, focusing on using the telehealth platform and specific steps to implement adapted delivery of services. An **evaluation and intervention toolbox were established for each rehabilitation discipline**, which included guides for appropriate tests, measures, and interventions to be utilized in a telehealth format, such as equipment needs, preferred location in the home for assessment or intervention, modifications necessary for remote delivery, as well as caregiver or support needs for a test or intervention to be completed. A **HIPAA-compliant telehealth-specific consent to treat process** was developed, including informing clients of the potential limitations and differences between remote and in-person care, confirming locations of both clinicians and SM/Vs at the start of each session, and establishing a plan for adverse events. Program staff and clinicians also developed a process to **help SM/Vs prepare for telerehabilitation** treatment sessions and to receive added support for using the technology if needed.

External Payor Coverage

Questions about external payor coverage (e.g., commercial insurance, workers' compensation) were raised early on by the Telehealth Taskforce. At the time, telehealth regulations and billing codes were in flux as federal COVID-19 Public Health Emergency guidance to healthcare organizations on the provision of services and billing practices for telehealth care was continually updated. These changes required close collaboration and monitoring across hospital departments. Because the SHARE program is able to provide services paid for by donor funds, meeting client care needs was able to be prioritized and telerehabilitation programming at SHARE was launched before billing/coding details were finalized. Initially, reimbursement rates were modest, but this improved as Health and Human Services later expanded permissions for healthcare providers to broaden the scope of which telehealth services could be delivered for patients and as updates billing codes were tied to the new telehealth appointment types used in the hospital electronic medical record system.

Staff and Client Communication

Among SHARE staff members, **clarification of roles and responsibilities** (e.g., between case managers and outreach/admissions staff) was continuously communicated to avoid redundancies and ensure a smooth and positive client experience as the telerehabilitation program was implemented. **Expectations of telerehabilitation program participation** were clearly presented to clients resuming treatment following initial clinic closure, as well as to new clients seeking to begin treatment during the COVID-19 pandemic. Communication regarding the nature of telerehabilitation and remote program participation occurred at multiple client touchpoints prior to initiation of treatment, such that client fit and motivation for treatment were confirmed.

Pilot Data from SHARE

From April 2020 through July 2021, at the height of the COVID-19 pandemic, clinical services were provided through SHARE's telerehabilitation program to 69 clients, totaling nearly 2,200 telehealth visit appointments across medical, behavioral health, and physical, occupational, and speech-language therapy providers. During this period, approximately 75% of SM/Vs who presented to SHARE received at least some of their clinical programming through remote delivery. Telehealth visits were most common

for behavioral health providers (approximately 1,000 visits), followed by other rehabilitation therapists (approximately 800 physical therapy visits, 700 occupational therapy visits, and 800 speech-language therapy visits), while medical telehealth visits were less frequent (approximately 100 visits). These numbers for telehealth appointments across disciplines were similar to in-person visit count ratios, with fewer medical appointments relative to intervention-specific disciplines.

Preliminary statistical analyses using available outcome data from SHARE clients who completed IOP between April 2020 and July 2021 support telerehabilitation implementation and hybrid programming (Conklin et al., 2023a). While treatment plans were individualized and varied in their ratio of in-person to telehealth care, data generally showed that participation in telehealth therapy sessions did not decrease program effectiveness. Clients who completed IOP showed similar functional gains and symptom improvements regardless of whether their care was primarily in person or primarily telehealth. Rates of improvement in global functioning were also similar to historical data previously collected at SHARE (i.e., in pre-pandemic settings), further suggesting that remote delivery of telerehabilitation was effective and beneficial for clients. Finally, anonymous post-treatment client satisfaction survey responses indicated high satisfaction and likelihood to recommend care among clients who completed treatment during the telerehabilitation period.

Lessons Learned and Next Steps

Hybrid Programming for Comprehensive Interdisciplinary Rehabilitation for TBI

Within the pandemic environment, **hybrid programming (i.e., in-person evaluation with primarily telehealth delivery of rehabilitation therapy intervention sessions)** was established as a feasible solution that, upon review, holds potential for programming moving forward. The benefits of in-person assessments included the availability of specialized equipment (e.g., specialized equipment for oculomotor or vestibular functioning) and testing procedures (e.g., cognitive screening requiring paper-and-pencil responses), which enhanced the amount and quality of clinical data gathered during the evaluation process. Notably, the 2022 WWP Warrior Survey highlighted a critical patient preference, with 90% of respondents who self-reported TBI emphasizing the importance of easy appointment scheduling. This includes options such as telehealth services, text appointment reminders, and convenient online scheduling methods when selecting a healthcare provider (Wounded Warrior Project, 2022).

Remote delivery of rehabilitation therapies addressed barriers to care access when hospital restrictions were in place, and public health recommendations emphasized the reduction of in-person contact. Data from our clinic provides preliminary evidence for the efficacy and acceptability/satisfaction of telerehabilitation programming by clinicians and clients.

Retaining components of the in-person treatment experience likely contributed to SHARE's successful telerehabilitation programming adaptation and implementation. For example, before the COVID-19 pandemic, SHARE participants and graduates consistently provided positive feedback regarding the benefits of formal (i.e., staff facilitated) and informal peer support (i.e., general milieu, access to other program participants in varying stages of treatment completion). As such, SHARE staff prioritized the **establishment of virtual peer support services** in order to promote a sense of community among telerehabilitation clients despite remote treatment participation. Additional ancillary services

also became available over time, as remote programming became increasingly incorporated throughout Sheperd Center, including **chaplaincy services, vocational counseling,** and **recreation therapy**.

Value and Role of Telerehabilitation Services

As noted above, analyses of pilot data provide preliminary evidence supporting the feasibility and utility of telerehabilitation (Conklin et al., 2023a). SM/Vs who participated in SHARE programming during the height of telehealth service implementation and utilization (i.e., April 2020-July 2021) showed positive responses to programming, with an increased number of rehabilitation sessions associated with better overall functioning following treatment, while treatment modality (i.e., participation in in-person or telehealth programming) did not impact treatment effects. Treatment outcomes also provide evidence of the non-inferiority of telehealth incorporation compared to standard in-person programming, when compared to a historical cohort. While additional studies are needed to expand upon these findings, the pilot data nevertheless provides initial support for the value of telerehabilitation.

After the peak of COVID-19-related public health restrictions (i.e., August 2021 and onward), SHARE began offering increased in-person services as hospital policies allowed. As the program re-established its footing for standard operations and social distancing concerns relaxed, the percentage of telehealth services provided decreased relative to the height of the pandemic. Yet, due to the development of telehealth programming and identified benefits of remote service delivery, a hybrid approach to care delivery persisted, resulting in more flexible treatment options individualized to client needs. As such, 36% of clients received at least a portion of their rehabilitation care via telehealth during the first two years following the height of the pandemic social distancing (August 2021 to September 2023). Throughout this time, some clients indicated they prefer in-person care. Preference for in-person program participation is likely due to factors that cannot be fully replicated in a telehealth format (e.g., general milieu of in-person program participation, enhanced sense of community via in-person peer support opportunities, community integration/engagement opportunities via recreational therapy, etc.). Indeed, the percentage of telehealth rehabilitation was associated with less improvement in community participation at discharge in our pilot study (Conklin et al., 2023a), highlighting a potential limitation of telerehabilitation.

Nevertheless, the option of providing **telerehabilitation services across disciplines has remained important to optimizing the treatment experience for SHARE participants due to its versatility and flexibility**. Most prominently, telerehabilitation offers increased access to care for SM/Vs who may otherwise not receive any services for their symptoms and impairments. Overcoming geographical and travel requirements is especially helpful for individuals who live far distances from specialized care, do not have ready access to transportation, or whose TBI symptoms are escalated by transport in a moving vehicle, rendering the individual unable to benefit fully from treatment upon arrival. Remote program participation may be a good fit for active-duty military personnel with leave restrictions, as well as SM/Vs with similar circumstantial barriers to treatment (e.g., limited time off work, family obligations, etc.).

Some SM/Vs who are higher functioning may not require the full spectrum of interdisciplinary care, in which case telehealth participation in select outpatient therapies enables targeted interventions without requiring the time commitment of standard in-person IOP. Additionally, telehealth allows for the active involvement of care partners and support people in the rehabilitation process, fostering a

more comprehensive and supportive environment for the patient's recovery journey. Further, delivery of services to SM/Vs' homes provides clinicians with more information about the home environment and can allow for the opportunity to more directly address environmental barriers and enhance environmental facilitators of treatment progress.

Relatedly, telerehabilitation sessions have been a critical source of support and connection to the treatment team for clients who travel home for a trial transition period. Remote sessions allow for ecologically valid adaptation of skills and exercises learned at SHARE to clients' home and community environments. This allows for an increased sense of confidence and mastery of skills, which promotes the maintenance of gains post-treatment.

Future of Telerehabilitation at SHARE

Telerehabilitation programming will remain a critical ancillary component of clinical treatment options at SHARE. Clinicians will continue to have access to discipline-specific telehealth toolkits, which the treatment team will expand as novel assessments and interventions are developed. Exploring the integration of remote patient monitoring and leveraging digital therapeutics to gather real-time, remote data will be a focus of future program development efforts. Quality improvement tools (i.e., PDSA cycles) will continue to be utilized for further process improvement as time progresses. In particular, the need for clinicians to maintain licensure in the top referring states outside of Georgia will continue to be reviewed along with changes in licensure regulations or compact agreements. The lessons learned and programming developed will be shared at academic conferences and with SHARE's partner programs in the Avalon Action Alliance (www.avalonactionalliance.org).

Summary and Conclusions

High quality comprehensive interdisciplinary rehabilitation care is effective in the treatment and management of TBI/mTBI in military populations. Adaptation of interdisciplinary care to telehealth and hybrid service delivery models is necessary in order to expand clinical programming options and increase access to care for SM/Vs. Telerehabilitation programming offers unique advantages and can complement standard in-person services, facilitating connections with the treatment team and supporting the transition process, although more research is needed to understand its long-term efficacy, patient outcomes, and the optimal integration of telerehabilitation into existing care framework. These models also help address barriers to care for SM/Vs, such as geographic constraints and scheduling challenges, while offering flexible options that align with patient preferences. TBI rehabilitation programs tasked with telehealth program development should consider utilizing quality improvement tools to guide development efforts and refer to our list of professional, legal, and technical considerations. Recommendations for clinical considerations and program development efforts are offered to advance the field and ensure optimal care for SM/V with TBI.

1) Clearly delineate how standard administrative and clinical procedures may be adapted for remote or virtual delivery and how administrative and/or clinical roles might shift upon expansion to telehealth programming.
2) Ensure that professional licensure issues are addressed regarding telehealth care delivery across disciplines.
3) Determine billing and documentation requirements and align processes with electronic medical record system.

4) Determine platform and information systems support needed for both providers and SM/Vs to utilize telehealth services.
5) Identify and address training needs for clinical staff as well as support for clients.
6) Engage in continuous data collection and monitoring (e.g., of program outcome measures) and elicit feedback from staff and those who receive care.
7) Consider for whom telehealth programming may be the most beneficial (e.g., SM/Vs. from rural areas, those with work/family responsibilities that may limit treatment participation, or those with higher levels of functioning who do not require comprehensive IOP).
8) Consider limitations to telehealth programming access (e.g., disability level, access to technology, access to appropriate space to receive in-home treatment, etc.).
9) Consider when in-person clinical service delivery may be most appropriate (e.g., during initial evaluation, when specialized equipment is needed, when telehealth access is limited, etc.).
10) Consider aspects of an in-person treatment experience that may not be readily replicated in a remote format (e.g., group therapy, community outings, informal peer support opportunities, general milieu, etc.).
11) Consider when telehealth service delivery may be best utilized (e.g., during routine or follow-up visits with medical providers, when continuing or reinforcing rehabilitation treatment services once a treatment plan has been established, meeting behavioral health needs, during a transition week to prepare for IOP discharge, etc.).

References

Acierno, R., Knapp, R., Tuerk, P., Gilmore, A. K., Lejuez, C., Ruggiero, K., Muzzy, W., Egede, L., Hernandez-Tejada, M. A., & Foa, E. B. (2017). A Non-Inferiority Trial of Prolonged Exposure for Posttraumatic Stress Disorder: In Person versus Home-Based Telehealth. *Behaviour Research and Therapy*, *89*, 57–65. https://doi.org/10.1016/j.brat.2016.11.009

Brenner, L. A., Forster, J. E., Gradus, J. L., Hostetter, T. A., Hoffmire, C. A., Walsh, C. G., Larson, M. J., Stearns-Yoder, K. A., & Adams, R. S. (2023). Associations of Military-Related Traumatic Brain Injury With New-Onset Mental Health Conditions and Suicide Risk. JAMA network open, 6(7), e2326296. https://doi.org/10.1001/jamanetworkopen.2023.26296

CDC. (2015). *Report to Congress on Traumatic Brain Injury in the United States: Epidemiology and Rehabilitation*. National Center for Injury Prevention and Control; Division of Unintentional Injury Prevention. https://www.cdc.gov/traumaticbraininjury/pdf/tbi_report_to_congress_epi_and_rehab-a.pdf

Cifu, D. X., Taylor, B. C., Carne, W. F., Bidelspach, D., Sayer, N. A., Scholten, J., & Campbell, E. H. (2013). Traumatic brain injury, posttraumatic stress disorder, and pain diagnoses in OIF/OEF/OND Veterans. *Journal of Rehabilitation Research and Development*, *50*(9), 1169–1176. https://doi.org/10.1682/JRRD.2013.01.0006

Conklin, J. P., McCauley, K. L., Breitenstein, J., Edelman, L., Gore, R. K., & Wallace, T. (2023a). Implementation of telehealth and hybrid service delivery of interdisciplinary rehabilitation for military populations with traumatic brain injury. *NeuroRehabilitation*, *53*(4), 535–545. https://doi.org/10.3233/NRE-230154

Conklin, J. P., Wallace, T., McCauley, K. L., Breitenstein, J., & Gore, R. K. (2023b). Level of Evidence of Telehealth Rehabilitation and Behavioral Health Services for Traumatic Brain Injury: A Scoping Review. Journal of clinical psychology in medical settings, 10.1007/s10880-023-09981-1. Advance online publication. https://doi.org/10.1007/s10880-023-09981-1

Cyr, M. E., Etchin, A. G., Guthrie, B. J., & Benneyan, J. C. (2019). Access to specialty healthcare in urban versus rural US populations: a systematic literature review. BMC health services research, 19(1), 974. https://doi.org/10.1186/s12913-019-4815-5

DeGraba, T. J., Williams, K., Koffman, R., Bell, J. L., Pettit, W., Kelly, J. P., Dittmer, T. A., Nussbaum, G., Grammer, G., Bleiberg, J., French, L. M., & Pickett, T. C. (2020). Efficacy of an Interdisciplinary Intensive Outpatient Program in Treating Combat-Related Traumatic Brain Injury and Psychological Health Conditions. *Frontiers in Neurology*, *11*, 580182. https://doi.org/10.3389/fneur.2020.580182

Hammond, F. M., Corrigan, J. D., Ketchum, J. M., Malec, J. F., Dams-O'Connor, K., Hart, T., Novack, T. A., Bogner, J., Dahdah, M. N., & Whiteneck, G. G. (2019). Prevalence of Medical and Psychiatric Comorbidities Following Traumatic Brain Injury. *The Journal of Head Trauma Rehabilitation*, *34*(4), E1. https://doi.org/10.1097/HTR.0000000000000465

Howard, J. T., Stewart, I. J., Amuan, M., Janak, J. C., & Pugh, M. J. (2022). Association of Traumatic Brain Injury With Mortality Among Military Veterans Serving After September 11, 2001. JAMA network open, 5(2), e2148150. https://doi.org/10.1001/jamanetworkopen.2021.48150

Humer, E., Stippl, P., Pieh, C., Pryss, R., & Probst, T. (2020). Experiences of Psychotherapists With Remote Psychotherapy During the COVID-19 Pandemic: Cross-sectional Web-Based Survey Study. *Journal of Medical Internet Research*, *22*(11), e20246. https://doi.org/10.2196/20246

Janak, J. C., Cooper, D. B., Bowles, A. O., Alamgir, A. H., Cooper, S. P., Gabriel, K. P., Pérez, A., & Orman, J. A. (2017). Completion of Multidisciplinary Treatment for Persistent Postconcussive Symptoms Is Associated With Reduced Symptom Burden. The Journal of head trauma rehabilitation, 32(1), 1–15. https://doi.org/10.1097/HTR.0000000000000202

Johnstone, B., Nossaman, L. D., Schopp, L. H., Holmquist, L., & Rupright, S. J. (2002). Distribution of Services and Supports for People With Traumatic Brain Injury in Ruraland Urban Missouri. *The Journal of Rural Health*, *18*(1), 109–117. https://doi.org/10.1111/j.1748-0361.2002.tb00882.x

Juengst, S. B., Terhorst, L., Nabasny, A., Wallace, T., Weaver, J. A., Osborne, C. L., Burns, S. P., Wright, B., Wen, P.-S., Kew, C.-L. N., & Morris, J. (2021). Use of mHealth Technology for Patient-Reported Outcomes in Community-Dwelling Adults with Acquired Brain Injuries: A Scoping Review. *International Journal of Environmental Research and Public Health*, *18*(4). https://doi.org/10.3390/ijerph18042173

Kontos, A. P., Jorgensen-Wagers, K., Trbovich, A. M., Ernst, N., Emami, K., Gillie, B., French, J., Holland, C., Elbin, R. J., & Collins, M. W. (2020). Association of Time Since Injury to the First Clinic Visit With Recovery Following Concussion. *JAMA Neurology*, *77*(4), 435–440. https://doi.org/10.1001/jamaneurol.2019.4552

Leddy, J. J., Sandhu, H., Sodhi, V., Baker, J. G., & Willer, B. (2012). Rehabilitation of Concussion and Post-concussion Syndrome. *Sports Health*, *4*(2), 147–154. https://doi.org/10.1177/1941738111433673

Lew, H. L., Otis, J. D., Tun, C., Kerns, R. D., Clark, M. E., & Cifu, D. X. (2009). Prevalence of chronic pain, posttraumatic stress disorder, and persistent postconcussive symptoms in OIF/OEF veterans: Polytrauma clinical triad. *Journal of Rehabilitation Research and Development*, *46*(6), 697–702. https://doi.org/10.1682/jrrd.2009.01.0006

Lewis, F. D., & Horn, G. J. (2015). Neurologic continuum of care: Evidence-based model of a post-hospital system of care. *NeuroRehabilitation*, *36*(3), 243–251. https://doi.org/10.3233/NRE-151213

National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Board on Health Care Services; Board on Health Sciences Policy; Committee on Accelerating Progress in Traumatic Brain Injury Research and Care; Matney C, Bowman K, Berwick D, editors. (2022). Traumatic Brain Injury: A Roadmap for Accelerating Progress. Washington DC: National

Academies Press. Available from: https://www.ncbi.nlm.nih.gov/books/NBK580081/ doi: 10.17226/25394

Ownsworth, T., Arnautovska, U., Beadle, E., Shum, D. H. K., & Moyle, W. (2018). Efficacy of Telerehabilitation for Adults With Traumatic Brain Injury: A Systematic Review. *The Journal of Head Trauma Rehabilitation*, *33*(4), E33. https://doi.org/10.1097/HTR.0000000000000350

Suarilah, I., Zulkarnain, H., Saragih, I. D., & Lee, B.-O. (2022). Effectiveness of telehealth interventions among traumatic brain injury survivors: A systematic review and meta-analysis. *Journal of Telemedicine and Telecare*, 1357633X221102264. https://doi.org/10.1177/1357633X221102264

Swanson, T. M., Isaacson, B. M., Cyborski, C. M., French, L. M., Tsao, J. W., & Pasquina, P. F. (2017). Traumatic Brain Injury Incidence, Clinical Overview, and Policies in the US Military Health System Since 2000. *Public Health Reports*, *132*(2), 251–259. https://doi.org/10.1177/0033354916687748

Tsaousides, T., D'Antonio, E., Varbanova, V., & Spielman, L. (2014). Delivering group treatment via videoconference to individuals with traumatic brain injury: A feasibility study. *Neuropsychological Rehabilitation*, *24*(5), 784–803. https://doi.org/10.1080/09602011.2014.907186

Wallace, T. D., McCauley, K. L., Hodge, A. T., Moran, T. P., Porter, S. T., Whaley, M. C., & Gore, R. K. (2022). Use of person-centered goals to direct interdisciplinary care for military service members and Veterans with chronic mTBI and co-occurring psychological conditions. *Frontiers in Neurology*, *13*. https://www.frontiersin.org/articles/10.3389/fneur.2022.1015591

Wojtowicz, M., Silverberg, N. D., Bui, E., Zafonte, R., Simon, N., & Iverson, G. L. (2017). Psychiatric Comorbidity and Psychosocial Problems Among Treatment-Seeking Veterans With a History of Mild Traumatic Brain Injury. *Focus (American Psychiatric Publishing)*, *15*(4), 384–389. https://doi.org/10.1176/appi.focus.20170028

Wounded Warrior Project. (2022). 2022 Annual Warrior Survey, Longitudinal: Wave 2.

Afterword

SHARE Military Initiative (SHARE) at Shepherd Center

The SHARE Military Initiative (SHARE) at Shepherd Center, a not-for-profit rehabilitation hospital in Atlanta, Georgia, provides interdisciplinary treatment to military service members and veterans (SM/Vs) with history of TBI with chronic symptomatology and other co-occurring psychological health conditions (Wallace et al., 2022). SHARE clients participate in either intensive outpatient programming (IOP) or outpatient care with specific disciplines (i.e., outpatient therapy), as clinically indicated. Treatment in the full IOP program consists of care by medical (i.e., neurology, physiatry), behavioral health, and physical, occupational, and speech-language therapy providers. SHARE also offers a range of additional services, including vocational counseling, recreation therapy, chaplaincy, and peer support to further enhance attainment of clients' goals. All treatment candidates undergo comprehensive evaluations to determine treatment needs, identify person-centered treatment goals, and assess other factors that may impact treatment participation (Wallace et al., 2022).

Wounded Warrior Project (WWP)

Wounded Warrior Project (WWP) is a nonprofit organization dedicated to honoring and empowering post-9/11 veterans and their families. Through innovative programs and strategic partnerships, WWP ensures that warriors have access to life-changing resources and support – harnessing the expertise of best-in-class organizations like Shepherd Center to meet specialized needs. Recognizing that no single organization can address every challenge warriors face, WWP provides critical funding to expand and enhance SHARE's ability to deliver interdisciplinary care tailored to the evolving needs of military service members and veterans.

WWP programs and services are driven by warriors' greatest needs, which are informed by the responses to the Warrior Survey. The 2022 WWP Warrior Survey was administered from June to August 2022 and represents the 165,967 wounded, ill, and injured post-9/11 service members and veterans registered with WWP as of April 2022. Further information about the survey methodology and comprehensive report of findings can be found at AnnualWarriorSurvey.com.

If you have questions or comments regarding this white paper, please contact tracey.wallace@shepherd.org.

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