Examining the Intersections of Brain Injury, Mental Health & Addictions: A Systematic Evidence Map of Treatments and Analysis of Community-Based Stakeholders' Priorities for Future Research

by

Cole J. Kennedy
Bachelor of Arts (Honours), University of Victoria, 2021

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We acknowledge and respect the Lək̓ʷəŋən (Songhees and Esquimalt) peoples on whose territory the university stands, and the Lək̓ʷəŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day.

Supervisory Page

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Abstract

Introduction: Acquired brain injury (ABI) and mental health and addiction (MHA) related conditions are leading causes of death and disability worldwide. Despite their high comorbidity and the devastatingly synergistic effects of their co-occurrence, ABI and MHA are frequently studied and managed as separate entities in both research and clinical practice. Addressing the profound need to better understand the intersections of ABI and MHA, this thesis involved two innovative community-engaged studies: (1) a systematic evidence map of interventions for MHA in ABI populations, completed with an interactive tool for knowledge users; and (2) a collaborative priority-setting study that identified stakeholders' top ten priorities for research. **Methods:** *Study 1:* Evidence mapping methodology was used to identify relevant literature. PsycINFO, SCOPUS, MEDLINE, the Cochrane Library (Cochrane Database of Systematic Reviews and Cochrane Central Register of Controlled Trials), Web of Science, and CINAHL were searched. The Measurement Tool to Assess Systematic Reviews 2nd edition (AMSTAR-2) evaluated methodological quality, and an iterative prototyping design was employed to develop the evidence map user interface. *Study 2:* A multi-phasic health research priority-setting process was co-designed and executed with community-based stakeholders, including researchers, clinicians, service providers, policy makers, and people with lived experience. Stakeholders' ideas led to the generation of research questions, which were prioritized at a one-day workshop and analyzed using an equation we created, the *Question Priority Composite* (QPC) formula. **Results:** *Study 1:* From the 63,843 identified records, a total of 485 studies involving 735,203 participants with ABI were included, comprised of 283 impact evaluations, 119 systematic reviews and meta-analyses, 39 clinical trial registries, 31 published study protocols, and four clinical practice guidelines. AMSTAR-2 ratings varied, with most falling within the low-quality

range. Cerebrovascular injuries, pharmacological interventions, and studies examining depression were among the most researched topics. Several gaps in the evidence base were identified, particularly for housing interventions and treatments for substance use post-ABI. *Study 2:* Fifty-nine stakeholders participated in the priority-setting activity during the workshop. Analysis of QPC scores resulted in a rank-ordered list of the top ten questions for research addressing the intersections of ABI and MHA. Questions identified touched on several pressing issues (e.g., opioid crisis, homelessness), encompassed multiple sub-types of ABI (e.g., hypoxic-ischemic, mild traumatic), and involved different domains (e.g., identification, intervention) of health research.

Conclusions: The present thesis led to two main outcomes. The evidence mapping review, the first of its kind in the field, resulted in the development of DECISION–MAP (*Database of Evidence Concerning Interventions Supporting the Intersections Of Neurotrauma–Mental health, & Addictions Problems*), a practical tool that culminates research on interventions for MHA in ABI populations while highlighting gaps in the knowledge base (www.decision-map.com). The priority-setting study led to a rank-ordered community driven list of ten research priorities, acting as a blueprint for high impact investigations that address stakeholders' most urgent needs. Together, these studies underscore the multitude of complexities that lie within the intersections of ABI and MHA and serve as catalysts for future research and improvements in clinical care.

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Acknowledgments

Behind every breakthrough is a community united in purpose. This was no exception.

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Dedication

My thesis is dedicated to all the survivors of brain injury whom I have had the honour of knowing, and to the families of those who did not survive, for they inspired this work and gave me the passion to pursue it. In my eyes, brain injury is not an invisible injury. I see you, I hear your stories, and I will continue to work towards improving life—and preventing death—for people living at the intersections of brain injury, mental health, and addictions.

Chapter 1: Literature Review

Brain injury is the leading cause of death and disability worldwide, affecting well over 80 million people each year and costing the global economy upwards of 900 billion (US) dollars annually (de Robles et al., 2015; Dewan et al., 2018; Feigin et al., 2022; Humphreys et al., 2013). Approximately 60% of those with brain injury also struggle with some form of mental health or addiction-related disorder (Gould et al., 2011; Kim et al., 2007; Ponsford et al., 2018). However, relative to the enormous body of literature and funding dedicated to these phenomena in isolation, research efforts focused on understanding the intersections of brain injury, mental health, and addictions have been limited. Stakeholders have called for the development of evidence-based best practice guidelines to effectively support those struggling with these concurrent difficulties, which at present, are non-existent. The importance of understanding the intersections of brain injury, mental health, and addictions cannot be understated.

The primary objective of Chapter 1 is to provide a broad yet comprehensive review of the literature addressing brain injury in the context of mental health and addictions. To do so, this section will first begin by reviewing the overarching phenomenology of brain injury, including its classification and clinical presentation, incidence and prevalence, diagnosis and treatment, and contemporary problems and inequities. Throughout this section, foundational neurological information will be synthesised with recent empirical findings to provide a broad review of the relevant literature. Chapter 1 will then proceed to discuss brain injury in the context of mental health and addictions, focusing on the comorbidity, consequences, neurological underpinnings, and clinical treatment of these intricate and commonly co-occurring conditions.

Overview of Acquired Brain Injury

Acquired brain injury[i] (ABI) refers to any form of post-natal damage to the brain causing disruption of healthy neurological functioning (Kwan et al., 2019). The clinical sequalae of ABI (of which the possibilities are immense, ranging from headache and fatigue to paralysis and death) are caused by an alteration to neural activity, a neuropathophysiological disturbance which can be structural or functional (commonly both) in nature (Maas et al., 2008; Prins et al., 2013). The multifaceted, multimorbid, and devastating nature of ABI is what renders it the leading cause of death and disability in Canadians under the age of 40 (Northern Brain Injury Association, 2022). Treatment modalities for ABI are vast, ranging from medically induced comas and neurosurgical interventions to psychotherapeutic treatments and community-based supports, with the suitability of each approach depending on various pathological (e.g., injury cause, type, or severity) and psychosocial (e.g., ability, culture, or personal history) factors (Kwan et al., 2019; Maas et al., 2008). Conceptually, ABI is an umbrella term encompassing various forms of insult and injury, classically divided into the *traumatic* and *non-traumatic* subtypes (Prins et al., 2013).

Traumatic Brain Injury

Traumatic brain injury (TBI) is a form of ABI defined as "an alteration in brain function, or other evidence of brain pathology, caused by an external force" (Menon et al., 2010, p. 1637). Approximately 165,000 individuals in Canada sustain a TBI every year, which is equivalent to roughly 456 people per day, or one person every three minutes (Brain Injury Canada, 2022; Public Health Agency of Canada., 2014). The external force which causes TBI, referred to as the mechanism(s) of injury, include *penetrating* (open), *non-penetrating* (closed), *blunt*, and *blast*

[i] Throughout this thesis the term 'brain injury' will refer to ABI and all its subtypes, unless specified otherwise.

injuries (National Academies of Sciences, Engineering, and Medicine [NASEM], 2019). The severity of TBI is most accurately categorized at time of injury and is classified by clinical presentation as either *mild*, *moderate*, or *severe* (Menon et al., 2010; NASEM, 2019). While classification methods differ, the Glasgow Coma Scale (GCS) is the most widely used measure to inform TBI severity (mild: 14–15, moderate: 9–13, severe: 3–8). Majority (70–85%) of TBI cases are considered 'mild', yet the diagnosis, prognosis, and clinical characteristics of *mild traumatic brain injury* (mTBI) remains one of the most contested topics among researchers, clinicians, and leaders in the field (Leo & McCrea, 2016).

mTBI & Concussion

Concussion is a form of mTBI caused by direct or indirect biomechanical forces that temporarily disrupt one's normal brain functioning (Patricios et al., 2023). Concussion is typically caused by a direct blow to the head, face, or neck, leading to an onset of neurological dysfunction caused by neuronal shearing and stretching that begins immediately after an injury is sustained; inducing a rapid, sequential, and complex cascade of neurometabolic events resulting in transient neurological dysfunction (Dessy et al., 2015; Patricios et al., 2023; Signoretti et al., 2011). Unlike moderate and severe brain injuries, most mTBIs occur without observable physical signs (Patricios et al., 2023). However, when they do occur, signs often manifest as vomiting, loss of consciousness, and reduced motor coordination (Meehan & Bachur, 2009; Patricios et al., 2023). Physical signs are fleeting, typically resolving within minutes to hours post-concussion onset, whereas post-concussion symptoms may emerge and persist at a much different and variable pace (Mainwaring et al., 2004; Patricios et al., 2023). The primary symptomatology of concussion can be divided into three categories, ordered here by their typical course of onset and resolution: (1) somatic (e.g., sleep disturbance, headache, fatigue, dizziness, nausea, blurred or

double vision, and sensitivity to noise or light; Mainwaring et al., 2004; Patricios et al., 2023); (2) cognitive (e.g., declines in attention, concentration, processing speed, memory, and executive functioning; Goldberg & Madathil, 2015; Mainwaring et al., 2004; Patricios et al., 2023); and (3) emotional (e.g., increased levels of anxiety, frustration, sadness, confusion, irritability, and aggression; (Ho et al., 2020; Mainwaring et al., 2004; Patricios et al., 2023). Recovery is a process involving the gradual reduction in symptoms and subsequent return to premorbid functioning, which occurs continuously across time (McCrea et al., 2015). Fortunately, for 80–90% of those who sustain a concussion, symptoms are suggested to resolve within two weeks (Patricios et al., 2023).

Contrary to the general opinions and guidelines, there is previous research suggesting that somewhere between 5–43% of people who sustain concussion experience symptoms lasting beyond three months, commonly referred to as post-concussion syndrome (Hiploylee et al., 2017). Severity of injury (i.e., negative dose-response relationship), female sex (Covassin & Elbin, 2011; Moser et al., 2019), and pre-existing mental health diagnoses (Ho et al., 2020; Moser et al., 2019; Sandel et al., 2017) are some of the strongest risk factors for prolonged symptoms and functional impairments. While traditionally characterised by sedentarism, the contemporarily prescribed concussion treatment is a brief period (24–48 hours) of cognitive and physical rest, followed by a gradual increase in activity (Schneider et al., 2017). Much like any form of ABI, the clinical presentation, symptomatology, prognosis, and approach to rehabilitation for mTBI is contingent on numerous patient-specific factors (e.g., sex, pre-injury mental health, severity of injury, etc.) and as such, is varied significantly case by case.

Moderate & Severe TBI

Moderate and severe TBI are associated with greater morbidity and long-term disability (Maas et al., 2008; McAllister, 2008). Moderate TBI often results in a longer period of unconsciousness (20 minutes to 6 hours) or amnesia, while severe TBI can lead to prolonged comas and lasting substantial motor and cognitive deficits (Maas et al., 2008; McAllister, 2008). The neuropathophysiology of moderate and severe TBI are generally much more heterogenous than that of mTBI. Structural abnormalities are more commonly observed on neuroimaging in these higher severity TBIs, with intracranial haematomas occurring in 25–35% of patients with severe TBI and in 5–10% of those with moderate injuries (Maas et al., 2008). Moreover, moderate and severe TBI often co-occur with extracranial injuries (e.g., limb fractures or abdominal injuries) in approximately 35% of cases (Maas et al., 2008). This, paired with the fact that higher severity TBIs almost always involves both focal and diffuse damage, elevates the risk for secondary neurological injury due to hypoxia, hypotension, coagulopathy, or edema (Maas et al., 2008; McAllister, 2008). Secondary damage occurs over hours to days following TBI-onset, and often involves abnormal neurotransmitter (e.g., glutamate) release and increased intracranial pressure (ICP), both of which contribute to early necrotic cell death and poor long-term outcomes for individuals afflicted (Maas et al., 2008).

Acute emergency treatment of more severe TBI aims to prevent secondary injury by reducing swelling and, in turn, ICP (Greenwald et al., 2003). Even in cases where patients initially present with little to no clinical signs or symptoms, *neuroworsening* (e.g., deterioration of GCS motor score, development of CT lesions, etc.) can progressively occur at a rapid pace and has been reported in roughly 29–44% of severe TBI patients (Morris et al., 1998). Therefore, mitigating the risk for secondary injury in severe TBI typically involves sedation and artificial

ventilation to medically induce the optimal conditions for neurological recovery (Maas et al., 2008). Aside from quickly detecting and treating operable lesions, controlling ICP is the foremost predictor for more positive outcomes following moderate and severe TBI (Greenwald et al., 2003; Maas et al., 2008; McAllister, 2008). While rehabilitation is often a lifelong and lengthy up-hill battle, research shows that 85% of recovery following moderate to severe TBI in adults occurs within the first six months (Maas et al., 2008). For individuals with severe closed head injuries, the outcomes are more dichotomous, with most patients either dying or recovering and returning to an independent lifestyle (Maas et al., 2008; McAllister, 2008). Together, the neuropathological characteristics and the timeliness of clinical intervention are highly influential predictors for the physical and neurobehavioral prognosis of moderate and severe TBI.

Non-Traumatic Brain Injury

Non-traumatic brain injury (nTBI) represents roughly half of all ABI cases in Canada (Colantonio et al., 2011). The leading causes of nTBI are from common clinical conditions, such as cancer (e.g., cerebral gliomas) and cardiovascular disease (e.g., ischemic and hemorrhagic stroke), with other additional aetiologies including oxygen deprivation (i.e., hypoxia and anoxia), neurotoxic poisoning, or seizures, as well as infectious and autoimmune diseases (Chan et al., 2013; Lindberg, 2021). Cerebrovascular accidents affect 15 million people worldwide each year, which for approximately 33% are fatal and for another third causes permanent disability from nTBI (Pompili et al., 2015). In contrast to TBI, sex and age differences in nTBI incidence are less prominent, with more even distribution across the lifespan and relatively equal rates between males and females. Much like primary and secondary injuries in TBI, a single mechanism of injury can cause multiple different types of nTBI (e.g., drug overdose can result in anoxic and neurotoxic nTBI), many of which—including stroke—involve hypoxic-anoxic or hypoxic-

ischemic brain injuries (i.e., types of nTBI caused by reduced or complete lack of blood flow and oxygen to the brain). Also similar to TBI, the neurobehavioral consequences of nTBI are primarily representative of the affected neural regions, with different mechanisms of injury having more localized (e.g., neoplasms) versus widespread (e.g., hypoxic-ischemic) damage to brain structures depending on the nature of the injury. However, in general, functional recovery tends to be better following TBI than after nTBI (Lindberg, 2021). Treatment approaches and prognoses for nTBI vary greatly, and significant public health efforts are placed on prevention.

In cases of hypoxic/anoxic-ischemic brain injury, cellular death begins within minutes and permanent injury will follow if oxygen delivery is not re-established promptly (Lacerte et al., 2022). Intervention efforts typically entail managing the underlying cause, such as resuscitation and optimizing blood pressure in cases of cardiac arrest, to prevent ongoing brain damage. The leading cause of hypoxic-anoxic brain injury is cardiac arrest, leaving 50–83% of survivors experiencing clinically significant cognitive symptoms, which, more often than not, causes lifelong disability (Howell et al., 2013). Several marginalized groups, including individuals who use opioids or illicit drugs, are especially at risk for experiencing these types of nTBI in light of the increasingly deadly North American overdose crisis (Adams et al., 2020; Winstanley et al., 2021). Following non-fatal overdose, identification of this more subtle type of ABI can be difficult at times and may be masked by effects of substances; a complication which is especially true for certain marginalized populations, such as homeless or marginally housed individuals, who have limited access to specialized neurological assessment (Milaney et al., 2021).

Acquired Brain Injury: Disparities and Inequities

The increased recognition of ABI and its multidimensional consequences for those affected, paired with changes in the global sociopolitical climate calling for equity and inclusion,

have drawn some researchers to answer the question, *'who is most vulnerable to brain injury, and why?'*. While predisposing biological factors such as genetic vulnerabilities and sex have been the focus of many, others have placed their efforts on identifying more sociocultural factors that influence ABI vulnerability in hopes of promoting positive, equitable change.

Sex & Gender

Sex and gender are key demographic variables for the epidemiological study of ABI and its inequities. In the general adult population, it is estimated that men are approximately 40% more likely to experience TBI than women (Faul & Coronado, 2015). Unfortunately, majority of the literature stratifies ABI-related findings by biological sex; the lack of inclusive research on incidence, reporting patterns, and outcomes by gender (including non-binary and transgender samples) represents a significant knowledge gap (Giordano et al., 2020). Of all individuals considered 'high-risk' for TBI (e.g., athletes or military personnel), victims of intimate partner violence (IPV), who are predominantly female, are perhaps at greatest risk for TBI yet remain the most underrepresented population in published TBI research, education, or advocacy (Faul & Coronado, 2015; Giordano et al., 2020). While the exact rates of IPV-related TBI remain unknown, it is estimated that TBI occurs in 50–90% of all reported IPV cases, equating to roughly 250,000 cases each year in Canada alone (Brain Injury Canada, 2022; Haag et al., 2022). Importantly, sex-related disparities are further complicated by intersectional influences with other demographic factors, such as race and ethnicity.

Race & Ethnicity

In recent years there has been a push to better understand racial disparities in burdens of disease and treatment inequalities across the fields of health and behavioural sciences. Although race is a socially constructed category of identity with no biological basis (Bonilla-Silva, 1997),

research suggests that Black, Indigenous, and people of colour experience a greater incidence of TBI (Bazarian et al., 2003), have worse long-term outcomes (Shafi et al., 2007), including higher rates of TBI-related deaths (Coronado et al., 2011), and receive inferior TBI treatment in comparison to non-racialized patients (see Saadi et al. 2022 for a recent review). In regard to nTBI, whilst rates of stroke have been declining for most of Canada's population (Heart and Stroke Foundation, 2008), the opposite is true for Indigenous peoples, for whom the prevalence and mortality of stroke have increased and continue to climb (Heart and Stroke Foundation, 2008; Kapral et al., 2020). The same is true of TBI, with higher prevalence and greater risk for poor long-term outcomes in comparison to non-Indigenous Canadians (Keightley et al., 2009; Lasry et al., 2016; Salaheen et al., 2022).

Contributing to these adverse outcomes are findings from several studies which have found that race is associated with lower referral rates for neurorehabilitation services following TBI. Analysis of nearly 300,000 American TBI patients' discharge destinations between 2007–2010 found that Latinx and Black patients were less likely to be discharged to specialized neurorehabilitation services than white patients (Meagher et al., 2015). Another study using the same data found that even after controlling for insurance status, non-white patients were still 15% less likely to receive neurorehabilitation services and were more likely to have moderate or severe disability at follow-up in comparison to white patients (Shafi et al., 2007). Similarly, as a result of racist historical and contemporary colonial practices, Indigenous peoples recovering from ABI face more significant barriers to rehabilitation than non-Indigenous Canadians (Keightley et al., 2009; Salaheen et al., 2022).

Housing & Homelessness

The role of housing and the prevalence of brain injury amongst those who are homeless or marginally housed has received greater attention over the past decade. Vancouver, Canada based researchers Stubbs and colleagues (2020) conducted what they proclaim to be the first meta-analysis to evaluate the prevalence of TBI in homeless and marginally housed individuals. Of the 22 studies included in their meta-analysis, 18 (n = 9702) assessed the lifetime prevalence of TBI, and nine (n = 5787) assessed the lifetime prevalence of moderate or severe TBI (Stubbs et al., 2020). Using random-effects modeling, the pooled estimate for lifetime history of TBI (any severity) across studies was 53.1%, which is approximately 2.5 to 4-times higher than the general population (Corrigan et al., 2018). For moderate and severe TBI, the estimated lifetime prevalence was 22.5%, a staggering rate ten-times that of current estimates in the general population (Corrigan et al., 2018). In a cross-sectional survey of 500 homeless individuals residing in three major cities (Victoria, Vancouver, and Prince George) in British Colombia, Canada, Song et al. (2018) found prevalence rates similar to Stubbs and colleagues, with 63.6% of participants reporting a lifetime history of TBI.

In their examination of age at first experience of TBI among homeless and marginally housed individuals, Stubbs et al. (2020) uncovered an early history of incidence, ranging from 15 years to 19.9 years old (M = 15.8). Between 51% and 92% of participants had experienced their first TBI before their first experience of homelessness; suggesting that not only is TBI disproportionately high in this population, but also that TBI appears to be a risk factor for loosing stable housing. In the words of Michelle McDonald, Executive Director of Brain Injury Canada, “there’s many factors that lead to homelessness, but brain injury can be the root cause of some of those factors, such as unemployment, substance abuse, family breakdown” (Young,

2019, p. 1). Higher rates of substance use and addictions in homeless and marginally housed populations also possess a significant risk for overdose related hypoxic-anoxic brain injury, although the nature of this vulnerability remains largely understudied (Milaney et al., 2021).

Acquired Brain Injury in the Context of Mental Health and Addictions

Brain injury has global impacts on an individual's health and well-being. Mental health and addictions concerns, such as anxiety, depression, and substance use disorders are common following ABI and have been recognized as significant contributors to the morbidity of all types of brain injury (Byars & Jorge, 2015; Gould et al., 2011; Kim et al., 2007; Koponen et al., 2002; Ponsford et al., 2018). The relationship between ABI, mental health, and addictions is complex and multifaceted, and a growing body of literature has begun to explore the ways in which these conditions interact and co-occur. This section will begin by defining the terms 'mental health' and 'addictions', before discussing their patterns of co-occurrence in ABI. Once individually conceptualized, *mental health and addictions* (MHA) will be generally referred to as one entity, capturing the vast biological, psychological, and social interactions, aetiologies, and consequences of these broad categories of intertwined psychiatric phenomena. To conclude, the shared neurobehavioral correlates of ABI and MHA will be examined through a literature review to understand the neuropathological relationship between these commonly comorbid conditions.

Definition of Mental Health

The most current estimates from the World Health Organization (WHO) indicate that 970 million people worldwide have mental health disorders, a figure which has risen over 25% in the past two decades (WHO, 2022). On account of its complicated history, multi-disciplinary implications, and cross-cultural differences, there is little agreement on what exactly constitutes 'mental health', its delimitation, or its modern use of as a euphemism for 'mental illness', a term

which has been scrutinized for decades on the basis that it is socially harmful (Whiteford et al., 2013). Indeed, mental health can be defined as the absence of mental disease, or the ability to adapt and self-manage, or the state of well-being which every individual realizes their own potential, and so on, and so forth (Huber et al., 2011). Needless to say, answers to the question '*what is mental health?*' will depend on who you ask. According to the Public Health Agency of Canada (2006):

> Mental health is the capacity of each and all of us to feel, think, and act in ways that enhance our ability to enjoy life and deal with the challenges we face. It is a positive sense of emotional and spiritual well-being that respects the importance of culture, equity, social justice, interconnections and personal dignity. (p. 2)

An international survey by Manwell et al. (2015) found that this definition of mental health was the most preferred among experts, even more so than the WHO's definition of the term, possibly because it trends away from the notion of a mental health-mental illness continuum and instead symbolizes that "mental health is more than the absence of mental illness" (Public Health Agency of Canada [PHAC], 2006, p. 2). The PHAC conceptualization closely reflects the epistemological position of the first author; therefore, it will be adopted and reflected throughout this thesis, with particular emphasis on examining maladaptive mental health and the promotion of adaptive mental health through a holistic, biopsychosocial framework (Engel, 1977).

Definition of Addiction

Addiction is a devastating global phenomenon that has been studied extensively across the health and behavioural sciences. Of the nearly one billion people living with mental health conditions, approximately 319 million suffer from substance use and addiction-related disorders (WHO, 2022). The term addiction has classically been used to describe the ailment of having a

dependence on a chemical substance (Walters, 1999), a conceptualization which has since expanded to non-substance use related objects and activities (e.g., gambling, sex, technology, etc.) over the past few decades (Walters & Gilbert, 2009). Much like mental health, there is no one definition for the term 'addiction'. Campbell's psychiatric dictionary (2009) defines it as a "loss of control over drug use (including alcohol), typically manifested as compulsive seeking and taking of drugs despite adverse consequences, with a high vulnerability to relapse" (p. 16). Previous definitions have placed more emphasis on *physical dependence*, which albeit a common feature, is not an invariable accompaniment of addiction (Campbell, 2009). Adapted from the American Psychiatric Association's (APA) definition of substance use disorders, the National Institute on Drug Abuse (2023) defines addiction as "a chronic, relapsing disorder characterized by compulsive drug seeking and use despite adverse consequences" (p. 4). Under this definition, addiction is considered a 'brain disorder' as its etiology lies within complex neural networks, many of which overlap with those implicated in mental health conditions (see pages 15–20).

Given the shared biopsychosocial pathology of mental health and addiction difficulties, it only makes sense that substance use and addiction-related conditions be considered mental disorders, as reflected in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM) since its third edition (APA, 1980). For the purposes of this thesis, the term 'addiction' will be used exclusively in the context of a chemical substance, and therefore, closely matches the definition conceptualized by the APA and provided by the National Institute on Drug Abuse (American Psychiatric Association, 2022; National Institute on Drug Abuse, 2023).

ABI & MHA: Comorbidity & Consequences

In general, it is suggested that upwards of 60% of ABI patients struggle with MHA disorders (Gould et al., 2011; Kim et al., 2007; Ponsford et al., 2018). For both nTBI and TBI,

the most commonly occurring and studied psychiatric outcomes are anxiety and depressive disorders (Byars & Jorge, 2015; Ponsford et al., 2018). Prevalence rates for anxiety disorders (e.g., generalized anxiety disorder, acute stress disorder, panic disorder, or post-traumatic stress disorder [PTSD]) and depressive disorders (e.g., bipolar disorder or major depressive disorder [MDD]) among TBI patients range between 25–70% across the literature, thereby considered as the two most common psychiatric consequences of TBI (Ponsford et al., 2018; Scholten et al., 2016). In their systematic review of 30 articles assessing risk factors for anxiety and depressive disorders following TBI, Scholten et al. (2016) concluded that female sex, those without employment, and those with a history of psychiatric disorders or substance use pre-TBI are at the highest risk for MHA conditions following TBI. Lastly, chronic pain, which affects approximately 50% of those with TBI, has been associated with higher rates of mood disorders following TBI and has implications for potential substance use and addiction concerns (Moshourab et al., 2015; Nampiaparampil, 2008).

Substance use and addiction-related disorders are the third most common psychiatric outcome of TBI, with lower rates for mTBI (approximately 10% for any substance-use disorder) than moderate to severe TBI (approximately 6–19% for any substance-use disorder) one-year post-injury (Bryant et al., 2010; Gould et al., 2011; Koponen et al., 2002). Prevalence rates of pre-injury substance use are especially high relative to anxiety and depression, a fact which may be unsurprising given shared risk factors (e.g., male sex and young age), paired with the knowledge that substance intoxication is a leading contributor to accident-related brain injury (Faul & Coronado, 2015; Gould et al., 2011; Ponsford et al., 2018).

People who live with TBI are disproportionately represented among those with opioid use disorder (Adams et al., 2020; Corrigan & Adams, 2019). Global studies indicate that 80% of all

deaths associated with illicit drugs are attributed to opioids (The United Nations Office on Drugs and Crime, 2020), a rate which has only increased and does not include the 20 Canadians who die each day from opioid toxicity-related overdoses (Health Canada, 2022). For these reasons and more, individuals with history of TBI are ten-times more likely to die from accidental drug poisoning than the general public (Harrison-Felix et al., 2015). In cases of non-fatal drug poisoning, opioid-induced respiratory depression may lead to cerebral hypoxia, which if not resolved quickly, can leave survivors with mental and physical disability from hypoxic, anoxic, and/or ischemic injuries (Seal et al., 2003; Winstanley et al., 2021). These multi-directional interactions create an exceptionally dangerous environment for ABI incidence and mortality.

Previous research suggests that individuals who experience TBI have both higher pre-injury rates of MHA disorders and post-injury MHA diagnoses than the general population (Ashman et al., 2004; Gould et al., 2011; Kureshi et al., 2023; Ponsford et al., 2018). Indeed, these epidemiological patterns portray how MHA disorders are both a risk factor for, and an outcome of, ABI. Several reasons for the high prevalence of MHA problems among the ABI population exist, such as injury-related communication and occupational limitations or motor and cognitive impairments, as well as a multitude of psycho-emotional factors, such as heightened levels of stress or frustration when faced with coping to post-injury functional abilities (Gould et al., 2011; Kim et al., 2007; Koponen et al., 2002; Ponsford et al., 2018). Ultimately, these factors are all underpinned by neurological processes, and their disruptions from ABI and MHA related complications.

ABI & MHA: Overlapping Neurobehavioral Correlates

ABI and MHA involve many shared neuroanatomical substrates, which may, in part, explain why so many people with ABI struggle with MHA disorders. This section summarizes

the shared neuropathophysiology of ABI and MHA, while placing emphasis on describing the predominant role of the prefrontal cortex (PFC), its functional divisions, and how prefrontal structural and functional disturbances associated with ABI and MHA result in the co-occurring neurobehavioral consequences of these and commonly comorbid neuropsychiatric conditions.

Structural Disturbances

While widely understood that ABI typically involves structural neurological damage, lesser known is the fact that MHA conditions can also alter the structure of our brains. Across addiction populations, structural magnetic resonance imaging (sMRI) studies have shown reduced PFC grey matter density of up to 20% (Goldstein & Volkow, 2011). Evidence from individuals addicted to cocaine, methamphetamine, heroin, nicotine, and alcohol all illustrate similar patterns of grey matter reductions, with the dorsal lateral prefrontal cortex (DLPFC), anterior cingulate cortex (ACC), and orbitofrontal cortex (OFC) being most affected (Franklin et al., 2002; Lyoo et al., 2006; Schwartz et al., 2010; Sim et al., 2007). Moreover, longer durations and increased severity of substance use are positively correlated with these volumetric PFC reductions, suggesting a dose-response relationship of substance intake with grey matter deterioration (Goldstein & Volkow, 2011).

In their sMRI study of 66 opiate-dependent participants, Lyoo et al. (2006) uncovered significantly decreased (versus controls) gray matter density in prefrontal areas, namely the bilateral mPFC (Brodmann's Area [BA] 10 and 11), right superior and inferior PFC (BA 9 and 47), and the left PFC (BA 8, 9, and 10). Gray matter reductions were also found in the insular cortex (BA 13), located deep within the Sylvain fissure. The insula, along with various subcortical (e.g., hypothalamus) and brainstem (e.g., medulla) areas, is implicated opioid-induced respiratory depression, the primary mechanism underlying overdose; in some cases,

causing hypoxic-ischemic brain injury. Certain neurons are especially vulnerable to this type of ischemia, including hippocampal pyramidal cells (especially CA1) and cerebellar purkinje cells, which may account for learning, memory, and spatial coordination deficits sometimes seen amongst overdose survivors (Winstanley et al., 2021). In rare cases, delayed toxic-hypoxic leukoencephalopathy has been recorded following opioid-related overdose, which is characterized by rapidly progressive white matter degeneration (Chachkhiani et al., 2021).

Much like the patterns of atrophy associated with substance use and addiction, grey matter reductions in the ACC and dorsal medial prefrontal cortex (dmPFC) have been documented in patients with MDD (Castanheira et al., 2019). Degeneration in these areas has been suggested to give rise to impairments in affective regulation, attention, problem-solving, and motivation, all of which are commonly observed in cases of MDD. Moreover, sMRI findings illustrate reduced corpus callosum (CC) microstructure in patients with MDD and bipolar disorder, suggesting that decreased communication between the two hemispheres may be responsible for impairments in emotional processing (Piras et al., 2021). Likewise, reduced hemispheric connectivity (i.e., lower fractional anisotropy) via the CC has been observed in those who chronically use substances such as alcohol, cocaine, and opioids, which likely contributes to the emotional impairments associated with long-term use of these substances (Hampton et al., 2019). Another mechanism by which the structural integrity of the CC may be threatened is through TBI. In fact, the CC is one of the more vulnerable structures to TBI given its midline position and higher probability of disruption from elevated ICP from secondary injury (Jang et al., 2019). Reduced CC microstructure and decreased hemispheric communication has been shown to occur in cases of diffuse axonal injury, including concussion, and has been linked to symptoms of emotional dysregulation which are commonly observed following this type of

injury (Caeyenberghs et al., 2014; Jang et al., 2019; Kim et al., 2007). Altogether, altered structural networks in general are a shared feature of ABI and MHA, which may, at least in part, relate to the high comorbidity and non-discriminate symptomology of these phenomena.

Functional Abnormalities

While both ABI and MHA can cause prefrontal inactivity and volumetric reduction, patterns of PFC overactivation are also implicated in the neurobehavioral consequences of these conditions. In populations struggling with addictions, functional MRI (fMRI) findings indicate that OFC, ACC, VMPFC, and DLPFC areas are overactivated for drug-seeking (meaning enhanced motivation for procurement of substances) but under-activated (meaning decreased motivation) for goals unrelated to drug use (Goldstein & Volkow, 2011). These regions communicate with subcortical areas (e.g., nucleus accumbens [NAc], ventral pallidum, substantia nigra pars compacta, and medial dorsal thalamic nuclei), where drug-related behaviours are further reinforced through dopaminergic systems; a neurobiological process which can make it extremely challenging for individuals with addictions to prioritize prosocial behaviours, such as maintaining relationships, working, or attending school. Through long-term substance misuse, working memory representations in the DLPFC can become biased towards drug-related stimuli and away from such alternatives, further confounding this problem (Goldstein & Volkow, 2011). These functional abnormalities can render it challenging for people with substance use and addiction concerns to self-advocate and engage with treatment.

In cases of concurrent MHA and ABI, clinical sequelae and treatment barriers are *severely* exacerbated. Functional disturbances in neural correlates of MHA (e.g., DLPFC, OFC, ACC, VMPFC) can result in neurocognitive difficulties (e.g., impaired self-control [DLPFC, ACC], emotion regulation [VMPFC, ACC], and motivation [DLPFC, OFC, ACC, VMPFC]) that

make it incredibly difficult for patients to seek and engage with ABI rehabilitation services. Conversely, damage to prefrontal regions through ABI can result in cognitive impairments (e.g., impaired working memory [DLPFC] and self-awareness [ACC, OFC]) that make seeking and maintaining MHA treatments exceptionally challenging for ABI patients. These neurocognitive relationships may explain why health service utilization behaviours and treatment maintenance rates are often poor among persons with concurrent ABI and MHA (Simpson et al., 2014).

Executive functioning is one domain of cognition which is impaired across virtually all phenotypes of ABI and MHA syndromes. Executive function (EF) refers to an interactive network of neurocognitive processes that control and guide goal-directed behaviour (Duggan & Garcia-Barrera, 2015). Although EF involves a wide cerebral network including frontoparietal and fronto-basal-thalamic pathways, the PFC is especially crucial for executive functioning. PFC injuries account for a large majority of all ABI cases, and PFC abnormalities (both functional and structural) are well documented in MHA (Goldstein & Volkow, 2011; Kim et al., 2007). Therefore, the PFC is a critical neuropathological substrate for MHA and ABI, with each condition being characterised by varying degrees of executive dysfunction.

For individuals with MHA disorders, abnormal DLPFC and VMPFC functionality are thought to give rise to dysexecutive symptoms such as impulsivity, reactivity, and compulsivity (Goldstein & Volkow, 2011). Unsurprisingly, TBI affecting the DLPFC and VMPFC is likely to result in these same deficits (Kim et al., 2007). Moreover, self-control difficulties can also arise from occlusion of the superior branches of the middle cerebral artery, leading to ischemia, a commonly occurring form of nTBI (Lindberg, 2021). In addition to impulsivity, reactivity, and compulsivity, dysexecutive commonalities in MHA and ABI such as impaired updating of working memory, planning, set-shifting, decision-making, and problem-solving all serve as

significant barriers to independence and prosocial functioning for individuals with concurrent ABI and MHA (Caeyenberghs et al., 2014). Due to the vastly executive nature of ABI and MHA symptomatology, rehabilitation experts have called for greater inclusion of EF training components into clinical treatment approaches and guidelines (Poulin et al., 2021).

Clinical Intervention for Concurrent ABI & MHA

Though principally understood that individuals with concurrent ABI and MHA related difficulties have unique treatment needs, there are very few interventions specifically designed to treat MHA disorders among those with ABI relative to the services allocated for either of these conditions in isolation. Post-injury neurocognitive deficits in self-awareness, communication, attention, and executive functioning can make it extremely difficult to engage in traditional MHA interventions such as psychotherapy and counselling (Caeyenberghs et al., 2014; Kim et al., 2007; McAllister, 2008). Despite their specialized healthcare needs and unique barriers to intervention, problems with MHA are generally treated using stand-alone and additive interventions (Chan et al., 2022). For example, prescribing anxiolytics for anxiety, or cognitive behavioural therapy for depression, on top of any ABI-focused services the patient may already be receiving. Service providers, treatment recipients, and caregivers to those afflicted have declared that this siloed approach to treating MHA problems in persons with ABI is largely ineffective and not suitable for their needs and resources, calling for an end to fragmented care and a push towards service integration.

Informed by a national stakeholder survey and a comprehensive literature review, the Canadian Agency for Drugs and Technologies in Health (CADTH) conducted an environmental scan in 2020 to identify Canadian integrated care systems and services supporting individuals with ABI and concurrent MHA disorders. Results of the survey indicated that very few

community-based brain injury organizations are equipped with in-house mental health care staff, nor do they feel that their employees are adequately trained to support MHA issues amongst clients. This finding has also been reported in a separate Canadian study (Munce et al., 2014) suggesting a systems level gap in care delivery and education. Potentially even more disappointing was CADTH's inability to identify any literature regarding Canadian integrated patient-centred care centres for individuals with concurrent ABI and MHA disorders, despite their comprehensive search of multiple bibliographic databases and grey literature sources.

In the experimental sphere, researchers have designed and tested their own alternative approaches to treating concurrent MHA and ABI related challenges. Recent studies have explored the potential efficacy of various unique treatments from concurrent ABI and MHA difficulties, ranging from the use of traditional Chinese medicines (Gao et al., 2023) to repeated transcranial magnetic stimulation combined with mindfulness-based therapy (Duan et al., 2023). Despite the breadth of alternative approaches in the literature, delivering these programmes may be outside the means or expertise of some practitioners, and their integration into evidence-based mainstream treatment regiments remains far from achievement.

Conclusions

ABI and MHA are highly prevalent and devastatingly comorbid phenomena. Together, these neuropsychiatric conditions affect well over 80 million people worldwide each year, resulting in tremendous individual, relational, economic, and societal costs (de Robles et al., 2015; Dewan et al., 2018; Feigin et al., 2022; Humphreys et al., 2013). Neuropathophysiological underpinnings and overlapping neurobehavioral deficits, paired with disparities in clinical diagnosis and care, create a dangerously toxic environment for exceptionally high mortality and morbidity in cases of concurrent ABI and MHA (Caeyenberghs et al., 2014; Castanheira et al.,

2019; Faul & Coronado, 2015; Harrison-Felix et al., 2015; Kim et al., 2007; Madsen et al., 2018). Despite the substantial breadth of extant literature on these two heavily researched topics, numerous unknowns surrounding the intersections of ABI and MHA remain. Importantly, there is a lack of guidance on how to best treat individuals struggling with concurrent ABI and MHA disorders, and stakeholders have expressed that current approaches to treatment for this underserved and vulnerable population are insufficient. To conclude, the importance of understanding the intersections of ABI and MHA cannot be understated.

Chapter 2:

Interventions for Mental Health and Addictions after Acquired Brain Injury:

A Systematic Evidence Mapping Review

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Abstract

Importance: Acquired brain injury (ABI) and mental health/addictions (MHA) are both leading causes of death and disability globally. Despite high rates of comorbidity, ABI and MHA are often treated as separate entities. Best practices for treating MHA disorders in individuals with ABI have not been established and it remains unclear on how to best support this population.

Objective: To conduct a comprehensive systematic evidence mapping review on interventions for treating MHA in the ABI population. Equally as important, we sought to understand what gaps exists in the current evidence base to inform agendas for future research.

Evidence Review: Evidence mapping methodology was used to identify and organize relevant publications. PsycINFO, SCOPUS, MEDLINE, the Cochrane Library (Cochrane Database of Systematic Reviews and Cochrane Central Register of Controlled Trials), Web of Science, and CINAHL were searched. The Measurement Tool to Assess Systematic Reviews 2nd edition (AMSTAR-2) was used to evaluate methodological quality and all outcomes are reported according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Findings: We identified 485 research records involving 735,203 participants with ABI. Records were comprised of 283 impact evaluations, 119 systematic reviews and meta-analyses, 39 clinical trial registries, 31 published study protocols, and four clinical practice guidelines. AMSTAR-2 ratings varied, with most falling within the low quality range. Cerebrovascular injuries, pharmacological interventions, and studies examining depression were among the most researched topics. Several gaps in the evidence base were identified, particularly surrounding evidence on housing interventions and treatments for substance use post-ABI.

Conclusions and Relevance: Over four hundred diverse and multidisciplinary interventional research records were captured and described in this evidence mapping review. These findings can be used by clinicians to inform treatment planning and by researchers to guide priority areas, ensuring that the most urgent and unmet treatment needs of individuals with concurrent ABI and MHA are addressed in future studies.

Introduction

The treatment of concurrent acquired brain injury (ABI) and mental health and addictions (MHA) related conditions presents many complex challenges. Depression, anxiety, post-traumatic stress disorder, substance use disorders, and other MHA conditions are common after ABI and substantially impair rehabilitation and recovery.[1–4] A growing body of research indicates that MHA disorders are both a risk factor for ABI incidence and a common outcome of ABI.[4–6] Health comorbidities, regardless of time of onset, are associated with lower quality of life, higher healthcare costs, and decreased life expectancy after ABI.[7,8] Despite high rates of comorbidity and a breadth of services dedicated to each in isolation, psychiatric conditions and ABI have historically been treated as separate entities.[9]

There are no known comprehensive systematic reviews of interventions for treating MHA problems in the ABI population. Those that do exist primarily focus on specific sub-types of ABI, such as traumatic brain injury (TBI)[9] or cerebrovascular incidents and stroke;[10–13] the previous systematic reviews target discrete categories of MHA disorders, such as mood disorders,[10–14] trauma and stress-related disorders,[15] or other specified behavioral disturbances.[16] No systematic review has examined diverse interventions targeting broad MHA disorders across multiple types of ABI. A possible explanation for the lack of comprehensive systematic reviews is the sheer breadth and depth of ABI and MHA as scientific phenomena, complicated by the multidisciplinarity of personnel involved in their research and clinical practice. Indeed, the wide range of intervention types and the vastly divaricating taxonomy of ABI and MHA render it difficult, if not impossible, to conduct a traditional systematic review without narrowing scope.

Evidence mapping offers a unique, modern solution to this problem. Evidence mapping is considered the newest of the contemporary offshoots of evidence synthesis techniques.[17] In

contrast to other new-age methods such as rapid or scoping reviews, evidence maps show what evidence exists, not what it says.[18] The two most fundamental aspects of evidence mapping are (1) a systematic literature search across a broad field of study to understand the evidence landscape and/or identify knowledge gaps, and (2) presentation of the results in a user-friendly format, often a visual figure or graph.[17] Regarding the latter, there is an increasing emphasis on creating interactive databases that serve as practical resources for broader communities of stakeholders (e.g., researchers, policy makers, funding agencies, clinicians, etc.), rather than static figures within academic publications.[17,18] TBI[19–21] and mental health[22–24] are two of the more frequently mapped subjects,[17] yet no evidence map has targeted these topics together.

The current study describes an initiative called *Database of Evidence Concerning Interventions Supporting the Intersections Of Neurotrauma–Mental health, & Addictions Problems (DECISION–MAP)*, a collaborative research project which aimed to systematically map evidence addressing MHA interventions for people with ABI. With these purposes in mind, we aimed to address the broad question, "*what evidence exists on different types of mental health and addictions interventions for people with brain injury?"* Equally as important, we sought to identify evidence *gaps*, that is, *"what evidence doesn't exist?".* In doing so, we wanted to understand to what degree the current evidence base reflects interventions and outcomes of interest to the broad community of stakeholders. Furthermore, since systematic reviews and meta-analyses are regarded as the highest standard of synthesis and often used to inform decisions in research and clinical practice, we thought it important to examine the methodological quality of these evidence sources. Central to this initiative was the development of an interactive and open-sourced evidence map user interface. This paper outlines the core systematic evidence mapping review component of the DECISION–MAP project.

Methods

Stakeholder engagement was a principal component of the DECISION–MAP project. In fact, the project was born from identified needs and calls to actions that emerged from year one of the *BC Consensus on Brain Injury, Mental Health, and Addictions*, a participatory action research study involving over one-hundred stakeholders of diverse perspectives. In line with its origins, the map's objectives, scope, coverage, framework, design, and reporting all involved numerous rounds of stakeholder consultation. An expert group (n = 11) comprising of researchers, clinical psychologists, occupational therapists, patients, family members, service providers, and other stakeholders oversaw the development and execution of this evidence mapping study. Consultation with other stakeholders outside the advisory committee was also sought for several aspects of the study. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[25] were followed and an a priori protocol was prepared, according to the Reporting Standards for Systematic Evidence Synthesis (ROSES)[26] for systematic evidence maps, and was registered on Open Science Framework prior to initiating the search (https://osf.io/6j4tb/?view_only=2f5b3978d6bc4d3e84e70740b029416b).

Literature Search

Eight electronic databases were systematically searched: PsycINFO (EbscoHost), SCOPUS (Elsevier), MEDLINE (Ovid), Cochrane Databases of Systematic Reviews (Ovid), Cochrane Controlled Trials Register (Ovid), Web of Science (Clarivate), and CINAHL (EbscoHost). All database searches were executed on March 13, 2023. The search strategy was developed by the lead author and informationist (CJK) in collaboration with the research team and expert consultants. Relevant keywords and subject headings were mined from seed articles and used to develop the search strategy. Additional subject headings were identified from the

APA Thesaurus of Psychological Index Terms and the Medical Subject Headings (MeSH) thesaurus. As a result of this process, over 100 subject headings and 150 search terms were compiled into a comprehensive search strategy that was applied and translated across databases to describe the following broad search concepts: (1) ABI, (2) MHA, and (3) Interventions. Expert consultation with multi-disciplinary researchers and an institutional librarian (ZP) with expertise in health-related evidence synthesis led to the identification of the chosen information sources and formulation of our comprehensive search strategy. The full search strategy can be found in Supplementary Table 1.

Eligibility Criteria

Publications that evaluated and reported on interventions for MHA problems in ABI populations were sought. Current (i.e., published 2015 onwards) retrospective and prospective peer-reviewed impact evaluations, clinical practice guidelines, systematic reviews, and meta-analyses that reported primary or secondary research findings on interventions involving participants with any and all types of non-progressive ABI were eligible. For our purposes, publications were considered systematic reviews if they (1) met the Cochrane Collaboration's definition of systematic reviews[27] and (2) explicitly referred to the review as systematic anywhere in the title or main text. Quantitative, qualitative, and mixed-method impact evaluations of any design (randomized and non-randomized controlled trials, experimental and quasi-experimental designs, non-experimental designs) were eligible for inclusion. Pilot and feasibility studies were included only if they had an impact evaluation component (i.e., reported efficacy data). On-going research, in the form of published study protocols for impact evaluations and clinical trial registries, were also eligible for inclusion. Given our broad scope, no specific MHA-related outcomes were sought. Reports that contributed to understanding

interventions for persons with ABI and MHA were considered relevant, so long as one or more of the primary outcomes were MHA-related and that all other eligibility criteria were met. Table 1 provides an overview of these desired characteristics based on the PICO ('Population', 'Intervention', 'Comparator', 'Outcome') format, and Supplementary Table 2 provides an in-depth summary of our inclusion and exclusion criteria.

Non-English language publications, theses and dissertations, grey literature (e.g., government reports, letters, editorials), animal studies, studies of non-ABI participants or with progressive ABI (e.g., cerebral neoplasms or infections), clinical cases series or studies where $n < 10$, published secondary research study protocols, non-impact evaluations, including articles that were narrative, commentaries, or describe a theoretical framework or rationale for interventions, and studies whose primary outcome(s) were not MHA-related were excluded. Assuming all other inclusion criteria were met, conditional rules were created and followed related to these exclusion criteria: (1) samples of patient-caregiver dyads were eligible for inclusion so long as (a) the intervention was focused on patients and (b) ≥ 50% of the sample was comprised of patients with ABI; (2) studies involving patients with a range of neurological diagnoses sampled from neurology wards, intensive care units, or other similar hospital-based settings were eligible for inclusion if ≥ 90% of the sample was composed of patients with ABI. These exceptions were made to address the complexity of capturing a broad spectrum of study types and designs without excluding potentially informative records. The publication date criterion was set for two key reasons: (1) ABI and MHA are highly researched topics with millions of published articles and it was not feasible to evaluate all records to date without restricting our comprehensive coverage of conditions, publication types, and outcomes; (2) articles published prior to 2015 can be considered outdated[28] and our objective was to capture

current, state-of-the-art evidence. Altogether, these inclusion and exclusion criteria were selected as the best fit with our broad evidence mapping method and objectives.

Selection Process

Identified reports were saved and uploaded to the web-based systematic review management software Covidence.[29] Training and pilot-testing using a portion (200 records each pilot) of the search yield was conducted prior to both stages of article selection. Formal screening did not begin until a minimum of 80% agreement rate was reached on pilot tests. Once achieved, the full search yield was uploaded to Covidence and duplicate records were automatically removed. Following extensive training and preparation of resources and materials, five reviewers (one graduate and four undergraduate researchers) individually applied eligibility criteria and selected studies for inclusion at the title and abstract stage. To ensure accuracy, a random proportion of excluded reports was evaluated by the team informationist (CJK). Double-masked screening was used at the full text review stage and all disagreements were resolved by the team informationist. Further discussion and consultation was used to solve disagreements when required. Inter-rater reliability was calculated using Cohens kappa (κ). Published study protocols or clinical trial registries for included full text publications were identified and removed. To ensure transparency and reproducibility, all decisions were recorded in Covidence and are reported here according to PRISMA guidelines.[25]

Data Extraction

Pre-determined data elements were extracted from all included records (see Supplementary Table 3). Data extraction was completed by five members of the research team and organized using Microsoft Excel. Information from each included study was carefully

extracted and entered into the data extraction form by one reviewer then double-checked by a second reviewer to ensure consistency and accuracy.

Quality Assessment

While risk of bias and critical appraisal assessments are considered optional for evidence maps,[30] we elected to evaluate the systematic reviews included in our study for two key reasons: (1) to understand the methodological strength of the evidence base, (2) to provide knowledge users with an indication of overall confidence to inform their own evaluations of systematic reviews, and their potential usefulness for their decision-making processes. Therefore, A Measurement Tool to Assess Systematic Reviews 2nd edition (AMSTAR-2)[31] was used to evaluate the methodological quality of included systematic reviews. The AMSTAR-2 is a widely used tool with strong test-retest reliably and content validity for critically appraising systematic reviews (with or without meta-analyses) involving randomized and/or non-randomized studies of healthcare interventions.[31] Using the web-based AMSTAR-2 checklist, each of the 16 items were evaluated and an overall quality descriptor was generated ('critically low', 'low', 'moderate', or 'high'). Training and pilot-tests were conducted prior to initiating formal AMSTAR-2 assessments. Two reviewers independently performed the quality assessments and disagreements were resolved by the team informationist via revaluation and consensus.

Mapping the Evidence

The primary outcomes of a systematic evidence map consist of a narrative description of the available evidence on a specific research topic, and a visual representation that maps the findings of the review process.[18] Regarding the latter, the methodological system used to organize evidence by category and subcategory titles within each axis of an evidence map is referred to as the *map framework,*[18,30] a critical component that is best formulated through

consultive processes with stakeholders.[18] Using the standard intervention-outcome matrix configuration for evidence maps,[18,30] our framework organizes interventions based on setting and mode of service delivery on the y-axis, and adopts the biopsychosocial model[32] to categorize outcomes on the x-axis. Each is further divided into nested sub-categories. For example, psychological outcome sub-categories are organized by Diagnostic and Statistical Manual Of Mental Disorders, Fifth Edition, Text Revision (DSM-5-TR) taxonomy.[33] The map framework was designed iteratively and informed by multiple sources, including review of previous literature, incorporation of interventions and outcomes of interest to stakeholders identified through findings from the *BC Consensus on Brain Injury, Mental Health, and Addictions*, and numerous rounds of expert consultation with multidisciplinary researchers, clinicians, and other key stakeholders. Through these iterative and collaborative processes, we refined the framework to provide an eloquent and parsimonious approach to organizing data within the map.

The evidence map user interface was developed using JavaScript and Vue.js programming languages. The development process used an iterative prototyping design methodology and was derived based on stakeholder feedback through on-going consultation. Interactive design elements were prioritized to enhance user engagement and all evidence sources are hyperlinked. The tabular ‘bubble map' serves as the core component, allowing users to visualize clusters of evidence and identify gaps in the evidence landscape. Included reports (i.e., data) are plotted on the map and represented as ‘bubbles’, the size of which depending on the number of reports included within each quadrant, with larger bubbles indicating a larger body of evidence, and bubble colour indicates the type of evidence (e.g., impact evaluation, systematic review, clinical trial registry, etc.). Filters and controls were implemented to enable users to

customize evidence presented within the map to their personal parameters. DECISION–MAP is open-sourced and free to access globally (www.decision-map.com).[ii]

Results

Our database searches identified 63,843 potentially eligible studies. After removal of duplicate records, 36,263 original research articles were screened. Full texts for articles were sought and 1,631 were retrieved and evaluated against inclusion criteria. Of these, 1,146 were excluded. There was fair inter-rater agreement (80%) and reliability ($\kappa = .53$). Figure 1 is a PRISMA coherent flow chart detailing the article selection process.

The final sample included 485 research records published between January 2015 and March 2023 (see Supplemental Material for full references). Of the included records, 415 were completed studies, comprised of 283 impact evaluations, 119 systematic reviews and meta-analyses, and four clinical practice guidelines. There were a total of 70 on-going research records, including 39 clinical trial registries and 31 published study protocols. Regarding accessibility, 40% of all included records were open-access (*n* = 194) and the remainder (*n* = 291) were subscription-based publications. Supplementary Table 4 is a summary of all research records included in this evidence mapping review.

Temporal publications trends steadily increased, peaking at 103 records in 2022 (see Figure 2). Majority of the studies originated from China (*n* = 106), followed by the United States (*n* = 94), United Kingdom (*n* = 26), Australia (*n* = 15), Canada (*n* = 13), Taiwan (*n* = 10), South Korea (*n* = 10), Netherlands (*n* = 9), Spain (*n* = 8), Brazil (*n* = 6), Italy (*n* = 6), Indonesia (*n* = 5), Iran (*n* = 5), Poland (*n* = 5), Norway (*n* = 4), India (*n* = 4), Turkey (*n* = 4), Sweden (*n* = 3), and several others (see Supplementary Table 4). Systematic reviews and meta-analysis involved

[ii] DECISION–MAP is most compatible with the Google Chrome web-browser, followed by Microsoft Edge, Mozilla Firefox, and Brave. It is not currently compatible with Safari.

primary studies conducted in multiple different countries. Figure 3 is a geographical heat map depicting number of publications by country.

Participant Characteristics

Our evidence mapping review covers research involving 735,203 people with ABI. The average age of participants was 55 years (*SD* = 11.7 years) and most studies included individuals of both male and female sex. Few (*n* = 7) included male subjects only, and none included samples that were exclusively comprised of female sex participants. Relatively few (*n* = 65, 13.4%) articles reported information on participants' race or ethnicity, and only one reported information on sexual orientation or gender.[34] Of the articles that reported this level of participant demographic information (13.4% of all included studies), there were 5,382 Black, Indigenous, and people of color and seven transgender or non-binary individuals. Fifty-seven studies specifically sampled military populations, involving 55,734 service members or veterans with ABI (7.6% of the total sample). Regarding sub-types of ABI investigated, ischemic and hemorrhagic stroke was the most commonly investigated (*n* = 322), primarily comprised of studies on post-stroke depression (*n* = 269), followed by non-specific (i.e., any severity) TBI (*n* = 88), mild TBI and/or concussion (*n* = 37), moderate TBI (*n* = 1), both moderate and severe TBI (*n* = 6), and severe TBI (*n* = 5). Several (*n* = 25) studies involved participants with ABI in general and did not delineate between sub-types. One study involved research on participants with anoxic brain injuries.[35]

Study Designs

Of the 356 primary research studies, majority (77.8%) employed experimental (randomized controlled trial) designs. The second most common study design was non-experimental designs (*n* = 27), followed by upper-tier quasi-experimental designs (*n* = 26) and

lower-tier quasi-experimental designs (*n* = 23). Figure 4 depicts the number of publications by study design for impact evaluations. Of the 119 systematic reviews and meta-analyses, 66 were systematic reviews with meta-analyses, 35 were systematic reviews without meta-analyses, and 18 were standalone meta-analyses. Five were Cochrane commissioned reviews.[11,13,36–38] Few studies employed qualitative (*n* = 16) or mixed-methods (*n* = 29) approaches, with the overwhelming majority of evidence being quantitative in nature.

Quality Assessment

The AMSTAR-2 ratings for included systematic reviews with or without meta-analyses were as follows: 41 were rated as critically low (i.e., more than one critical flaw with or without non-critical weaknesses), 38 were rated as low (i.e., one critical flaw with or without non-critical weaknesses), 12 were rated as moderate (i.e., more than one weakness but no critical flaws), and 10 were rated as high (i.e., no or one non-critical weakness) quality. The agreement rate between appraisers was 82%, indicating good agreement for overall AMSTAR-2 ratings across evaluated articles. Supplementary Table 5 lists the AMSTAR-2 ratings for all included systematic reviews.

Evidence by Interventions

Figure 5 is an intervention-outcome heat map depicting the number of publications in each quadrant of the matrix. Pharmacological interventions were the most common across included articles, involving 56 primary studies (*n* = 43 randomized controlled trials) and 48 secondary studies. The majority of pharmacological interventions focused on depressive disorders (*n* = 82), with antidepressants (*n* = 72) being the predominant class of studied pharmaceuticals. Twenty-four articles studied the use of non-psychotropic medications, such as N-acetylcysteine,[39] pioglitazone,[40] and vitamin D[41] or N-Pep-12[42] supplements. Seven studies explored antipsychotics and anticonvulsants medications, which were primarily used to treat

agitation and aggression in TBI patients.[43–46] Anxiolytics (*n* = 3) and psychostimulants (*n* = 9) were the least represented. Many studies involving pharmacological interventions were cross-categorized in more than one intervention category (*n*=21, 23.6% of all pharmacological interventions), indicating that pharmaceuticals are often examined as adjunctive treatments with other types of interventions, most commonly out-patient psychotherapy with antidepressants.

Studies involving in-patient and out-patient interventions were well represented, with a relatively equal distribution of evidence across the two categories (*n* = 116 in-patient, *n* = 124 out-patient). Regarding in-patient interventions, 56 studies examined neuromodulation and neurofeedback, primarily for depression (*n* = 50), but also for treating trauma and stress-related and anxiety disorders. Neuromodulation and neurofeedback interventions had a total of nine systematic reviews and meta-analyses,[47–55] more so than any other in-patient or out-patient intervention category, coming in second to anti-depressants for the greatest number of secondary research articles in the map overall. Twenty-eight studies examined the impact of interventions delivered in acute in-patient settings, such as evidence-based and comprehensive nursing regimes[56–69] or hyperbaric oxygen therapy.[70–73] Psychotherapy was the second highest populated sub-category, with most psychotherapy studies being conducted in out-patient (*n* = 74) compared to in-patient (*n* = 31) settings. Forty-two in-patient and out-patient psychotherapy studies involved telehealth and technology-based methods, such as remote cognitive behavioural therapy[74–76] or virtual reality[77–81] interventions. Only one study involved withdrawal management, specifically an alcohol withdrawal assessment protocol in an in-patient TBI rehabilitation setting.[82] Notably, the out-patient intervention category appeared to be an area of large growth through future research, as evidenced by having the highest number of on-going research records (*n* = 25) within the evidence map.

Community-based interventions were less commonly examined among the included studies. Evidence in this category primarily encompassed studies that evaluated patient-caregiver (*n* = 16) or home-based care (*n* = 8) interventions. Three and 16 studies focused on peer-to-peer[83–85] and social support[85–98] programs, respectively. Congruent with the rest of the evidence base, most of these studies involved samples of stroke (*n* = 30) or people with TBI (*n* = 9) and focused on depression or anxiety as outcomes. Studies examining integrated care were sparser. Of the records in this category, 16 studies reported on integrated care and case management activities, involving social workers, nurses, psychologists, occupational therapists, and other professionals delivering multidisciplinary and coordinated healthcare services.[9,99–113] No studies examined community-based harm reduction services or housing first initiatives, indicating an absolute evidence gap for these types of interventions in the literature.

The alternative approaches category was the third most populated intervention category within the map, containing 101 primary and 40 secondary studies. Fifty-percent of studies within this category investigated the effects of acupuncture (*n* = 49) or herbal medicine (*n* = 21), including 18 systematic reviews and meta-analyses. The vast majority of evidence in these categories targeted post-stroke depression (*n* = 63). Studies on exercise and movement-based interventions were well represented (*n* = 39) and involved a broad range of physical exercise activities, such aerobic exercise,[114–124], including aquatic aerobic exercise,[123,125] yoga,[126,127] tai chi,[128,129] and surfing.[130] Twenty-six studies investigated interventions using mindfulness and meditation-based approaches, mostly involving stroke (*n* = 20) but also TBI (*n* = 6) samples. Music and art interventions were the least of the studied alternative approaches, with 14 primary[131–141] and two secondary studies.[142,143] Notably, alternative approaches housed the second most on-going research records (*n* = 22) of any higher-level intervention category within

the map, suggesting that more researchers are turning their focus to investigating the impacts of less conventional approaches.

Evidence by Outcomes

Of the three outcome categories, social outcomes were the least represented among the included records (*n* = 13), comprised of by eight impact evaluations,[35,83,93,95,99,104,144,145] three clinical trial registries[146–148] and two published study protocols.[85,96] Within this category, community engagement was most common (*n* = 9), followed by relationships (*n* = 2), and healthcare utilization (*n* = 2). No studies examining occupational-related outcomes were identified. Physical outcomes were the second least represented (*n* = 44) with 35 primary and nine secondary research reports, comprised of 29 impact evaluations,[80,105,113,121,125,126,129,149–168] five systematic reviews and meta-analyses,[12,84,169–171] one clinical practice guideline,[106] five published study protocols,[79,117,172–175] and four clinical trial registries.[75,175,176] Studies evaluating the effect of interventions on sleeping and eating related outcomes were most common (*n*=20), primarily focusing on fatigue or insomnia,[75,106,156,159,163,165,166,170,172,176,177] followed by somatic symptoms (*n* = 14) and physical activity (*n* = 10) related outcomes. Overdose-related outcomes emerged as a substantial evidence gap, demonstrated by zero records examining overdose-related outcomes across all the included studies.

Psychological outcomes were the most studied among the included records, with 346 primary and 126 secondary research articles, comprised of 274 of impact evaluations, 118 systematic reviews and meta-analyses (35 systematic reviews, 18 standalone meta-analyses, 65 systematic reviews with meta-analyses), four clinical practice guidelines, 39 published study protocols, and 37 clinical trial registries. Majority of studies evaluated the impact of interventions on depression (*n* = 355) or anxiety (*n* = 106), many of which examined both (*n* =

82) through combined measures such as the Hospital Anxiety and Depression Scale.[178] Quality of life was the third most populated outcome category (*n* = 51), followed by trauma and stress related (*n* = 33), cognition (*n* = 30), self-awareness and self-efficacy (*n* = 22), aggression (*n* = 15), and activities of daily living/life skills (*n* = 12). In comparison to other psychological outcomes, studies measuring aggression or trauma and stress related outcomes were more likely to involve people with TBI as participants in their investigations. Six studies examined addiction-related outcomes,[39,78,149,179–181] encompassed only of primary research studies and no secondary evidence synthesis publications. No studies examining bipolar-related or obsessive-compulsive related outcomes were idented. Altogether, the psychological outcomes category encompassed 94.6% of all included records within the entire evidence map.

Discussion

This systematic evidence mapping review evaluated the landscape of completed and on-going research assessing interventions for MHA amongst individuals with ABI. Majority of studies originated from the United States and China. Impact evaluations testing the effect of individual interventions, predominately using randomized controlled trial designs, were the most represented study type, as were systematic reviews and meta-analyses. Only four clinical practice guidelines were identified.[92,106,182,183] Methodological quality of systematic reviews as assessed by the AMSTAR-2 varied, with the strong majority of reviews falling within the critically low to low range, indicating a pitfall in the confidence of synthesis reports. Evidence and gap analyses revealed several patterns, most notably a strong affinity for research examining post-stroke depression. In general, pharmacological and psychotherapeutic interventions possessed the most evidence, as did neuromodulation and alternative approaches. Most research was quantitative, with relatively few qualitative or mix-methods studies.

Several evidence gaps were identified. There was little-to-no research on withdrawal management centres, long-term in-patient services, or peer-to-peer programs as interventions. Community harm reduction services, agonists and safe supply initiatives, and housing first initiatives were the only three intervention categories for which no evidence was identified. Previous research suggests that individuals with history of TBI are ten-times more likely to die from overdose and accidental drug poisoning,[8] and are significantly over-represented in homeless population, with meta-analytic evidence suggesting that roughly half of all people who are homeless have experienced a TBI.[184] The lack of literature on harm reduction and housing interventions for people with ABI, in combination with our result of no studies examining overdose-related outcomes, represents a substantial evidence gap.

In regard to outcomes studied, very few records examined psychosis-related, healthcare utilization, and relationship-related outcomes. Moreover, only one record examined suicide and self-harm: a clinical trial registry for a randomized controlled trial using intermittent theta burst brain stimulation for treating suicidal ideation and impulsivity in veterans with mTBI.[185] Suicide risk is doubled for people with history of TBI[8] and the lack of information on interventions directly targeting suicidality is a significant evidence gap.

The most generalized evidence gap was the limited research focusing on interventions and related outcomes for substance use and addictions. The few records that did primarily studied alcohol use disorder in veteran populations.[39,78,179,181] Civilian or military, survivors of ABI have significantly higher rates of problematic substance use, extending beyond just alcohol.[3–6] The overall limited research on how to best support the unique treatment needs of those with concurrent ABI and substance use concerns represents a tremendous gap in the evidence base that must be addressed through future research.

This evidence mapping review was not without its limitations. Our search strategy was limited to records published 2015 onwards and therefore it is possible that informative articles published prior to then may have been missed. However, most of the over one-hundred included systematic reviews captured evidence published prior to 2015; therefore, this information it not entirely absent from our analysis. We did however exclude grey literature, meaning the map may be susceptible to publication bias and the of favouring elitist sources of information. Lastly, articles published in different languages are not reflected here, as our team is primarily English-speaking and was limited to evaluating English-language publications only.

Conclusion

This paper presents a comprehensive systematic evidence map covering a diverse spectrum of interventions for MHA in ABI populations. This is the first ever review undertaken to capture and describe this information, serving as a significant knowledge source for practitioners and healthcare policy makers. Such a wide breadth of study types is uncommon, even for evidence maps, rendering this work a first in the field of evidence mapping and health-related knowledge synthesis. Development of the interactive DECISION–MAP user interface serves as a valuable tool to researchers, clinicians, and policy makers to aid in their primary study and systematic review planning, treatment formulation, and evidence-based funding and healthcare policy decisions. Importantly, our findings highlight several evidence gaps in pressing areas of intersectional ABI and MHA research. These provide an evidence-based agenda for researchers and funding decision-makers to maximize the impact of future studies and support advancements in designing and delivering effective interventions for these highly prevalent and commonly co-occurring health conditions.

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Tables

Table 1.

DECISION–MAP PICO Elements

PICO Components	Delimitation for DECISION-MAP
Population	People with non-progressive ABI
Intervention	Interventions targeting MHA-related symptoms
Comparison	N/A
Outcome	MHA-related outcomes

Note: Acquired brain injury (ABI), mental health/addictions (MHA).

Figures

Figure 1.

PRIMSA Flowchart.

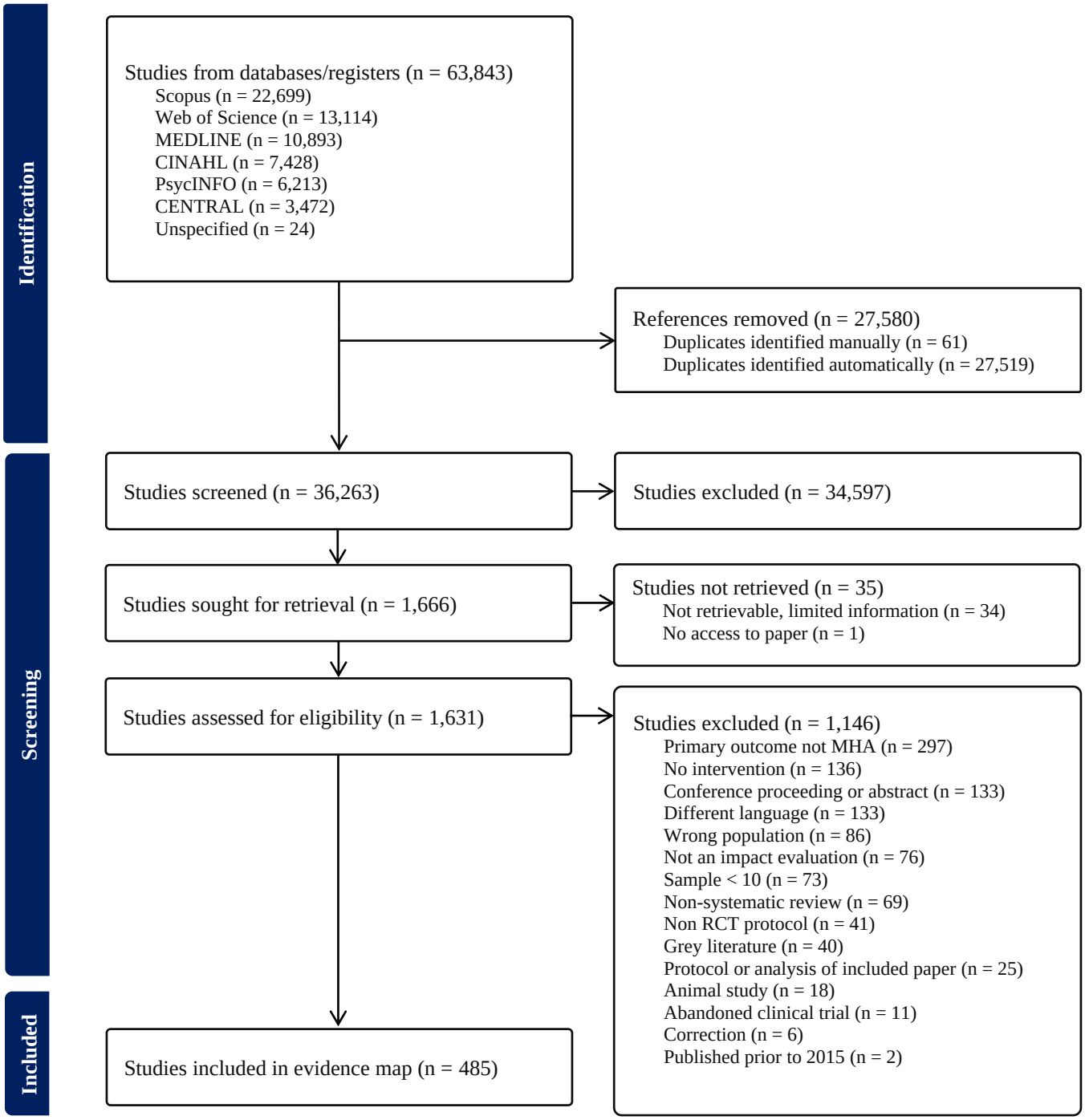
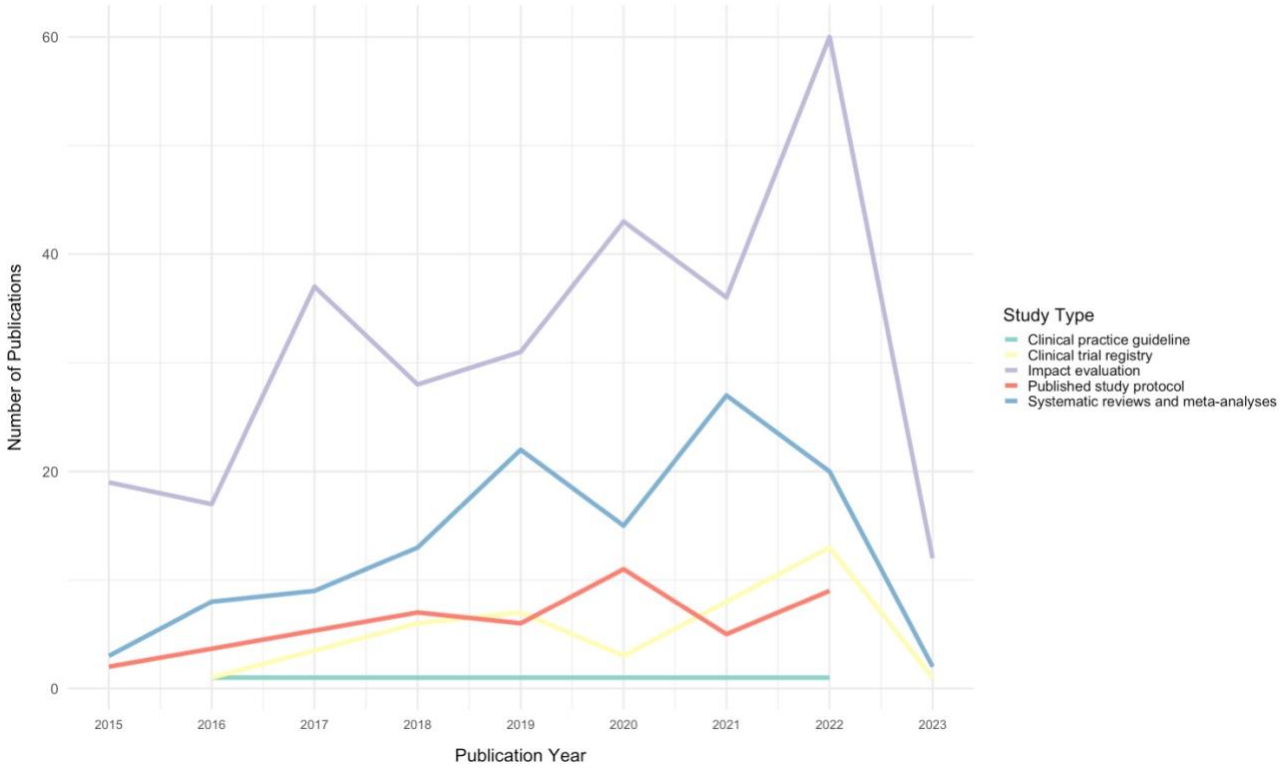


Figure 2.

Temporal Trends in Number of Publications.



Note. Organized by research record type.

Figure 3.

Geographical Heat Map Depicting Number of Publications by Country.

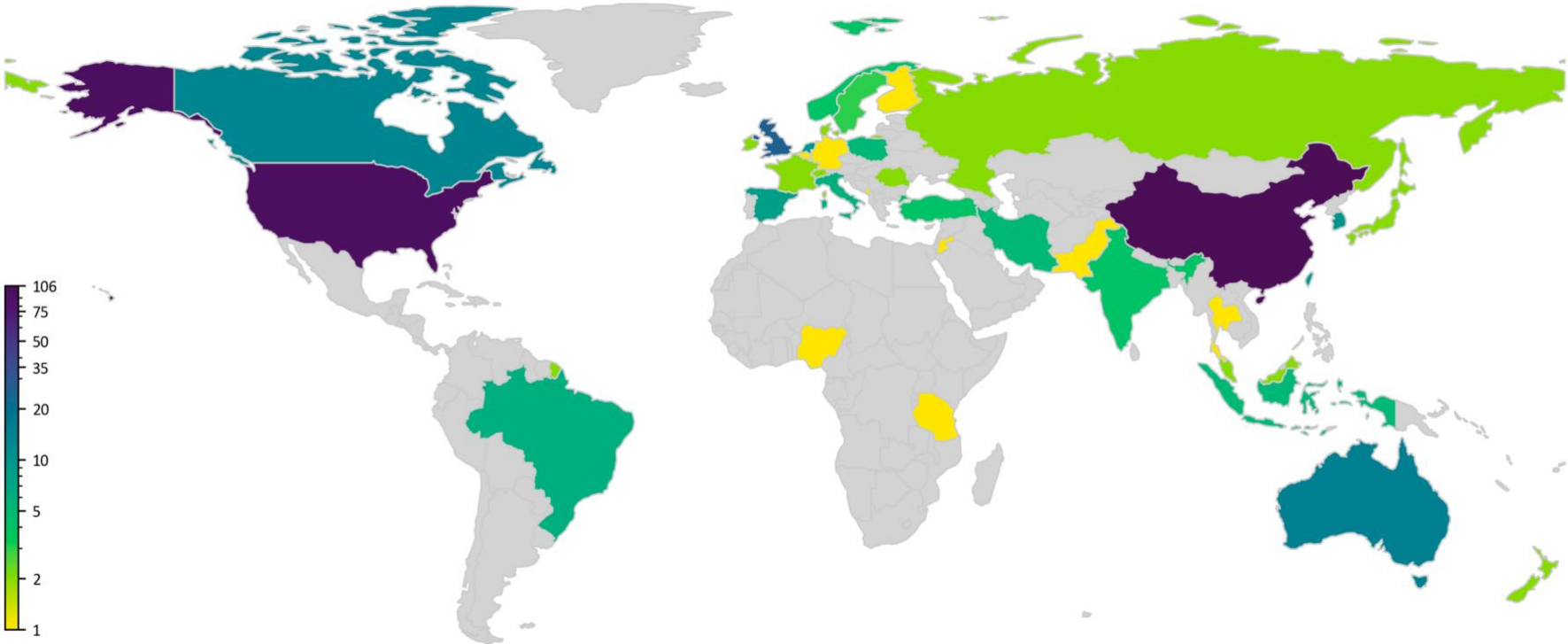
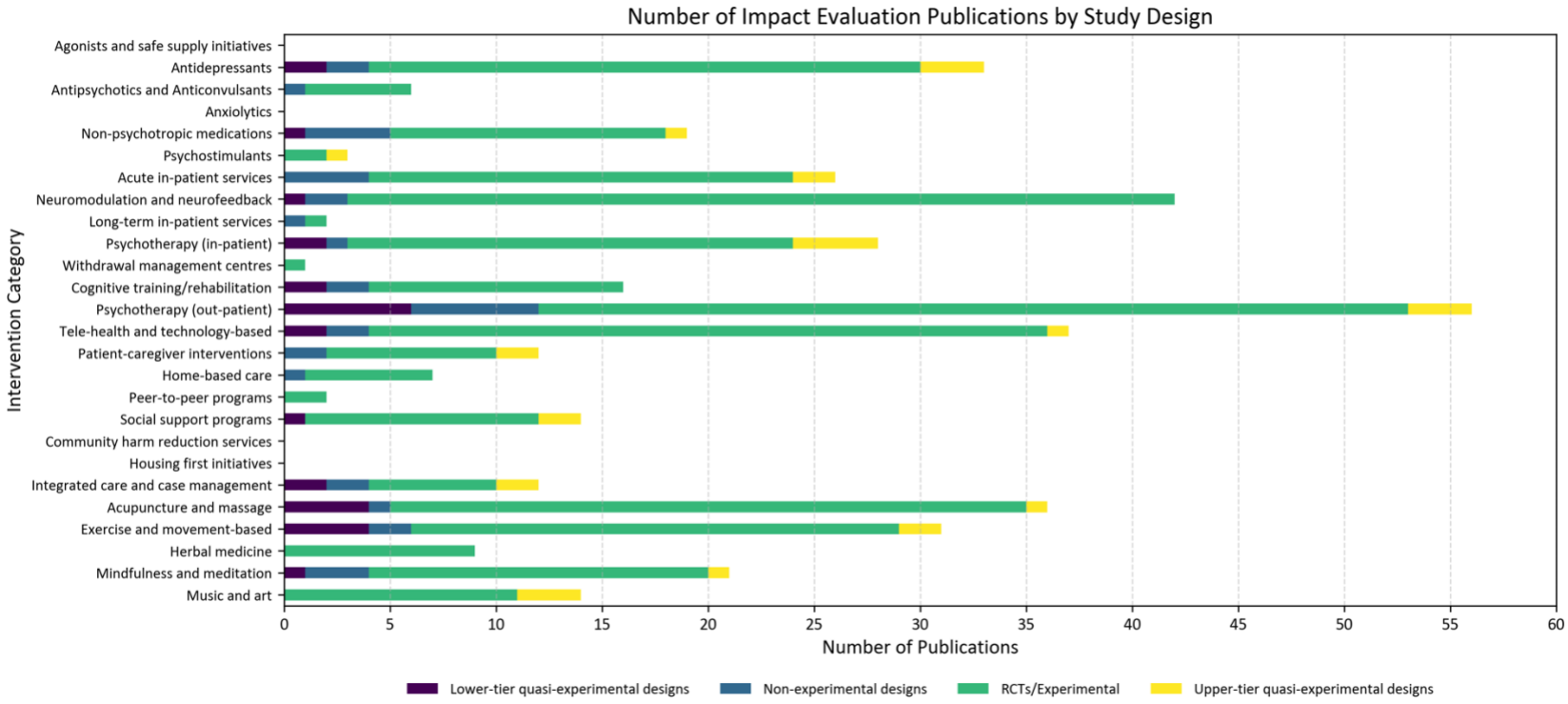


Figure 4.

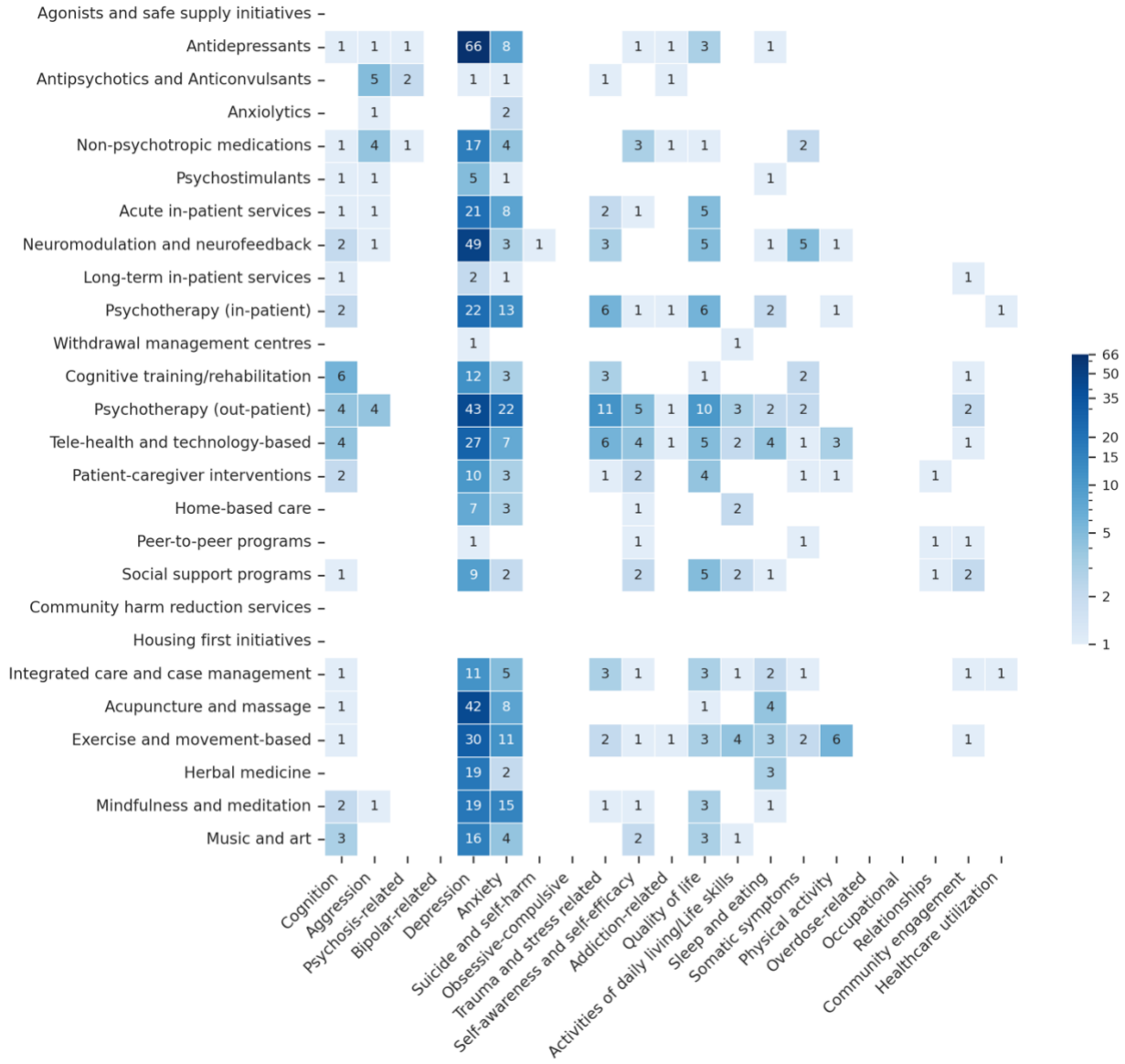
Impact Evaluations by Study Design.



Note. Number of impact evaluation publications organized by study design.

Figure 5.

Intervention-Outcome Heat Map Matrix Illustrating Number of Publications.



Note. Darker tiles indicate greater number of publications. White tiles indicate evidence gaps.

Supplemental Material

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475. Efficacy of Acupuncture at Acupoints Group Around the Base of Skull for Post-Stroke Depression. Published online 2022. https://ichgcp.net/clinical-trials-registry/NCT05310175

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Supplementary Table 1.

Full Search Strategy

DECISION-MAP Search Equation – MEDLINE (Ovid)				
ABI	1	Brain Injuries/	55671	Subject headings, ABI
	2	exp brain hemorrhage, traumatic/ or exp brain injuries, diffuse/ or brain injuries, traumatic/ or brain concussion/ or brain contusion/ or brain injury, chronic/	24966	
	3	craniocerebral trauma/ or head injuries, closed/ or head injuries, penetrating/ or intracranial hemorrhage, traumatic/	28089	
	4	exp brain ischemia/ or intracranial hemorrhages/ or exp stroke/ or exp hypoxia, brain/	232103	
	5	("traumatic brain injur*" or tbi or neurotrauma* or "neuro-trauma*").tw,kf.	54468	Keyword terms including acronyms, ABI. The concussion search string from the following paper were adapted and used: Schneider et al. (in press). The Amsterdam 2022 Process: A Summary of the Methodology for the 6th International Consensus Conference on Concussion in Sport. British Journal of Sports Medicine.
	6	(head adj2 (injur* or impact* or trauma*)).tw,kf.	38193	
	7	(brain adj2 (injur* or impact* or trauma*)).tw,kf.	92285	
	8	(concussion* or concussed or concussive or "mild traumatic brain injur*" or mtbi).tw,kf.	16424	
	9	(craniocerebral adj2 (trauma* or injur*)).tw,kf.	3339	
	10	("acquired brain injur*" or abi or "non-traumatic brain injur*" or "non traumatic brain injur*" or stroke or "brain damage" or "cerebrovascular event*" or "cerebrovascular accident*").tw,kf.	340469	
	11	("brain injur*" adj2 (hypoxic or hypoxia or anoxic or ischemia or ischemic)).tw,kf.	6095	
	12	or/1-11	565316	Combination line for brain injury concept combined with OR
MHA	13	exp mental health/ or mental disorders/ or exp anxiety disorders/ or exp "bipolar and related disorders"/ or "disruptive, impulse control, and conduct disorders"/ or	824041	Subject headings, mental health and mental disorders

		exp dissociative disorders/ or exp mood disorders/ or exp "attention deficit and disruptive behavior disorders"/ or exp personality disorders/ or exp "schizophrenia spectrum and other psychotic disorders"/ or somatoform disorders/ or exp conversion disorder/ or exp "trauma and stressor related disorders"/ or affective symptoms/ or depression/ or self-injurious behavior/ or suicide/		
	14	exp substance-related disorders/ or exp drinking behavior/ or exp drug-seeking behavior/ or impulsive behavior/ or exp "marijuana use"/ or exp "recreational drug use"/ or exp smoking/ or exp "tobacco use"/ or drug overdose/	503742	Substance use and addiction related behaviour subject headings
	15	(mental* adj2 (disorder* or illness* or "ill-health")).tw,kf.	101458	Proximity operators for key MH related terms
	16	(psychological* adj2 (disorder* or illness* or distress or dysfunction)).tw,kf.	34012	
	17	addiction*.tw,kf.	60582	Keyword for addiction as a category term
	18	(substance* adj2 (use* or abuse* or misuse*)).tw,kf.	82429	Proximity operators for key addiction related terms
	19	(drug* adj2 (use* or abuse* or misuse*)).tw,kf.	170096	
	20	(overdose* adj1 (drug* or substance* or opiate* or opioid*)).tw,kf.	6234	
	21	(dependence adj2 (drug* or substance* or physical or psychological)).tw,kf.	10901	

	22	("affective disorder*" or "agoraphobia" or "anxiety*" or "anxiety disorder*" or "acute stress" or depression* or depressed or "depressive disorder*" or "dysthymia" or "generalized anxiety disorder" or gad or "mania" or "mood disorder*" or mdd or "major depression" or "moderate depression" or "depressive symptom*" or "obsessive compulsive disorder" or "obsessive-compulsive disorder" or ocd or psychosis or phobias or "phobic disorder*" or "panic disorder*" or "panic attack*" or "post-traumatic stress" or "post-traumatic stress disorder" or ptsd or "social anxiety disorder").tw,kf.	749903	Keyword terms including acronyms, MH disorders [1]Research (see Scholten et al. 2006 for SR) indicates that anxiety disorders (namely, generalized anxiety disorder, acute stress disorder, panic disorder, agoraphobia, specific phobia, social phobia, obsessive-compulsive disorder [OCD], and PTSD) and depressive disorders (dysthymia, bipolar disorder, and MDD) are the most commonly observed MH disorders following ABI.
	23	("addictive behaviour*" or "polysubstance addiction*" or "dual addiction" or "substance use disorder*" or sud).tw,kf.	22015	Keyword terms including acronyms, addiction
	24	or/13-23	1827642	Combination line for MHA concept combined with OR
Intervention	25	Program Evaluation/ or exp clinical protocol/ or exp guideline/ or guidelines as topic/ or exp practice guideline/ or practice guidelines as topic/ or health planning guidelines/	458084	Relevant subject headings
	26	(experimental or evaluat* or impact* or assess* or dif-dif or PSM or "double difference" or difference-in-difference or RDD or "difference in difference" or "statistical matching*" or "propensity score matching" or "covariate matching" or "coarsened-exact matching" or "propensity weighted" or "regression analysis" or "multiple regression" or "statistical regression" or "regression discontinuity*" or "experimental design" or "cohort analysis" or "quantitative method*" or "qualitative method*" or "program	12567617	Search terms describing impact evaluations adapted from Barretta et al.'s (2021) evidence map on energy efficiency impact evaluations

		evaluation" or "program development" or "interrupted time series" or ITS or (before adj5 after) or (pre adj5 post) or ((pretest or "pre test") and (posttest or "post test")) or ((("fixed effect*" or "random effect*") adj3 (model or estimation)) or "instrumental variable" or "synthetic control") or ((quantitative or "comparison group*" or counterfactual or "counter factual" or counter-factual or experiment*) adj3 (design or study or analysis))).mp.		
	27	Clinical Studies as Topic/ or exp Clinical Trial/ or exp Clinical Trials as Topic/ or Clinical Trial Protocol/ or Clinical Trial Protocols as Topic/ or Multicenter Study/ or Multicenter Studies as Topic/ or "Multicenter Study (topic)"/ or Randomization/ or Random Allocation/ or Double-Blind Method/ or Double Blind Procedure/ or Double-Blind Studies/ or Single-Blind Method/ or Single Blind Procedure/ or Single-Blind Studies/ or Placebos/ or Placebo/ or Control Groups/ or Control Group/ or Cross-Over Studies/ or Crossover Procedure/ or Non-Randomized Controlled Trials as Topic/	1574875	Search string for clinical trails (ALL) adapted from CADTH (2021). All Clinical Trials - MEDLINE, Embase, PsycInfo. In: CADTH Search Filters Database. Ottawa: CADTH; 2023: https://searchfilters.cadth.ca/link/34. Accessed 2023-01-04.
	28	(pragmatic study or pragmatic studies).ti,ab,kf.	574	
	29	(pragmatic or practical) adj3 trial*.ti,ab,hw,kf.	7495	
	30	(random* or sham or placebo*).ti,ab,hw,kf.	1782130	
	31	((singl* or doubl*) adj (blind* or dumm* or mask*)).ti,ab,hw,kf.	264836	
	32	((tripl* or trebl*) adj (blind* or dumm* or mask*)).ti,ab,hw,kf.	1548	
	33	(control* adj3 (study or studies or trial* or group*)).ti,ab,hw,kf.	1897175	
	34	(clinical adj3 (study or studies or trial*)).ti,ab,hw,kf.	1413034	
	35	(Nonrandom* or non random* or non-random* or quasi-random* or quasirandom*).ti,ab,hw,kf.	53506	

	36	(phase adj3 (study or studies or trial*)).ti,ab,hw,kf.	175158	
	37	((crossover or cross-over) adj3 (study or studies or trial*)).ti,ab,hw,kf.	75987	
	38	((multicent* or multi-cent*) adj3 (study or studies or trial*)).ti,ab,hw,kf.	402463	
	39	allocated.ti,ab,hw.	82073	
	40	((open label or open-label) adj5 (study or studies or trial*)).ti,ab,hw,kf.	43727	
	41	((equivalence or superiority or non-inferiority or noninferiority) adj3 (study or studies or trial*)).ti,ab,hw,kf.	11717	
	42	((quasiexperimental or quasi-experimental) adj3 (study or studies or trial*)).ti,ab,hw,kf.	11738	
	43	trial.ti,kf.	300954	
	44	or/25-43	14196564	Combination line for intervention concept combined with OR
	45	12 and 24 and 44	25895	Combination line: ABI AND MHA AND Intervention
	46	limit 45 to yr="2015 - current"	11849	Limited to 2015 to current
	47	(address or autobiography or bibliography or biography or congress or dataset or dictionary or directory or editorial or "expression of concern" or festschrift or government document or interactive tutorial or interview or lecture or legal case or legislation or letter or news or newspaper article or overall or patient education handout or periodical index or personal narrative or portrait or webcasts).pt.	2410555	Irrelevant publication types
	48	46 not 47	11789	Result after exclusion of irrelevant publication type
	49	exp Animals/ not humans.sh.	5101452	Final result after excluding animal studies
	50	48 not 49	10893	

DECISION-MAP Search Equation – Cochrane Central Register of Controlled Trials				
ABI	1	Brain Injuries/	2211	Exploded subject heading for brain hemorrhage and brain injuries diffuse
	2	exp brain hemorrhage, traumatic/ or exp brain injuries, diffuse/ or brain injuries, traumatic/ or brain concussion/ or brain contusion/ or brain injury, chronic/	1364	
	3	craniocerebral trauma/ or head injuries, closed/ or head injuries, penetrating/ or intracranial hemorrhage, traumatic/	493	Additional subject headings of relevance
	4	exp brain ischemia/ or intracranial hemorrhages/ or exp stroke/ or exp hypoxia, brain/	15547	
	5	("traumatic brain injur*" or tbi or neurotrauma* or "neuro-trauma*").tw,kw.	5138	Keyword terms including acronyms The concussion search string from the following paper were adapted and used: Schneider et al. (in press). The Amsterdam 2022 Process: A Summary of the Methodology for the 6th International Consensus Conference on Concussion in Sport. British Journal of Sports Medicine.
	6	(head adj2 (injur* or impact* or trauma*)).tw,kw.	2327	
	7	(brain adj2 (injur* or impact* or trauma*)).tw,kw.	7377	
	8	(concussion* or concussed or concussive or "mild traumatic brain injur*" or mtbi).tw,kw.	1311	
	9	(craniocerebral adj2 (trauma* or injur*)).tw,kw.	174	
	10	("acquired brain injur*" or abi or "non-traumatic brain injur*" or "non traumatic brain injur*" or stroke or "brain damage" or "cerebrovascular event*" or "cerebrovascular accident*").tw,kw.	66164	
	11	("brain injur*" adj2 (hypoxic or hypoxia or anoxic or ischemia or ischemic)).tw,kw.	214	
	12	or/1-11	76741	Combination line for brain injury concept combined with OR
MHA	13	exp mental health/ or mental disorders/ or exp anxiety disorders/ or exp "bipolar and related disorders"/ or "disruptive, impulse control, and conduct disorders"/ or	59517	Exploded subject heading for mental health and mental disorders

		exp dissociative disorders/ or exp mood disorders/ or exp "attention deficit and disruptive behavior disorders"/ or exp personality disorders/ or exp "schizophrenia spectrum and other psychotic disorders"/ or somatoform disorders/ or exp conversion disorder/ or exp "trauma and stressor related disorders"/ or affective symptoms/ or depression/ or self-injurious behavior/ or suicide/		
	14	exp substance-related disorders/ or exp drinking behavior/ or exp drug-seeking behavior/ or impulsive behavior/ or exp "marijuana use"/ or exp "recreational drug use"/ or exp smoking/ or exp "tobacco use"/ or drug overdose/	27623	Substance use and addiction related behaviour subject headings
	15	(mental* adj2 (disorder* or illness* or "ill-health")).tw,kw.	12913	Proximity operators for key MH related terms
	16	(psychological* adj2 (disorder* or illness* or distress or dysfunction)).tw,kw.	5428	
	17	addiction*.tw,kw.	8825	Keyword for addiction as a category term
	18	(substance* adj2 (use* or abuse* or misuse*)).tw,kw.	9409	Proximity operators for key addiction related terms
	19	(drug* adj2 (use* or abuse* or misuse*)).tw,kw.	20069	
	20	(overdose* adj1 (drug* or substance* or opiate* or opioid*)).tw,kw.	1008	
	21	(dependence adj2 (drug* or substance* or physical or psychological)).tw,kw.	2796	

	22	("affective disorder*" or "agoraphobia" or "anxiety*" or "anxiety disorder*" or "acute stress" or depression* or depressed or "depressive disorder*" or "dysthymia" or "generalized anxiety disorder" or gad or "mania" or "mood disorder*" or mdd or "major depression" or "moderate depression" or "depressive symptom*" or "obsessive compulsive disorder" or "obsessive-compulsive disorder" or ocd or psychosis or phobias or "phobic disorder*" or "panic disorder*" or "panic attack*" or "post-traumatic stress" or "post-traumatic stress disorder" or ptsd or "social anxiety disorder").tw,kw.	139089	Keyword terms including acronyms, MH disorders [1]Research (see Scholten et al. 2006 for SR) indicates that anxiety disorders (namely, generalized anxiety disorder, acute stress disorder, panic disorder, agoraphobia, specific phobia, social phobia, obsessive-compulsive disorder [OCD], and PTSD) and depressive disorders (dysthymia, bipolar disorder, and MDD) are the most commonly observed MH disorders following ABI.
	23	("addictive behaviour*" or "polysubstance addiction*" or "dual addiction" or "substance use disorder*" or sud).tw,kw.	2472	Keyword terms including acronyms, addiction
	24	or/13-23	210340	Combination line for MHA concept combined with OR
Intervention	25	Program Evaluation/ or exp clinical protocol/ or exp guideline/ or guidelines as topic/ or exp practice guideline/ or practice guidelines as topic/ or health planning guidelines/	33377	Relevant subject headings
	26	(experimental or evaluat* or impact* or assess* or dif-dif or PSM or "double difference" or difference-in-difference or RDD or "difference in difference" or "statistical matching*" or "propensity score matching" or "covariate matching" or "coarsened-exact matching" or "propensity weighted" or "regression analysis" or "multiple regression" or "statistical regression" or "regression discontinuity*" or "experimental design" or "cohort analysis" or "quantitative method*" or "qualitative method*" or "program	1176973	Search terms describing impact evaluations adapted from Barretta et al.'s (2021) evidence map on energy efficiency impact evaluations

		evaluation" or "program development" or "interrupted time series" or ITS or (before adj5 after) or (pre adj5 post) or ((pretest or "pre test") and (posttest or "post test")) or ((("fixed effect*" or "random effect*") adj3 (model or estimation)) or "instrumental variable" or "synthetic control") or ((quantitative or "comparison group*" or counterfactual or "counter factual" or counter-factual or experiment*) adj3 (design or study or analysis))).mp.		
	27	Clinical Studies as Topic/ or exp Clinical Trial/ or exp Clinical Trials as Topic/ or Clinical Trial Protocol/ or Clinical Trial Protocols as Topic/ or Multicenter Study/ or Multicenter Studies as Topic/ or "Multicenter Study (topic)"/ or Randomization/ or Random Allocation/ or Double-Blind Method/ or Double Blind Procedure/ or Double-Blind Studies/ or Single-Blind Method/ or Single Blind Procedure/ or Single-Blind Studies/ or Placebos/ or Placebo/ or Control Groups/ or Control Group/ or Cross-Over Studies/ or Crossover Procedure/ or Non-Randomized Controlled Trials as Topic/	273326	Search string for clinical trails (ALL) adapted from CADTH (2021). All Clinical Trials - MEDLINE, Embase, PsycInfo. In: CADTH Search Filters Database. Ottawa: CADTH; 2023: https://searchfilters.cadth.ca/link/34. Accessed 2023-01-04.
	28	(pragmatic study or pragmatic studies).ti,ab,kw.	344	
	29	(pragmatic or practical) adj3 trial*.ti,ab,hw,kw.	6317	
	30	(random* or sham or placebo*).ti,ab,hw,kw.	1308013	
	31	((singl* or doubl*) adj (blind* or dumm* or mask*)).ti,ab,hw,kw.	386946	
	32	((tripl* or trebl*) adj (blind* or dumm* or mask*)).ti,ab,hw,kw.	2527	
	33	(control* adj3 (study or studies or trial* or group*)).ti,ab,hw,kw.	977728	
	34	(clinical adj3 (study or studies or trial*)).ti,ab,hw,kw.	673884	
	35	(Nonrandom* or non random* or non-random* or quasi-random* or quasirandom*).ti,ab,hw,kw.	10168	

	36	(phase adj3 (study or studies or trial*)).ti,ab,hw,kw.	132451	
	37	((crossover or cross-over) adj3 (study or studies or trial*)).ti,ab,hw,kw.	90381	
	38	((multicent* or multi-cent*) adj3 (study or studies or trial*)).ti,ab,hw,kw.	136137	
	39	allocated.ti,ab,hw.	72403	
	40	((open label or open-label) adj5 (study or studies or trial*)).ti,ab,hw,kw.	52266	
	41	((equivalence or superiority or non-inferiority or noninferiority) adj3 (study or studies or trial*)).ti,ab,hw,kw.	13839	
	42	((quasiexperimental or quasi-experimental) adj3 (study or studies or trial*)).ti,ab,hw,kw.	5137	
	43	trial.ti,kw.	734167	
	44	or/25-43	1681586	Combination line for intervention concept combined with OR
	45	12 and 24 and 44	5543	Combination line: ABI AND MHA AND Intervention
	46	limit 45 to yr="2015 - current"	3478	Limited to 2015 to current
	47	(address or autobiography or bibliography or biography or congress or dataset or dictionary or directory or editorial or "expression of concern" or festschrift or government document or interactive tutorial or interview or lecture or legal case or legislation or letter or news or newspaper article or overall or patient education handout or periodical index or personal narrative or portrait or webcasts).pt.	18844	Irrelevant publication types
	48	46 not 47	3472	Result after exclusion of irrelevant publication type
	49	exp Animals/ not humans.sh.	2683	Animal filter
	50	48 not 49	3472	

DECISION-MAP Search Equation –Cochrane Database of Systematic Reviews

ABI	1	("traumatic brain injur*" or tbi or neurotrauma* or "neuro-trauma*").ti,ab,kw.	60	
	2	(head adj2 (injur* or impact* or trauma*)).ti,ab,kw.	60	The concussion search string from the following paper were adapted and used: Schneider et al. (in press). The Amsterdam 2022 Process: A Summary of the Methodology for the 6th International Consensus Conference on Concussion in Sport. British Journal of Sports Medicine.
	3	(brain adj2 (injur* or impact* or trauma*)).ti,ab,kw.	84	
	4	(concussion* or concussed or concussive or "mild traumatic brain injur*" or mtbi).ti,ab,kw.	4	
	5	(craniocerebral adj2 (trauma* or injur*)).ti,ab,kw.	7	
	6	("acquired brain injur*" or abi or "non-traumatic brain injur*" or "non traumatic brain injur*" or stroke or "brain damage" or "cerebrovascular event*" or "cerebrovascular accident*").ti,ab,kw.	543	
	7	("brain injur*" adj2 (hypoxic or hypoxia or anoxic or ischemia or ischemic)).ti,ab,kw.	0	
	8	or/1-7	623	Combination line for brain injury concept combined with OR
MHA	9	(mental* adj2 (disorder* or illness* or "ill-health")).ti,ab,kw.	245	Proximity operators for key MH related terms
	10	(psychological* adj2 (disorder* or illness* or distress or dysfunction)).ti,ab,kw.	56	
	11	addiction*.ti,ab,kw.	104	Keyword for addiction as a category term
	12	(substance* adj2 (use* or abuse* or misuse*)).ti,ab,kw.	56	Proximity operators for key addiction related terms
	13	(drug* adj2 (use* or abuse* or misuse*)).ti,ab,kw.	232	
	14	(overdose* adj1 (drug* or substance* or opiate* or opioid*)).ti,ab,kw.	2	
	15	(dependence adj2 (drug* or substance* or physical or psychological)).ti,ab,kw.	40	

	16	("affective disorder*" or "agoraphobia" or "anxiety*" or "anxiety disorder*" or "acute stress" or depression* or depressed or "depressive disorder*" or "dysthymia" or "generalized anxiety disorder" or gad or "mania" or "mood disorder*" or mdd or "major depression" or "moderate depression" or "depressive symptom*" or "obsessive compulsive disorder" or "obsessive-compulsive disorder" or ocd or psychosis or phobias or "phobic disorder*" or "panic disorder*" or "panic attack*" or "post-traumatic stress" or "post-traumatic stress disorder" or ptsd or "social anxiety disorder").ti,ab,kw.	972	Keyword terms including acronyms, MH disorders [1]Research (see Scholten et al. 2006 for SR) indicates that anxiety disorders (namely, generalized anxiety disorder, acute stress disorder, panic disorder, agoraphobia, specific phobia, social phobia, obsessive-compulsive disorder [OCD], and PTSD) and depressive disorders (dysthymia, bipolar disorder, and MDD) are the most commonly observed MH disorders following ABI.
	17	("addictive behaviour*" or "polysubstance addiction*" or "dual addiction" or "substance use disorder*" or sud).ti,ab,kw.	15	Keyword terms including acronyms, addiction
	18	or/9-17	1388	Combination line for MHA concept combined with OR
Intervention	19	(experimental or evaluat* or impact* or assess* or dif-dif or PSM or "double difference" or difference-in-difference or RDD or "difference in difference" or "statistical matching*" or "propensity score matching" or "covariate matching" or "coarsened-exact matching" or "propensity weighted" or "regression analysis" or "multiple regression" or "statistical regression" or "regression discontinuity*" or "experimental design" or "cohort analysis" or "quantitative method*" or "qualitative method*" or "program evaluation" or "program development" or "interrupted time series" or ITS or (before adj5 after) or (pre adj5 post) or ((pretest or "pre test") and (posttest or "post test")) or ((("fixed effect*" or "random effect*") adj3 (model or	11006	Search terms describing impact evaluations adapted from Barretta et al.'s (2021) evidence map on energy efficiency impact evaluations

		estimation)) or "instrumental variable" or "synthetic control") or ((quantitative or "comparison group*" or counterfactual or "counter factual" or counter-factual or experiment*) adj3 (design or study or analysis))).mp.		
	20	(pragmatic study or pragmatic studies).ti,ab,kw.	2	Search string for clinical trails (ALL) adapted from CADTH (2021). All Clinical Trials - MEDLINE, Embase, PsycInfo. In: CADTH Search Filters Database. Ottawa: CADTH; 2023: https://searchfilters.cadth.ca/link/34. Accessed 2023-01-04.
	21	(pragmatic or practical) adj3 trial*.ti,ab,kw.	25	
	22	(random* or sham or placebo*).ti,ab,kw.	8863	
	23	((singl* or doubl*) adj (blind* or dumm* or mask*)).ti,ab,kw.	530	
	24	((tripl* or trebl*) adj (blind* or dumm* or mask*)).ti,ab,kw.	1	
	25	(control* adj3 (study or studies or trial* or group*)).ti,ab,kw.	8579	
	26	(clinical adj3 (study or studies or trial*)).ti,ab,kw.	3426	
	27	(Nonrandom* or non random* or non-random* or quasi-random* or quasirandom*).ti,ab,kw.	1913	
	28	(phase adj3 (study or studies or trial*)).ti,ab,kw.	74	
	29	((crossover or cross-over) adj3 (study or studies or trial*)).ti,ab,kw.	535	
	30	((multicent* or multi-cent*) adj3 (study or studies or trial*)).ti,ab,kw.	180	
	31	allocated.ti,ab.	283	
	32	((open label or open-label) adj5 (study or studies or trial*)).ti,ab,kw.	82	
	33	((equivalence or superiority or non-inferiority or noninferiority) adj3 (study or studies or trial*)).ti,ab,kw.	18	
	34	((quasiexperimental or quasi-experimental) adj3 (study or studies or trial*)).ti,ab,kw.	19	
	35	trial.ti,kw.	18	
	36	or/19-35	11045	Combination line for intervention concept combined with OR
	37	8 and 18 and 36	61	Combination line: ABI AND MHA AND Intervention

	38	limit 37 to yr="2015 - current"	24	Limited to 2015 to current

DECISION-MAP Search Equation – PsycINFO (EBSCOhost)				
ABI	S1	DE "Brain Injuries" OR DE "Traumatic Brain Injury" OR DE "Brain Concussion" OR DE "Post-Concussive Symptoms" OR DE "Brain Damage" OR DE "Head Injuries" OR DE "Cerebral Ischemia" OR DE "Cerebral Infarction" OR DE "Cerebrovascular Accidents" OR DE "Anoxia" OR DE "Cerebral Hemorrhage"	77,471	Subject headings for ABI
	S2	TI (("traumatic brain injur*" OR "tbi" OR "neurotrauma*" OR "neuro-trauma*")) OR AB (("traumatic brain injur*" OR "tbi" OR "neurotrauma*" OR "neuro-trauma*")) OR KW (("traumatic brain injur*" OR "tbi" OR "neurotrauma*" OR "neuro-trauma*"))	21,479	Keyword terms including acronyms The concussion search string from the following paper were adapted and used: Schneider et al. (in press). The Amsterdam 2022 Process: A Summary of the Methodology for the 6th International Consensus Conference on Concussion in Sport. British Journal of Sports Medicine.
	S3	TI (("head" N2 ("injur*" OR "impact*" OR "trauma*"))) OR AB (("head" N2 ("injur*" OR "impact*" OR "trauma*"))) OR KW (("head" N2 ("injur*" OR "impact*" OR "trauma*")))	9,132	
	S4	TI (("brain" N2 ("injur*" OR "impact*" OR "trauma*"))) OR AB (("brain" N2 ("injur*" OR "impact*" OR "trauma*"))) OR KW (("brain" N2 ("injur*" OR "impact*" OR "trauma*")))	35,946	
	S5	TI (("concussion*" OR "concussed" OR "concussive" OR "mild traumatic brain injur*" OR "mtbi")) OR AB (("concussion*" OR "concussed" OR "concussive" OR "mild traumatic brain injur*" OR "mtbi")) OR KW (("concussion*" OR "concussed" OR "concussive" OR "mild traumatic brain injur*" OR "mtbi"))	6,809	
	S6	TI (("craniocerebral" N2 ("trauma*" OR "injur*"))) OR AB (("craniocerebral" N2 ("trauma*" OR "injur*"))) OR KW (	211	

		("craniocerebral" N2 ("trauma*" OR "injur*")))		
	S7	TI (("acquired brain injur*" OR "abi" OR "non-traumatic brain injur*" OR "non traumatic brain injur*" OR "stroke" OR "brain damage" OR "cerebrovascular event*" OR "cerebrovascular accident*")) OR AB (("acquired brain injur*" OR "abi" OR "non-traumatic brain injur*" OR "non traumatic brain injur*" OR "stroke" OR "brain damage" OR "cerebrovascular event*" OR "cerebrovascular accident*")) OR KW (("acquired brain injur*" OR "abi" OR "non-traumatic brain injur*" OR "non traumatic brain injur*" OR "stroke" OR "brain damage" OR "cerebrovascular event*" OR "cerebrovascular accident*"))	50,842	
	S8	TI (("brain injur*" N2 ("hypoxic" OR "hypoxia" OR "anoxic" OR "ischemia" OR "ischemic"))) OR AB (("brain injur*" N2 ("hypoxic" OR "hypoxia" OR "anoxic" OR "ischemia" OR "ischemic"))) OR KW (("brain injur*" N2 ("hypoxic" OR "hypoxia" OR "anoxic" OR "ischemia" OR "ischemic")))	1,070	
	S9	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8	105,254	Combination line for brain injury concept combined with OR
MHA	S10	DE "Mental Health" OR DE "Mental Disorders" OR DE "Affective Disorders" OR DE "Anxiety Disorders" OR DE "Bipolar Disorder" OR DE "Borderline States" OR DE "Chronic Mental Illness" OR DE "Dissociative Disorders" OR DE "Attention Deficit Disorder" OR DE "Emotional and Behavioral Disorders "OR DE "Obsessive Compulsive Disorder" OR DE "Personality Disorders" OR DE "Psychosis" OR DE "Serious Mental Illness" OR DE "Sleep Wake Disorders" OR DE "Somatoform Disorders" OR DE "Stress and Trauma Related Disorders" OR DE "Thought Disorders" OR DE "Serious Mental Illness" OR DE "Major Depression" OR DE "Persistent Depressive Disorder" OR DE "Schizophrenia"	954,263	Subject heading for mental health and mental disorders

		OR DE "Acute Schizophrenia" OR DE "Schizoaffective Disorder" OR DE "Schizophreniform Disorder" OR DE "Nonsuicidal Self-Injury" OR DE "Self-Inflicted Wounds" OR DE "Suicide" OR DE "Conversion Disorder" OR DE "Psychosis" OR DE "Affective Psychosis" OR DE		
	S11	DE "Substance Related and Addictive Disorders" OR DE "Addiction" OR DE "Drug Addiction" OR DE "Substance Use Disorder" OR DE "Alcohol Use Disorder" OR DE "Alcohol Abuse" OR DE "Cannabis Use Disorder" OR DE "Drug Abuse" OR DE "Drug Dependency" OR DE "Opioid Use Disorder" OR DE "Tobacco Use Disorder" OR DE "Substance Induced Psychotic Disorders"	108,644	Substance use and addiction related subject headings
	S12	TI (("mental*" N2 ("disorder*" OR "illness*" OR "ill-health"))) OR AB (("mental*" N2 ("disorder*" OR "illness*" OR "ill-health"))) OR KW (("mental*" N2 ("disorder*" OR "illness*" OR "ill-health")))	123,733	Proximity operators for key MH related terms
	S13	TI (("psychological*" N2 ("disorder*" OR "illness*" OR "distress" OR "dysfunction"))) OR AB (("psychological*" N2 ("disorder*" OR "illness*" OR "distress" OR "dysfunction"))) OR KW (("psychological*" N2 ("disorder*" OR "illness*" OR "distress" OR "dysfunction")))		
	S14	TI "addiction*" OR AB "addiction*" OR KW "addiction*"	51,850	Keyword for addiction as a category term
	S15	TI (("substance*" N2 ("use*" OR "abuse*" OR "misuse*"))) OR AB (("substance*" N2 ("use*" OR "abuse*" OR "misuse*"))) OR KW (("substance*" N2 ("use*" OR "abuse*" OR "misuse*")))	85,328	Proximity operators for key addiction related terms
	S16	TI (("drug*" N2 ("use*" OR "abuse*" OR "misuse*"))) OR AB (("drug*" N2 ("use*" OR "abuse*" OR "misuse*"))) OR KW (("drug*" N2 ("use*" OR "abuse*" OR "misuse*")))	77,909	
	S17	TI (("overdose*" N1 ("drug*" OR "substance*" OR "opiate*" OR "opioid*"))) OR AB (("overdose*"	2,756	

		N1 ("drug*" OR "substance*" OR "opiate*" OR "opioid*"))) OR KW (("overdose*" N1 ("drug*" OR "substance*" OR "opiate*" OR "opioid*")))		
	S18	TI (("dependence" N2 ("drug*" OR "substance*" OR "physical" OR "psychological"))) OR AB (("dependence" N2 ("drug*" OR "substance*" OR "physical" OR "psychological"))) OR KW (("dependence" N2 ("drug*" OR "substance*" OR "physical" OR "psychological")))	10,669	
	S19	TI (("affective disorder*" OR "agoraphobia" OR "anxiety*" OR "anxiety disorder*" OR "acute stress" OR "depression*" OR "depressed" OR "depressive disorder*" OR "dysthymia" OR "generalized anxiety disorder" OR "gad" OR "mania" OR "mood disorder*" OR "mdd" OR "major depression" OR "moderate depression" OR "depressive symptom*" OR "obsessive compulsive disorder" OR "obsessive-compulsive disorder" OR "ocd" OR "psychosis" OR "phobias" OR "phobic disorder*" OR "panic disorder*" OR "panic attack*" OR "post-traumatic stress" OR "post-traumatic stress disorder" OR "ptsd" OR "social anxiety disorder")) OR AB (("affective disorder*" OR "agoraphobia" OR "anxiety*" OR "anxiety disorder*" OR "acute stress" OR "depression*" OR "depressed" OR "depressive disorder*" OR "dysthymia" OR "generalized anxiety disorder" OR "gad" OR "mania" OR "mood disorder*" OR "mdd" OR "major depression" OR "moderate depression" OR "depressive symptom*" OR "obsessive compulsive disorder" OR "obsessive-compulsive disorder" OR "ocd" OR "psychosis" OR "phobias" OR "phobic disorder*" OR "panic disorder*" OR "panic attack*" OR "post-traumatic stress" OR "post-traumatic stress disorder" OR "ptsd" OR "social anxiety disorder")) OR KW (("affective disorder*" OR	570,920	Keyword terms including acronyms, MH disorders [1]Research (see Scholten et al. 2006 for SR) indicates that anxiety disorders (namely, generalized anxiety disorder, acute stress disorder, panic disorder, agoraphobia, specific phobia, social phobia, obsessive-compulsive disorder [OCD], and PTSD) and depressive disorders (dysthymia, bipolar disorder, and MDD) are the most commonly observed MH disorders following ABI.

		"agoraphobia" OR "anxiety*" OR "anxiety disorder*" OR "acute stress" OR "depression*" OR "depressed" OR "depressive disorder*" OR "dysthymia" OR "generalized anxiety disorder" OR "gad" OR "mania" OR "mood disorder*" OR "mdd" OR "major depression" OR "moderate depression" OR "depressive symptom*" OR "obsessive compulsive disorder" OR "obsessive-compulsive disorder" OR "ocd" OR "psychosis" OR "phobias" OR "phobic disorder*" OR "panic disorder*" OR "panic attack*" OR "post-traumatic stress" OR "post-traumatic stress disorder" OR "ptsd" OR "social anxiety disorder"))		
	S20	TI (("addictive behaviour*" OR "polysubstance addiction*" OR "dual addiction" OR "substance use disorder*" OR "sud")) OR AB (("addictive behaviour*" OR "polysubstance addiction*" OR "dual addiction" OR "substance use disorder*" OR "sud")) OR KW (("addictive behaviour*" OR "polysubstance addiction*" OR "dual addiction" OR "substance use disorder*" OR "sud"))	20,360	Keyword terms including acronyms, addiction
	S21	S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20	1,386,989	Combination line for MHA concept combined with OR
Intervention	S22	(DE "Mental Health Program Evaluation") OR (DE "Treatment Guidelines")	11,345	Relevant subject headings
	S23	TI (("experimental" OR "evaluat*" OR "impact*" OR "assess*" OR "dif-dif" OR "PSM" OR "double difference" OR "difference-in-difference" OR "RDD" OR "difference in difference" OR "statistical matching*" OR "propensity score matching" OR "covariate matching" OR "coarsened-exact matching" OR "propensity weighted" OR "regression analysis" OR "multiple regression" OR "statistical regression" OR "regression discontinuity*" OR "experimental design" OR "cohort analysis" OR "quantitative method*" OR	2,292,259	Search terms describing impact evaluations adapted from Barretta et al.'s (2021) evidence map on energy efficiency impact evaluations

		"qualitative method*" OR "program evaluation" OR "program development" OR "interrupted time series" OR "ITS" OR ("before" N5 "after") OR ("pre" N5 "post") OR (("pretest" OR "pre test") and ("posttest" OR "post test")) OR ((("fixed effect*" OR "random effect*") N3 ("model" OR "estimation")) OR "instrumental variable" OR "synthetic control") OR (("quantitative" OR "comparison group*" OR "counterfactual" OR "counter factual" OR "counter-factual" OR "experiment*") N3 ("design" OR "study" OR "analysis")))) OR AB (("experimental" OR "evaluat*" OR "impact*" OR "assess*" OR "dif-dif" OR "PSM" OR "double difference" OR "difference-in-difference" OR "RDD" OR "difference in difference" OR "statistical matching*" OR "propensity score matching" OR "covariate matching" OR "coarsened-exact matching" OR "propensity weighted" OR "regression analysis" OR "multiple regression" OR "statistical regression" OR "regression discontinuity*" OR "experimental design" OR "cohort analysis" OR "quantitative method*" OR "qualitative method*" OR "program evaluation" OR "program development" OR "interrupted time series" OR "ITS" OR ("before" N5 "after") OR ("pre" N5 "post") OR (("pretest" OR "pre test") and ("posttest" OR "post test")) OR ((("fixed effect*" OR "random effect*") N3 ("model" OR "estimation")) OR "instrumental variable" OR "synthetic control") OR (("quantitative" OR "comparison group*" OR "counterfactual" OR "counter factual" OR "counter-factual" OR "experiment*") N3 ("design" OR "study" OR "analysis")))) OR KW (("experimental" OR "evaluat*" OR "impact*" OR "assess*" OR "dif-dif" OR "PSM" OR "double difference" OR "difference-in-difference" OR		

		"RDD" OR "difference in difference" OR "statistical matching*" OR "propensity score matching" OR "covariate matching" OR "coarsened-exact matching" OR "propensity weighted" OR "regression analysis" OR "multiple regression" OR "statistical regression" OR "regression discontinuity*" OR "experimental design" OR "cohort analysis" OR "quantitative method*" OR "qualitative method*" OR "program evaluation" OR "program development" OR "interrupted time series" OR "ITS" OR ("before" N5 "after") OR ("pre" N5 "post") OR (("pretest" OR "pre test") and ("posttest" OR "post test")) OR ((("fixed effect*" OR "random effect*") N3 ("model" OR "estimation")) OR "instrumental variable" OR "synthetic control") OR (("quantitative" OR "comparison group*" OR "counterfactual" OR "counter factual" OR "counter-factual" OR "experiment*") N3 ("design" OR "study" OR "analysis"))))		
	S24	(((MH "Experimental Studies+") OR (MH "Multicenter Studies") OR (MH "Random Sample+") OR (MH "Placebos") OR (MH "Control (Research)+") OR (MH "Crossover Design") OR ((TI random* OR AB random*) OR (TI sham OR AB sham) OR (TI placebo* OR AB placebo*)) OR (((TI singl* OR AB singl*) OR (TI doubl* OR AB doubl*)) W1 ((TI blind* OR AB blind*) OR (TI dumm* OR AB dumm*) OR (TI mask* OR AB mask*))) OR (((TI tripl* OR AB tripl*) OR (TI trebl* OR AB trebl*)) W1 ((TI blind* OR AB blind*) OR (TI dumm* OR AB dumm*) OR (TI mask* OR AB mask*))) OR ((TI control* OR AB control*) N3 ((TI study OR AB study) OR (TI studies OR AB studies) OR (TI trial* OR AB trial*) OR (TI group* OR AB group*))) OR ((TI clinical OR AB clinical) N3 ((TI study OR AB study) OR (TI studies OR AB studies) OR (TI trial* OR AB trial*))) OR ((TI	473,358	Search string for clinical trails (ALL) adapted from CADTH (2021). All Clinical Trials - MEDLINE, Embase, PsycInfo. In: CADTH Search Filters Database. Ottawa: CADTH; 2023: https://searchfilters.cadth.ca/link/34. Accessed 2023-01-04.

		Nonrandom* OR AB Nonrandom*) OR (TI "non random*" OR AB "non random*") OR (TI "non-random*" OR AB "non-random*") OR (TI "quasi-random*" OR AB "quasi-random*") OR (TI quasirandom* OR AB quasirandom*)) OR ((TI phase OR AB phase) N3 ((TI study OR AB study) OR (TI studies OR AB studies) OR (TI trial* OR AB trial*))) OR (((TI crossover OR AB crossover) OR (TI "cross-over" OR AB "cross-over")) N3 ((TI study OR AB study) OR (TI studies OR AB studies) OR (TI trial* OR AB trial*))) OR (((TI multicent* OR AB multicent*) OR (TI "multi-cent*" OR AB "multi-cent*")) N3 ((TI study OR AB study) OR (TI studies OR AB studies) OR (TI trial* OR AB trial*))) OR (TI allocated OR AB allocated) OR (((TI "open label" OR AB "open label") OR (TI "open-label" OR AB "open-label")) N5 ((TI study OR AB study) OR (TI studies OR AB studies) OR (TI trial* OR AB trial*))) OR (((TI equivalence OR AB equivalence) OR (TI superiority OR AB superiority) OR (TI "non-inferiority" OR AB "non-inferiority") OR (TI noninferiority OR AB noninferiority)) N3 ((TI study OR AB study) OR (TI studies OR AB studies) OR (TI trial* OR AB trial*))) OR ((TI "pragmatic study" OR AB "pragmatic study") OR (TI "pragmatic studies" OR AB "pragmatic studies")) OR (((TI pragmatic OR AB pragmatic) OR (TI practical OR AB practical)) N3 (TI trial* OR AB trial*)) OR (((TI quasiexperimental OR AB quasiexperimental) OR (TI "quasi-experimental" OR AB "quasi-experimental")) N3 ((TI study OR AB study) OR (TI studies OR AB studies) OR (TI trial* OR AB trial*))) OR TI trial)		
	S25	S22 OR S23 OR S24	2,478,252	Combination line for intervention concept combined with OR
	S26	S9 AND S21 AND S25	16,008	Combination line: ABI AND MHA AND Intervention

	46	Limit publication Year: 2015–2023, limit to academic journal articles	5,726	Final result after limiting by publication date and type

DECISION-MAP Search Equation – CINHAL Complete (EBSCOhost)				
ABI	S1	(MH "Brain Injuries+") OR (MH "Brain Concussion+") OR (MH "Brain Contusions+") OR (MH "Brain Damage, Chronic+") OR (MH "Hypoxia-Ischemia, Brain+") OR (MH "Head Injuries+") OR (MH "Stroke+")	85,863	Subject headings for ABI
	S2	TI (("traumatic brain injur*" OR "tbi" OR "neurotrauma*" OR "neuro-trauma*")) OR AB (("traumatic brain injur*" OR "tbi" OR "neurotrauma*" OR "neuro-trauma*"))	20,613	Keyword terms including acronyms, The concussion search string from the following paper were adapted and used: Schneider et al. (in press). The Amsterdam 2022 Process: A Summary of the Methodology for the 6th International Consensus Conference on Concussion in Sport. British Journal of Sports Medicine.
	S3	TI (("head" N2 ("injur*" OR "impact*" OR "trauma*"))) OR AB (("head" N2 ("injur*" OR "impact*" OR "trauma*")))	11,948	
	S4	TI (("brain" N2 ("injur*" OR "impact*" OR "trauma*"))) OR AB (("brain" N2 ("injur*" OR "impact*" OR "trauma*")))	31,910	
	S5	TI (("concussion*" OR "concussed" OR "concussive" OR "mild traumatic brain injur*" OR "mtbi")) OR AB (("concussion*" OR "concussed" OR "concussive" OR "mild traumatic brain injur*" OR "mtbi"))	8,623	
	S6	TI (("craniocerebral" N2 ("trauma*" OR "injur*"))) OR AB (("craniocerebral" N2 ("trauma*" OR "injur*")))	206	
	S7	TI (("acquired brain injur*" OR "abi" OR "non-traumatic brain injur*" OR "non traumatic brain injur*" OR "stroke" OR "brain damage" OR "cerebrovascular event*" OR "cerebrovascular accident*")) OR AB (("acquired brain injur*" OR "abi" OR "non-traumatic brain injur*" OR "non traumatic brain injur*" OR "stroke" OR "brain damage" OR "cerebrovascular event*" OR "cerebrovascular accident*"))	119,862	
	S8	TI (("brain injur*" N2 ("hypoxic" OR "hypoxia" OR "anoxic" OR "ischemia" OR "ischemic"))) OR AB (("brain injur*" N2 ("hypoxic" OR "hypoxia" OR "anoxic" OR "ischemia" OR "ischemic")))	1,253	
	S9	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8	188,397	Combination line for brain injury concept combined with OR
MHA	S10	(MH "Mental Health") OR (MH "Research, Mental Health" OR MH "Behavioral Symptoms") OR (MH "Affective Symptoms+") OR (MH "Agitation") OR (MH "Communicative Disorders+") OR (MH	664,008	Subject heading for mental health and mental disorders

		"Compulsive Behavior+") OR (MH "Eating Disorders+") OR (MH "Social Behavior Disorders+") OR (MH "Stress+") OR (MH "Suicide+") OR (MH "Adjustment Disorders+") OR (MH "Mental Disorders, Chronic") OR (MH "Organic Mental Disorders+") OR (MH "Neurotic Disorders+") OR (MH "Personality Disorders+") OR (MH "Psychotic Disorders+") OR (MH "Psychological Trauma+")		
	S11	(MH "Behavior, Addictive") OR (MH "Drug-Seeking Behavior") OR (MH "Substance Dependence+") OR (MH "Substance Use Disorders+")	190,698	Substance use and addiction related subject headings
	S12	TI (("mental*" N2 ("disorder*" OR "illness*" OR "ill-health"))) OR AB (("mental*" N2 ("disorder*" OR "illness*" OR "ill-health")))	45,844	Proximity operators for key MH related terms
	S13	TI (("psychological*" N2 ("disorder*" OR "illness*" OR "distress" OR "dysfunction"))) OR AB (("psychological*" N2 ("disorder*" OR "illness*" OR "distress" OR "dysfunction")))	17,717	
	S14	TI "addiction*" OR AB "addiction*"	25,150	Keyword for addiction as a category term
	S15	TI (("substance*" N2 ("use*" OR "abuse*" OR "misuse*"))) OR AB (("substance*" N2 ("use*" OR "abuse*" OR "misuse*")))	47,557	Proximity operators for key addiction related terms
	S16	TI (("drug*" N2 ("use*" OR "abuse*" OR "misuse*"))) OR AB (("drug*" N2 ("use*" OR "abuse*" OR "misuse*")))	59,464	
	S17	TI (("overdose*" N1 ("drug*" OR "substance*" OR "opiate*" OR "opioid*"))) OR AB (("overdose*" N1 ("drug*" OR "substance*" OR "opiate*" OR "opioid*")))	4,255	
	S18	TI (("dependence" N2 ("drug*" OR "substance*" OR "physical" OR "psychological"))) OR AB (("dependence" N2 ("drug*" OR "substance*" OR "physical" OR "psychological")))	3,866	
	S19	TI (("affective disorder*" OR "agoraphobia" OR "anxiety*" OR "anxiety disorder*" OR "acute stress" OR "depression*" OR "depressed" OR "depressive disorder*" OR "dysthymia" OR "generalized anxiety disorder" OR "gad" OR "mania" OR "mood disorder*" OR "mdd" OR "major depression" OR "moderate depression" OR "depressive symptom*" OR "obsessive compulsive disorder" OR "obsessive-compulsive disorder" OR "ocd" OR "psychosis" OR "phobias" OR "phobic disorder*" OR "panic disorder*" OR "panic attack*" OR "post-traumatic stress" OR "post-traumatic stress disorder" OR "ptsd" OR "social anxiety disorder")) OR AB (("affective disorder*" OR "agoraphobia" OR "anxiety*" OR "anxiety disorder*" OR "acute stress" OR "depression*" OR "depressed" OR "depressive	262,736	Keyword terms including acronyms, MH disorders [1]Research (see Scholten et al. 2006 for SR) indicates that anxiety disorders (namely, generalized anxiety disorder, acute stress disorder, panic disorder, agoraphobia, specific phobia, social phobia, obsessive-compulsive

		disorder*" OR "dysthymia" OR "generalized anxiety disorder" OR "gad" OR "mania" OR "mood disorder*" OR "mdd" OR "major depression" OR "moderate depression" OR "depressive symptom*" OR "obsessive compulsive disorder" OR "obsessive-compulsive disorder" OR "ocd" OR "psychosis" OR "phobias" OR "phobic disorder*" OR "panic disorder*" OR "panic attack*" OR "post-traumatic stress" OR "post-traumatic stress disorder" OR "ptsd" OR "social anxiety disorder"))		disorder [OCD], and PTSD) and depressive disorders (dysthymia, bipolar disorder, and MDD) are the most commonly observed MH disorders following ABI.
	S20	TI (("addictive behaviour*" OR "polysubstance addiction*" OR "dual addiction" OR "substance use disorder*" OR "sud")) OR AB (("addictive behaviour*" OR "polysubstance addiction*" OR "dual addiction" OR "substance use disorder*" OR "sud"))	12,638	Keyword terms including acronyms, addiction
	S21	S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20	965,433	Combination line for MHA concept combined with OR
Intervention	S22	TI (("experimental" OR "evaluat*" OR "impact*" OR "assess*" OR "dif-dif" OR "PSM" OR "double difference" OR "difference-in-difference" OR "RDD" OR "difference in difference" OR "statistical matching*" OR "propensity score matching" OR "covariate matching" OR "coarsened-exact matching" OR "propensity weighted" OR "regression analysis" OR "multiple regression" OR "statistical regression" OR "regression discontinuity*" OR "experimental design" OR "cohort analysis" OR "quantitative method*" OR "qualitative method*" OR "program evaluation" OR "program development" OR "interrupted time series" OR "ITS" OR ("before" N5 "after") OR ("pre" N5 "post") OR (("pretest" OR "pre test") and ("posttest" OR "post test")) OR ((("fixed effect*" OR "random effect*") N3 ("model" OR "estimation")) OR "instrumental variable" OR "synthetic control") OR (("quantitative" OR "comparison group*" OR "counterfactual" OR "counter factual" OR "counter-factual" OR "experiment*") N3 ("design" OR "study" OR "analysis")))) OR AB (("experimental" OR "evaluat*" OR "impact*" OR "assess*" OR "dif-dif" OR "PSM" OR "double difference" OR "difference-in-difference" OR "RDD" OR "difference in difference" OR "statistical matching*" OR "propensity score matching" OR "covariate matching" OR "coarsened-exact matching" OR "propensity weighted" OR "regression analysis" OR "multiple regression" OR "statistical regression" OR "regression discontinuity*" OR "experimental design" OR "cohort analysis" OR "quantitative method*" OR "qualitative method*" OR "program	2,386,592	Search terms describing impact evaluations adapted from Barretta et al.'s (2021) evidence map on energy efficiency impact evaluations

		evaluation" OR "program development" OR "interrupted time series" OR "ITS" OR ("before" N5 "after") OR ("pre" N5 "post") OR (("pretest" OR "pre test") and ("posttest" OR "post test")) OR ((("fixed effect*" OR "random effect*") N3 ("model" OR "estimation")) OR "instrumental variable" OR "synthetic control") OR (("quantitative" OR "comparison group*" OR "counterfactual" OR "counter factual" OR "counter-factual" OR "experiment*") N3 ("design" OR "study" OR "analysis"))))		
	S23	(((MH "Experimental Studies+") OR (MH "Multicenter Studies") OR (MH "Random Sample+") OR (MH "Placebos") OR (MH "Control (Research)+") OR (MH "Crossover Design") OR ((TI random* OR AB random*) OR (TI sham OR AB sham) OR (TI placebo* OR AB placebo*)) OR (((TI singl* OR AB singl*) OR (TI doubl* OR AB doubl*)) W1 ((TI blind* OR AB blind*) OR (TI dumm* OR AB dumm*) OR (TI mask* OR AB mask*))) OR (((TI tripl* OR AB tripl*) OR (TI trebl* OR AB trebl*)) W1 ((TI blind* OR AB blind*) OR (TI dumm* OR AB dumm*) OR (TI mask* OR AB mask*))) OR ((TI control* OR AB control*) N3 ((TI study OR AB study) OR (TI studies OR AB studies) OR (TI trial* OR AB trial*) OR (TI group* OR AB group*))) OR ((TI clinical OR AB clinical) N3 ((TI study OR AB study) OR (TI studies OR AB studies) OR (TI trial* OR AB trial*))) OR ((TI Nonrandom* OR AB Nonrandom*) OR (TI "non random*" OR AB "non random*") OR (TI "non-random*" OR AB "non-random*") OR (TI "quasi-random*" OR AB "quasi-random*") OR (TI quasirandom* OR AB quasirandom*)) OR ((TI phase OR AB phase) N3 ((TI study OR AB study) OR (TI studies OR AB studies) OR (TI trial* OR AB trial*))) OR (((TI crossover OR AB crossover) OR (TI "cross-over" OR AB "cross-over")) N3 ((TI study OR AB study) OR (TI studies OR AB studies) OR (TI trial* OR AB trial*))) OR (((TI multicent* OR AB multicent*) OR (TI "multi-cent*" OR AB "multi-cent*")) N3 ((TI study OR AB study) OR (TI studies OR AB studies) OR (TI trial* OR AB trial*))) OR (TI allocated OR AB allocated) OR (((TI "open label" OR AB "open label") OR (TI "open-label" OR AB "open-label")) N5 ((TI study OR AB study) OR (TI studies OR AB studies) OR (TI trial* OR AB trial*))) OR (((TI equivalence OR AB equivalence) OR (TI superiority OR AB superiority) OR (TI "non-inferiority" OR AB "non-inferiority") OR (TI noninferiority OR AB noninferiority)) N3 ((TI study OR AB study) OR (TI studies OR AB studies) OR (TI trial* OR AB trial*))) OR ((TI "pragmatic study"	1,224,209	Search string for clinical trails (ALL) adapted from CADTH (2021). All Clinical Trials - MEDLINE, Embase, PsycInfo. In: CADTH Search Filters Database. Ottawa: CADTH; 2023: https://searchfilters.cadth.ca/link/34. Accessed 2023-01-04.

		OR AB "pragmatic study") OR (TI "pragmatic studies" OR AB "pragmatic studies")) OR (((TI pragmatic OR AB pragmatic) OR (TI practical OR AB practical)) N3 (TI trial* OR AB trial*)) OR (((TI quasiexperimental OR AB quasiexperimental) OR (TI "quasi-experimental" OR AB "quasi-experimental")) N3 ((TI study OR AB study) OR (TI studies OR AB studies) OR (TI trial* OR AB trial*))) OR TI trial)		
	S24	S22 OR S23	2,908,413	Combination line for intervention concept combined with OR
	S25	S9 AND S21 AND S24	14,213	Combination line: ABI AND MHA AND Intervention
	S26	Published Date: 20150101-20230431	7,320	Limited to 2015 to current and limit to academic journals
	S27	(MH "Animals+")	35,702	Animal filter
	S28	(MH "Human")	1,188,722	
	S29	S27 NOT S28	33,074	
	S30	S26 NOT S29	7,258	Final result after exclusion of animals

DECISION-MAP Search Equation – Web of Science (Clarivate)				
ABI	1	TS=((("traumatic brain injur*" OR "tbi" OR "neurotrauma*" OR "neuro-trauma*")))	80741	Keyword terms including acronyms The concussion search string from the following paper were adapted and used: Schneider et al. (in press). The Amsterdam 2022 Process: A Summary of the Methodology for the 6th International Consensus Conference on Concussion in Sport. British Journal of Sports Medicine.
	2	TS=((("head" NEAR/2 ("injur*" OR "impact*" OR "trauma*"))))	56369	
	3	TS=((("brain" NEAR/2 ("injur*" OR "impact*" OR "trauma*"))))	135280	
	4	TS=((("concussion*" OR "concussed" OR "concussive" OR "mild traumatic brain injur*" OR "mtbi")))	22235	
	5	TS=((("craniocerebral" NEAR/2 ("trauma*" OR "injur*"))))	1958	
	6	TS=((("acquired brain injur*" OR "abi" OR "non-traumatic brain injur*" OR "non traumatic brain injur*" OR "stroke" OR "brain damage" OR "cerebrovascular event*" OR "cerebrovascular accident*")))	458546	

	7	TS=((("brain injur*" NEAR/2 ("hypoxic" OR "hypoxia" OR "anoxic" OR "ischemia" OR "ischemic"))))	8339	
	8	#7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1	612895	
MHA	9	TS=((("mental*" NEAR/2 ("disorder*" OR "illness*" OR "ill-health"))))	127368	Proximity operators and keyword terms for MHA and related terms
	10	TS=((("psychological*" NEAR/2 ("disorder*" OR "illness*" OR "distress" OR "dysfunction"))))	52872	
	11	TS=("addiction*" OR AB "addiction*" OR KW "addiction*")	88512	
	12	TS=((("substance*" NEAR/2 ("use*" OR "abuse*" OR "misuse*"))))	127999	
	13	TS=((("drug*" NEAR/2 ("use*" OR "abuse*" OR "misuse*"))))	239109	
	14	TS=((("overdose*" NEAR/1 ("drug*" OR "substance*" OR "opiate*" OR "opioid*"))))	7115	
	15	TS=((("dependence" NEAR/2 ("drug*" OR "substance*" OR "physical" OR "psychological"))))	16127	
	16	TS=((("affective disorder*" OR "agoraphobia" OR "anxiety*" OR "anxiety disorder*" OR "acute stress" OR "depression*" OR "depressed" OR "depressive disorder*" OR "dysthymia" OR "generalized anxiety disorder" OR "gad" OR "mania" OR "mood disorder*" OR "mdd" OR "major depression" OR "moderate depression" OR "depressive symptom*" OR "obsessive compulsive disorder" OR "obsessive-compulsive disorder" OR "ocd" OR "psychosis" OR "phobias" OR "phobic disorder*" OR "panic disorder*" OR "panic attack*" OR "post-traumatic stress" OR "post-traumatic stress disorder" OR "ptsd" OR "social anxiety disorder")))	1054082	Keyword terms including acronyms, MH disorders [1]Research (see Scholten et al. 2006 for SR) indicates that anxiety disorders (namely, generalized anxiety disorder, acute stress disorder, panic disorder, agoraphobia, specific phobia, social phobia, obsessive-compulsive disorder [OCD], and PTSD) and depressive disorders (dysthymia, bipolar disorder, and MDD) are the most commonly observed MH disorders following ABI.
	17	TS=((("addictive behaviour*" OR "polysubstance addiction*" OR "dual addiction" OR "substance use disorder*" OR "sud")))	31327	Keyword terms, addiction
	18	#17 OR #16 OR #15 OR #14 OR #13 OR #12 OR #11 OR #10 OR #9	1489783	Combination line for MHA concept combined with OR

Intervention	19	TS=((("experimental" OR "evaluat*" OR "impact*" OR "assess*" OR "dif-dif" OR "PSM" OR "double difference" OR "difference-in-difference" OR "RDD" OR "difference in difference" OR "statistical matching*" OR "propensity score matching" OR "covariate matching" OR "coarsened-exact matching" OR "propensity weighted" OR "regression analysis" OR "multiple regression" OR "statistical regression" OR "regression discontinuity*" OR "experimental design" OR "cohort analysis" OR "quantitative method*" OR "qualitative method*" OR "program evaluation" OR "program development" OR "interrupted time series" OR "ITS" OR ("before" NEAR/5 "after") OR ("pre" NEAR/5 "post") OR (("pretest" OR "pre test") and ("posttest" OR "post test")) OR ((("fixed effect*" OR "random effect*") NEAR/3 ("model" OR "estimation")) OR "instrumental variable" OR "synthetic control") OR (("quantitative" OR "comparison group*" OR "counterfactual" OR "counter factual" OR "counter-factual" OR "experiment*") NEAR/3 ("design" OR "study" OR "analysis")))))	22017690	Search terms describing impact evaluations adapted from Barretta et al.'s (2021) evidence map on energy efficiency impact evaluations
	20	TS=(("pragmatic study" OR "pragmatic studies"))	777	
	21	TS=(("pragmatic" OR "practical") NEAR/1 "trial*")	3965	Search string for clinical trails (ALL) adapted from CADTH (2021). All Clinical Trials - MEDLINE, Embase, PsycInfo. In: CADTH Search Filters Database. Ottawa: CADTH; 2023: https://searchfilters.cadth.ca/link/34. Accessed 2023-01-04.
	22	TS=(("random*" OR "sham" OR "placebo*"))	2456472	
	23	TS=((("singl*" OR "doubl*") NEAR ("blind*" OR "dumm*" OR "mask*")))	356868	
	24	TS=((("tripl*" OR "trebl*") NEAR ("blind*" OR "dumm*" OR "mask*")))	2347	
	25	TS=(("control*" NEAR/3 ("study" OR "studies" OR "trial*" OR "group*")))	1422647	
	26	TS=(("clinical" NEAR/3 ("study" OR "studies" OR "trial*")))	815702	
	27	TS=(("Nonrandom*" OR "non random*" OR "non-random*" OR "quasi-random*" OR "quasirandom*"))	60250	
	28	TS=(("phase" NEAR/3 ("study" OR "studies" OR "trial*")))	291653	

	29	TS=((("crossover" OR "cross-over") NEAR/3 ("study" OR "studies" OR "trial*")))	50767	
	30	TS=((("multicent*" OR "multi-cent*") NEAR/3 ("study" OR "studies" OR "trial*")))	181741	
	31	TS=("allocated")	112498	
	32	TS=((("open label" OR "open-label") NEAR/5 ("study" OR "studies" OR "trial*")))	51899	
	33	TS=((("equivalence" OR "superiority" OR "non-inferiority" OR "noninferiority") NEAR/3 ("study" OR "studies" OR "trial*")))	16073	
	34	TS=((("quasiexperimental" OR "quasi-experimental") NEAR/3 ("study" OR "studies" OR "trial*")))	15625	
	35	TS=("trial")	1325040	
	36	#35 OR #34 OR #33 OR #32 OR #31 OR #30 OR #29 OR #28 OR #27 OR #26 OR #25 OR #24 OR #23 OR #22 OR #21 OR #20 OR #19	24080251	Combination line for intervention concept combined with OR
	45	#36 AND #18 AND #8	24,077	Combination line: ABI AND MHA AND Intervention
	46	#36 AND #18 AND #8 and 2020 or 2019 or 2018 or 2017 or 2016 or 2015 or 2021 or 2022 or 2023 (Publication Years)	13,290	Limited to 2015 to current
	47	NOT Document Types: Proceeding Paper or Meeting Abstract or Editorial Material or Letter or Book Review or News Item or Poetry or Software Review or Art Exhibit Review or Bibliography or Fiction, Creative Prose or Meeting or Film Review or Meeting Summary or Tv Review Radio Review Video or Music Score or TV Review, Radio Review Video or Dance Performance Review or Music Performance Review or Hardware Review or Theater Review or Biographical-Item or Note.	12,995	Final result after excluding irrelevant publication types

DECISION-MAP Search Equation – SCOPUS (Elsevier)				
ABI	1	TITLE-ABS-KEY (("traumatic brain injur*" OR "tbi" OR	77,778	Keyword terms including acronyms

		"neurotrauma*" OR "neuro-trauma*"))		
	2	TITLE-ABS-KEY (((("head") W/2 ("injur*" OR "impact*" OR "trauma*"))))	864	The concussion search string from the following paper were adapted and used: Schneider et al. (in press). The Amsterdam 2022 Process: A Summary of the Methodology for the 6th International Consensus Conference on Concussion in Sport. British Journal of Sports Medicine.
	3	TITLE-ABS-KEY (((("brain") W/2 ("injur*" OR "impact*" OR "trauma*"))))	1,947	
	4	TITLE-ABS-KEY ((("concussion*" OR "concussed" OR "concussive" OR "mild traumatic brain injur*" OR "mtbi")))	23,781	
	5	TITLE-ABS-KEY (((("craniocerebral") W/2 ("trauma*" OR "injur*"))))	58	
	6	TITLE-ABS-KEY ((("acquired brain injur*" OR "abi" OR "non-traumatic brain injur*" OR "non traumatic brain injur*" OR "stroke" OR "brain damage" OR "cerebrovascular event*" OR "cerebrovascular accident*")))	647,480	
	7	TITLE-ABS-KEY (((("brain injur*") W/2 ("hypoxic" OR "hypoxia" OR "anoxic" OR "ischemia" OR "ischemic"))))	245	
	8	(TITLE-ABS-KEY (((("brain injur*") W/2 ("hypoxic" OR "hypoxia" OR "anoxic" OR "ischemia" OR "ischemic"))))) OR (TITLE-ABS-KEY ((("acquired brain injur*" OR "abi" OR "non-traumatic brain injur*" OR "non traumatic brain injur*" OR "stroke" OR "brain damage" OR "cerebrovascular event*" OR "cerebrovascular accident*")))) OR (TITLE-ABS-KEY (((("craniocerebral") W/2 ("trauma*" OR "injur*"))))) OR (TITLE-ABS-KEY ((("concussion*" OR "concussed" OR "concussive" OR "mild traumatic brain injur*" OR "mtbi")))) OR (TITLE-ABS-KEY (((("brain") W/2 ("injur*" OR "impact*" OR "trauma*"))))) OR (TITLE-ABS-KEY (((("head") W/2 ("injur*" OR "impact*" OR "trauma*"))))) OR (TITLE-ABS-KEY (("traumatic brain injur*" OR "tbi"	728,077	Combination line for brain injury concept combined with OR

		OR "neurotrauma*" OR "neuro-trauma*")))		
MHA	9	TITLE-ABS-KEY (((("mental*") W/2 ("disorder*" OR "illness*" OR "ill-health"))))	702	Proximity operators for key MH related terms
	10	TITLE-ABS-KEY (((("psychological*") W/2 ("disorder*" OR "illness*" OR "distress" OR "dysfunction"))))	406	
	11	TITLE-ABS-KEY ("addiction*")	166,677	Keyword for addiction as a category term
	12	TITLE-ABS-KEY (((("substance*") W/2 ("use*" OR "abuse*" OR "misuse*"))))	1,436	Proximity operators for key addiction related terms
	13	TITLE-ABS-KEY (((("drug*") W/2 ("use*" OR "abuse*" OR "misuse*"))))	11,720	
	14	TITLE-ABS-KEY (((("overdose*") W/1 ("drug*" OR "substance*" OR "opiate*" OR "opioid*"))))	105	
	16	TITLE-ABS-KEY (((("dependence") W/2 ("drug*" OR "substance*" OR "physical" OR "psychological"))))	3,198	
	17	TITLE-ABS-KEY ((("affective disorder*" OR "agoraphobia" OR "anxiety*" OR "anxiety disorder*" OR "acute stress" OR "depression*" OR "depressed" OR "depressive disorder*" OR "dysthymia" OR "generalized anxiety disorder" OR "gad" OR "mania" OR "mood disorder*" OR "mdd" OR "major depression" OR "moderate depression" OR "depressive symptom*" OR "obsessive compulsive disorder" OR "obsessive-compulsive disorder" OR "ocd" OR "psychosis" OR "phobias" OR "phobic disorder*" OR "panic disorder*" OR "panic attack*" OR "post-traumatic stress" OR "post-traumatic stress disorder" OR "ptsd" OR "social anxiety disorder")))	1,442,707	Keyword terms including acronyms, MH disorders [1]Research (see Scholten et al. 2006 for SR) indicates that anxiety disorders (namely, generalized anxiety disorder, acute stress disorder, panic disorder, agoraphobia, specific phobia, social phobia, obsessive-compulsive disorder [OCD], and PTSD) and depressive disorders (dysthymia, bipolar disorder, and MDD) are the most commonly observed MH disorders following ABI.
	18	TITLE-ABS-KEY ((("addictive behaviour*" OR "polysubstance addiction*" OR "dual addiction" OR "substance use disorder*" OR "sud")))	35,682	Keyword terms including acronyms, addiction

	19	(TITLE-ABS-KEY ((((("dependence*") W/2 ("drug*" OR "substance*" OR "physical" OR "psychological")))))) OR (TITLE-ABS-KEY ((("addictive behaviour*" OR "polysubstance addiction*" OR "dual addiction" OR "substance use disorder*" OR "sud")))) OR (TITLE-ABS-KEY ((("affective disorder*" OR "agoraphobia" OR "anxiety*" OR "anxiety disorder*" OR "acute stress" OR "depression*" OR "depressed" OR "depressive disorder*" OR "dysthymia" OR "generalized anxiety disorder" OR "gad" OR "mania" OR "mood disorder*" OR "mdd" OR "major depression" OR "moderate depression" OR "depressive symptom*" OR "obsessive compulsive disorder" OR "obsessive-compulsive disorder" OR "ocd" OR "psychosis" OR "phobias" OR "phobic disorder*" OR "panic disorder*" OR "panic attack*" OR "post-traumatic stress" OR "post-traumatic stress disorder" OR "ptsd" OR "social anxiety disorder")))) OR (TITLE-ABS-KEY (((("dependence") W/2 ("drug*" OR "substance*" OR "physical" OR "psychological")))))) OR (TITLE-ABS-KEY (((("overdose*") W/1 ("drug*" OR "substance*" OR "opiate*" OR "opioid*"))))) OR (TITLE-ABS-KEY (((("drug*") W/2 ("use*" OR "abuse*" OR "misuse*"))))) OR (TITLE-ABS-KEY (((("substance*") W/2 ("use*" OR "abuse*" OR "misuse*"))))) OR (TITLE-ABS-KEY ("addiction*")) OR (TITLE-ABS-KEY (((("psychological*") W/2 ("disorder*" OR "illness*" OR "distress" OR "dysfunction"))))) OR (TITLE-ABS-KEY (((("mental*") W/2 ("disorder*" OR "illness*" OR "ill-health")))))	1,615,550	Combination line for MHA concept combined with OR
Intervention	20	TITLE-ABS-KEY ((("experimental" OR "evaluat*" OR	30,710,951	Search terms describing impact evaluations adapted from Barretta et al.'s

		"impact*" OR "assess*" OR "dif-dif" OR "PSM" OR "double difference" OR "difference-in-difference" OR "RDD" OR "difference in difference" OR "statistical matching*" OR "propensity score matching" OR "covariate matching" OR "coarsened-exact matching" OR "propensity weighted" OR "regression analysis" OR "multiple regression" OR "statistical regression" OR "regression discontinuity*" OR "experimental design" OR "cohort analysis" OR "quantitative method*" OR "qualitative method*" OR "program evaluation" OR "program development" OR "interrupted time series" OR "ITS" OR (("before") W/5 "after") OR (("pre") W/5 "post") OR (("pretest" OR "pre test") AND ("posttest" OR "post test")) OR ((("fixed effect*" OR ("random effect*")) W/3 ("model" OR "estimation")) OR "instrumental variable" OR "synthetic control") OR (("quantitative" OR "comparison group*" OR "counterfactual" OR "counter factual" OR "counter-factual" OR ("experiment*")) W/3 ("design" OR "study" OR "analysis")))))		(2021) evidence map on energy efficiency impact evaluations
	21	TITLE-ABS-KEY (random* OR sham OR placebo*) OR TITLE-ABS-KEY ((singl* OR doubl*) W/1 (blind* OR dumm* OR mask*)) OR TITLE-ABS-KEY ((tripl* OR trebl*) W/1 (blind* OR dumm* OR mask*)) OR TITLE-ABS-KEY ((control*) W/3 (study OR studies OR trial* OR group*)) OR TITLE-ABS-KEY ((clinical) W/3 (study OR studies OR trial*)) OR TITLE-ABS-KEY (nonrandom* OR "non random*" OR non-random* OR quasi-random* OR quasirandom*) OR TITLE-ABS-KEY ((phase) W/3 (study OR studies OR trial*)) OR TITLE-ABS-KEY ((crossover OR cross-over) W/3 (study OR		Search string for clinical trails (ALL) adapted from CADTH (2021). All Clinical Trials - Scopus. In: CADTH Search Filters Database. Ottawa: CADTH; 2023: https://searchfilters.cadth.ca/link/106. Accessed 2023-03-10.

		studies OR trial*)) OR TITLE-ABS-KEY ((multicent* OR multi-cent*) W/3 (study OR studies OR trial*)) OR TITLE-ABS (allocated) OR TITLE-ABS-KEY (("open label" OR open-label) W/5 (study OR studies OR trial*)) OR TITLE-ABS-KEY ((equivalence OR superiority OR non-inferiority OR noninferiority) W/3 (study OR studies OR trial*)) OR TITLE-ABS-KEY ("pragmatic study" OR "pragmatic studies") OR TITLE-ABS-KEY ((pragmatic OR practical) W/3 (trial*)) OR TITLE-ABS-KEY ((quasiexperimental OR quasi-experimental) W/3 (study OR studies OR trial*)) OR TITLE (trial) OR KEY (trial)		
	22	(TITLE-ABS-KEY (random* OR sham OR placebo*) OR TITLE-ABS-KEY ((singl* OR doubl*) W/1 (blind* OR dumm* OR mask*)) OR TITLE-ABS-KEY ((tripl* OR trebl*) W/1 (blind* OR dumm* OR mask*)) OR TITLE-ABS-KEY ((control*) W/3 (study OR studies OR trial* OR group*)) OR TITLE-ABS-KEY ((clinical) W/3 (study OR studies OR trial*)) OR TITLE-ABS-KEY (nonrandom* OR "non random*" OR non-random* OR quasi-random* OR quasirandom*) OR TITLE-ABS-KEY ((phase) W/3 (study OR studies OR trial*)) OR TITLE-ABS-KEY ((crossover OR cross-over) W/3 (study OR studies OR trial*)) OR TITLE-ABS-KEY ((multicent* OR multi-cent*) W/3 (study OR studies OR trial*)) OR TITLE-ABS (allocated) OR TITLE-ABS-KEY (("open label" OR open-label) W/5 (study OR studies OR trial*)) OR TITLE-ABS-KEY ((equivalence OR superiority OR non-inferiority OR noninferiority) W/3 (study OR studies OR trial*)) OR TITLE-ABS-KEY ("pragmatic study" OR "pragmatic studies") OR TITLE-ABS-KEY ((	37,214,522	Combination line for intervention concept combined with OR

		pragmatic OR practical) W/3 (trial*)) OR TITLE-ABS-KEY ((quasiexperimental OR quasi-experimental) W/3 (study OR studies OR trial*)) OR TITLE (trial) OR KEY (trial)) OR (TITLE-ABS-KEY ((("experimental" OR "evaluat*" OR "impact*" OR "assess*" OR "dif-dif" OR "PSM" OR "double difference" OR "difference-in-difference" OR "RDD" OR "difference in difference" OR "statistical matching*" OR "propensity score matching" OR "covariate matching" OR "coarsened-exact matching" OR "propensity weighted" OR "regression analysis" OR "multiple regression" OR "statistical regression" OR "regression discontinuity*" OR "experimental design" OR "cohort analysis" OR "quantitative method*" OR "qualitative method*" OR "program evaluation" OR "program development" OR "interrupted time series" OR "ITS" OR (("before") W/5 "after") OR (("pre") W/5 "post") OR (("pretest" OR "pre test") AND ("posttest" OR "post test")) OR ((("fixed effect*" OR ("random effect*")) W/3 ("model" OR "estimation")) OR "instrumental variable" OR "synthetic control") OR (("quantitative" OR "comparison group*" OR "counterfactual" OR "counter factual" OR "counter-factual" OR ("experiment*")) W/3 ("design" OR "study" OR "analysis"))))))		
	23	((TITLE-ABS-KEY (random* OR sham OR placebo*) OR TITLE-ABS-KEY ((singl* OR doubl*) W/1 (blind* OR dumm* OR mask*)) OR TITLE-ABS-KEY ((tripl* OR trebl*) W/1 (blind* OR dumm* OR mask*)) OR TITLE-ABS-KEY ((control*) W/3 (study OR studies OR trial* OR group*)) OR TITLE-ABS-KEY ((clinical) W/3 (study OR studies	49,143	Combination line: ABI AND MHA AND Intervention

		OR trial*)) OR TITLE-ABS-KEY (nonrandom* OR "non random*" OR non-random* OR quasi-random* OR quasirandom*) OR TITLE-ABS-KEY ((phase) W/3 (study OR studies OR trial*)) OR TITLE-ABS-KEY ((crossover OR cross-over) W/3 (study OR studies OR trial*)) OR TITLE-ABS-KEY ((multicent* OR multi-cent*) W/3 (study OR studies OR trial*)) OR TITLE-ABS (allocated) OR TITLE-ABS-KEY (("open label" OR open-label) W/5 (study OR studies OR trial*)) OR TITLE-ABS-KEY ((equivalence OR superiority OR non-inferiority OR noninferiority) W/3 (study OR studies OR trial*)) OR TITLE-ABS-KEY ("pragmatic study" OR "pragmatic studies") OR TITLE-ABS-KEY ((pragmatic OR practical) W/3 (trial*)) OR TITLE-ABS-KEY ((quasiexperimental OR quasi-experimental) W/3 (study OR studies OR trial*)) OR TITLE (trial) OR KEY (trial)) OR (TITLE-ABS-KEY ((("experimental" OR "evaluat*" OR "impact*" OR "assess*" OR "dif-dif" OR "PSM" OR "double difference" OR "difference-in-difference" OR "RDD" OR "difference in difference" OR "statistical matching*" OR "propensity score matching" OR "covariate matching" OR "coarsened-exact matching" OR "propensity weighted" OR "regression analysis" OR "multiple regression" OR "statistical regression" OR "regression discontinuity*" OR "experimental design" OR "cohort analysis" OR "quantitative method*" OR "qualitative method*" OR "program evaluation" OR "program development" OR "interrupted time series" OR "ITS" OR (("before") W/5 "after") OR (("pre") W/5 "post") OR (("pretest" OR "pre test") AND ("posttest" OR "post		

		test")) OR ((("fixed effect*" OR ("random effect*")) W/3 ("model" OR "estimation")) OR "instrumental variable" OR "synthetic control") OR (("quantitative" OR "comparison group*" OR "counterfactual" OR "counter factual" OR "counter-factual" OR ("experiment*")) W/3 ("design" OR "study" OR "analysis"))))))) AND ((TITLE-ABS-KEY ((((("dependence*") W/2 ("drug*" OR "substance*" OR "physical" OR "psychological")))))) OR (TITLE-ABS-KEY ((("addictive behaviour*" OR "polysubstance addiction*" OR "dual addiction" OR "substance use disorder*" OR "sud")))) OR (TITLE-ABS-KEY ((("affective disorder*" OR "agoraphobia" OR "anxiety*" OR "anxiety disorder*" OR "acute stress" OR "depression*" OR "depressed" OR "depressive disorder*" OR "dysthymia" OR "generalized anxiety disorder" OR "gad" OR "mania" OR "mood disorder*" OR "mdd" OR "major depression" OR "moderate depression" OR "depressive symptom*" OR "obsessive compulsive disorder" OR "obsessive-compulsive disorder" OR "ocd" OR "psychosis" OR "phobias" OR "phobic disorder*" OR "panic disorder*" OR "panic attack*" OR "post-traumatic stress" OR "post-traumatic stress disorder" OR "ptsd" OR "social anxiety disorder")))) OR (TITLE-ABS-KEY (((("dependence") W/2 ("drug*" OR "substance*" OR "physical" OR "psychological")))))) OR (TITLE-ABS-KEY (((("overdose*") W/1 ("drug*" OR "substance*" OR "opiate*" OR "opioid*"))))) OR (TITLE-ABS-KEY (((("drug*") W/2 ("use*" OR "abuse*" OR "misuse*"))))) OR (TITLE-ABS-KEY (((("substance*") W/2 ("use*" OR "abuse*" OR		

		"misuse*"))))) OR (TITLE-ABS-KEY ("addiction*")) OR (TITLE-ABS-KEY (((("psychological*") W/2 ("disorder*" OR "illness*" OR "distress" OR "dysfunction"))))) OR (TITLE-ABS-KEY (((("mental*") W/2 ("disorder*" OR "illness*" OR "ill-health")))))) AND ((TITLE-ABS-KEY (((("brain injur*") W/2 ("hypoxic" OR "hypoxia" OR "anoxic" OR "ischemia" OR "ischemic"))))) OR (TITLE-ABS-KEY ((("acquired brain injur*" OR "abi" OR "non-traumatic brain injur*" OR "non traumatic brain injur*" OR "stroke" OR "brain damage" OR "cerebrovascular event*" OR "cerebrovascular accident*")))) OR (TITLE-ABS-KEY (((("craniocerebral") W/2 ("trauma*" OR "injur*"))))) OR (TITLE-ABS-KEY ((("concussion*" OR "concussed" OR "concussive" OR "mild traumatic brain injur*" OR "mtbi")))) OR (TITLE-ABS-KEY (((("brain") W/2 ("injur*" OR "impact*" OR "trauma*"))))) OR (TITLE-ABS-KEY (((("head") W/2 ("injur*" OR "impact*" OR "trauma*"))))) OR (TITLE-ABS-KEY (("traumatic brain injur*" OR "tbi" OR "neurotrauma*" OR "neuro-trauma*"))))		
	24	((TITLE-ABS-KEY (random* OR sham OR placebo*) OR TITLE-ABS-KEY ((singl* OR doubl*) W/1 (blind* OR dumm* OR mask*)) OR TITLE-ABS-KEY ((tripl* OR trebl*) W/1 (blind* OR dumm* OR mask*)) OR TITLE-ABS-KEY ((control*) W/3 (study OR studies OR trial* OR group*)) OR TITLE-ABS-KEY ((clinical) W/3 (study OR studies OR trial*)) OR TITLE-ABS-KEY (nonrandom* OR "non random*" OR non-random* OR quasi-random* OR quasirandom*) OR TITLE-ABS-KEY ((phase) W/3 (study OR studies OR trial*)) OR	22,587	Publication date limited to 2015 – current; irrelevant publication types removed (i.e., note, book chapter, conference paper, short survey, book, conference review, retracted, and data paper)

		TITLE-ABS-KEY ((crossover OR cross-over) W/3 (study OR studies OR trial*)) OR TITLE-ABS-KEY ((multicent* OR multi-cent*) W/3 (study OR studies OR trial*)) OR TITLE-ABS (allocated) OR TITLE-ABS-KEY (("open label" OR open-label) W/5 (study OR studies OR trial*)) OR TITLE-ABS-KEY ((equivalence OR superiority OR non-inferiority OR noninferiority) W/3 (study OR studies OR trial*)) OR TITLE-ABS-KEY ("pragmatic study" OR "pragmatic studies") OR TITLE-ABS-KEY ((pragmatic OR practical) W/3 (trial*)) OR TITLE-ABS-KEY ((quasiexperimental OR quasi-experimental) W/3 (study OR studies OR trial*)) OR TITLE (trial) OR KEY (trial)) OR (TITLE-ABS-KEY ((("experimental" OR "evaluat*" OR "impact*" OR "assess*" OR "dif-dif" OR "PSM" OR "double difference" OR "difference-in-difference" OR "RDD" OR "difference in difference" OR "statistical matching*" OR "propensity score matching" OR "covariate matching" OR "coarsened-exact matching" OR "propensity weighted" OR "regression analysis" OR "multiple regression" OR "statistical regression" OR "regression discontinuity*" OR "experimental design" OR "cohort analysis" OR "quantitative method*" OR "qualitative method*" OR "program evaluation" OR "program development" OR "interrupted time series" OR "ITS" OR (("before") W/5 ("after")) OR (("pre") W/5 ("post")) OR (("pretest" OR "pre test") AND ("posttest" OR "post test")) OR ((("fixed effect*" OR ("random effect*")) W/3 ("model" OR "estimation")) OR "instrumental variable" OR "synthetic control") OR (("quantitative" OR "comparison		

		group*" OR "counterfactual" OR "counter factual" OR "counter-factual" OR ("experiment*")) W/3 ("design" OR "study" OR "analysis"))))))) AND ((TITLE-ABS-KEY ((((("dependence*") W/2 ("drug*" OR "substance*" OR "physical" OR "psychological")))))) OR (TITLE-ABS-KEY ((("addictive behaviour*" OR "polysubstance addiction*" OR "dual addiction" OR "substance use disorder*" OR "sud")))) OR (TITLE-ABS-KEY ((("affective disorder*" OR "agoraphobia" OR "anxiety*" OR "anxiety disorder*" OR "acute stress" OR "depression*" OR "depressed" OR "depressive disorder*" OR "dysthymia" OR "generalized anxiety disorder" OR "gad" OR "mania" OR "mood disorder*" OR "mdd" OR "major depression" OR "moderate depression" OR "depressive symptom*" OR "obsessive compulsive disorder" OR "obsessive-compulsive disorder" OR "ocd" OR "psychosis" OR "phobias" OR "phobic disorder*" OR "panic disorder*" OR "panic attack*" OR "post-traumatic stress" OR "post-traumatic stress disorder" OR "ptsd" OR "social anxiety disorder")))) OR (TITLE-ABS-KEY (((("dependence") W/2 ("drug*" OR "substance*" OR "physical" OR "psychological")))))) OR (TITLE-ABS-KEY (((("overdose*") W/1 ("drug*" OR "substance*" OR "opiate*" OR "opioid*"))))) OR (TITLE-ABS-KEY (((("drug*") W/2 ("use*" OR "abuse*" OR "misuse*"))))) OR (TITLE-ABS-KEY (((("substance*") W/2 ("use*" OR "abuse*" OR "misuse*"))))) OR (TITLE-ABS-KEY ("addiction*")) OR (TITLE-ABS-KEY (((("psychological*") W/2 ("disorder*" OR "illness*" OR "distress" OR "dysfunction")))))		

		OR (TITLE-ABS-KEY (((("mental*") W/2 ("disorder*" OR "illness*" OR "ill-health")))))) AND ((TITLE-ABS-KEY (((("brain injur*") W/2 ("hypoxic" OR "hypoxia" OR "anoxic" OR "ischemia" OR "ischemic"))))) OR (TITLE-ABS-KEY (((("acquired brain injur*" OR "abi" OR "non-traumatic brain injur*" OR "non traumatic brain injur*" OR "stroke" OR "brain damage" OR "cerebrovascular event*" OR "cerebrovascular accident*")))) OR (TITLE-ABS-KEY (((("craniocerebral") W/2 ("trauma*" OR "injur*"))))) OR (TITLE-ABS-KEY ((("concussion*" OR "concussed" OR "concussive" OR "mild traumatic brain injur*" OR "mtbi")))) OR (TITLE-ABS-KEY (((("brain") W/2 ("injur*" OR "impact*" OR "trauma*"))))) OR (TITLE-ABS-KEY (((("head") W/2 ("injur*" OR "impact*" OR "trauma*"))))) OR (TITLE-ABS-KEY (("traumatic brain injur*" OR "tbi" OR "neurotrauma*" OR "neuro-trauma*")))) AND (LIMIT-TO (PUBYEAR , 2023) OR LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015)) AND (EXCLUDE (DOCTYPE , "ch") OR EXCLUDE (DOCTYPE , "cp") OR EXCLUDE (DOCTYPE , "no") OR EXCLUDE (DOCTYPE , "sh") OR EXCLUDE (DOCTYPE , "bk") OR EXCLUDE (DOCTYPE , "cr") OR EXCLUDE (DOCTYPE , "tb") OR EXCLUDE (DOCTYPE , "dp"))		

Supplementary Table 2.

Study Characteristics for Inclusion and Exclusion.

DECISION–MAP: Study Eligibility Criteria

Study characteristic	Inclusion criteria	Exclusion criteria
Population	Adults (≥18 years of age) receiving treatment for one or more mental health and/or substance-use/addiction concern(s)*, who have a self-reported or confirmed history of ABI of any type from the following categories: • Mild, moderate, or severe TBI (including concussion) • Cerebrovascular incident, stroke • Hypoxic and/or anoxic brain injury	• <18 years of age • Neoplasm or post-surgical brain injury • Infection (e.g., meningitis, encephalitis) or other inflammation (e.g., vasculitis, cerebral oedema) type brain injury • ABI populations not receiving MHA intervention • Caregivers of those with ABI
Intervention	Any intervention specifically aimed to ameliorate mental health *and/or* addiction problems in ABI populations	• Any intervention not relevant to MHA, or where MHA is not the primary focus • Physical rehabilitation where MHA is not the primary focus • Interventions for caregivers only
Comparator	Any comparator (e.g., control group, waiting list, active control, usual care, etc.) or no comparator	Not applicable
Outcomes	Any outcome that contributes to understanding MHA interventions for persons with ABI is considered relevant	Any outcome not relevant to MHA, or where MHA is not the primary focus
Timing	Any	Not applicable
Setting	Any (e.g., in-patient, out-patient, community-based, acute treatment facilitates, etc.)	Not applicable
Study designs	Quantitative, qualitative, or mixed-method impact evaluations†, including: • Randomized controlled trials (and variants), quasi-experimental designs (e.g., difference-in-differences, regression discontinuity, propensity score matching, etc.), and non-experimental impact evaluation designs (e.g., difference of means, before-after comparison, benchmarking, etc.) Systematic reviews, meta-analyses, registered study protocols and clinical practice guidelines**	• Not an impact evaluation study (e.g., editorial, letter to the editor, conference paper, etc.) • Non-systematic reviews
Language	English	Non-English language publications
Country	Any	Not applicable
Publication date	2015 onwards	Articles published 2014 and prior
Publication type	Full publication in a peer-reviewed journal or registered study protocol	Government reports, letters, editorials, reviews, dissertations, meeting abstracts, etc. (grey literature)

*Confirmed diagnosis of MHA disorder is not required

†According to the Impact and Innovation Unit of Impact Canada (2019) guidelines for impact measurement

** *"Clinical practice guidelines are systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances."* (Institute of Medicine, 1990)

Supplementary Table 3.

List of Elements for Data Extraction.

1. Title
2. Authors
3. Publication year
4. Journal
5. DOI
6. Reference
7. Access
8. Geographical coverage of the study, where applicable
9. Study status (completed, on-going)
10. A: Type of research (Primary, Secondary)
11. B: Type of research (Quantitative, Qualitative, Mixed-method)
12. Study type (Impact evaluation, Published study protocol, Systematic review, Meta-analysis, Systematic review with meta-analysis, Clinical trial registry, Clinical practice guideline)
13. Study design
14. Sample: Size (N)
15. Sample: Sex
16. Sample: Age (Mean)
17. Sample: Age (Min.)
18. Sample: Age (Max.)
19. A: Sample: LGBTQ2IA+ reported (Y/N)
20. B: Sample: LGBTQ2IA+ (N)
21. A: Sample: Race/ethnicity reported (Y/N)
22. B: Sample: BIPOC participants (N)
23. Type of ABI
24. Target MHA problem(s) (DSM category)
25. Was the intervention multi-component?
26. Intervention Category(s)
27. Outcome Category(s)

Note. Acquired brain injury (ABI), mental health/addictions (MHA).

Supplementary Table 4.

Summary of Included Records.

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Aaronson (2022)	Clinical trial registry	United States of America	RCTs/Experimental	mTBI or concussion	Neuromodulation and neurofeedback	Suicide and self-harm
Aboulafia-Brakha (2016)	Impact evaluation	Switzerland	Lower-tier quasi-experimental designs	ABI (non-specific)	Psychotherapy (out-patient)	Aggression
Acabchuk (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	mTBI or concussion	Mindfulness and meditation	Depression; Anxiety; Quality of life
Ackland (2019)	Systematic review	Multiple Countries	Systematic review	mTBI or concussion	Psychotherapy (out-patient)	Trauma and stress related
Ahl (2017)	Impact evaluation	Sweden	Upper-tier quasi-experimental designs	Severe TBI	Non-psychotropic medications	Depression
Ahrens (2022)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Psychotherapy (out-patient)	Depression; Anxiety
Aidar (2018)	Impact evaluation	Brazil	RCTs/Experimental	Stroke	Exercise and movement-based	Physical activity; Depression; Anxiety
Albrecht (2020)	Impact evaluation	United States of America	Non-experimental designs	TBI (non-specific)	Antidepressants	Addiction-related; Sleep and eating; Anxiety
Allida (2019)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Antidepressants	Self-awareness and self-efficacy

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Allida (2020)	Systematic review	Multiple Countries	Systematic review	Stroke	Antidepressants; Psychotherapy (out-patient); Neuromodulation and neurofeedback	Depression
Almeida (2021)	Impact evaluation	Australia; New Zealand; Vietnam	Upper-tier quasi-experimental designs	Stroke	Antidepressants	Depression
Alwledat (2023)	Impact evaluation	Jordan	Upper-tier quasi-experimental designs	Stroke	Music and art	Depression; Anxiety
An (2017)	Impact evaluation	South Korea	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback	Depression; Quality of life
Arcadi (2021)	Impact evaluation	Italy	Non-experimental designs	Stroke	Non-psychotropic medications	Depression
Ashworth (2015)	Impact evaluation	United Kingdom	Non-experimental designs	ABI (non-specific)	Psychotherapy (out-patient)	Anxiety
Aslan (2022)	Impact evaluation	Turkey	RCTs/Experimental	Stroke	Acupuncture and massage; Herbal medicine	Depression; Sleep and eating
Baig (2019)	Impact evaluation	United States of America	RCTs/Experimental	mTBI or concussion	Integrated care and case management	Healthcare utilization
Baig (2020)	Impact evaluation	United States of America	RCTs/Experimental	mTBI or concussion	Antipsychotics and Anticonvulsants	Trauma and stress related

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Baker (2018)	Systematic review	Multiple Countries	Systematic review	Stroke	Psychotherapy (out-patient)	Depression
Baldo (2019)	Clinical trial registry	United States of America	RCTs/Experimental	Stroke	Mindfulness and meditation	Anxiety; Cognition
Balea (2021)	Impact evaluation	Romania	RCTs/Experimental	Stroke	Non-psychotropic medications	Depression
Bang-Jiang (2018)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Acupuncture and massage	Depression
Batki (2016)	Clinical trial registry	United States of America	RCTs/Experimental	mTBI or concussion	Non-psychotropic medications	Addiction-related
Bay (2019)	Impact evaluation	United States of America	Lower-tier quasi-experimental designs	TBI (non-specific)	Psychotherapy (out-patient)	Depression
Baylan (2016)	Systematic review	Multiple Countries	Systematic review	Stroke	Music and art	Cognition; Depression
Beedham (2020)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	TBI (non-specific)	Antidepressants; Psychostimulants; Neuromodulation and neurofeedback	Depression
Belanger (2022)	Impact evaluation	United States of America	RCTs/Experimental	mTBI or concussion	Tele-health and technology-based	Depression; Trauma and stress related; Self-awareness and self-efficacy
Bell (2017)	Impact evaluation	United States of America	RCTs/Experimental	mTBI or concussion	Tele-health and technology-based;	Somatic symptoms; Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
					Cognitive training/rehabilitation	
Bellon (2015)	Impact evaluation	United States of America	Lower-tier quasi-experimental designs	TBI (non-specific)	Exercise and movement-based	Depression; Trauma and stress related
Beresford (2022)	Impact evaluation	United States of America	RCTs/Experimental	mTBI or concussion	Antipsychotics and Anticonvulsants	Aggression
Bermudo-Gallaguet (2022)	Published study protocol	Spain	RCTs/Experimental	Stroke	Mindfulness and meditation; Exercise and movement-based	Depression; Anxiety; Trauma and stress related
Berthier (2022)	Impact evaluation	Spain	Upper-tier quasi-experimental designs	Stroke	Psychotherapy (in-patient)	Depression
Berthier (2023)	Impact evaluation	Spain	RCTs/Experimental	Stroke	Psychostimulants; Social support programs	Depression
Berthier (2023)	Impact evaluation	Spain	RCTs/Experimental	Stroke	Psychostimulants; Cognitive training/rehabilitation	Depression
Bhardwaj (2018)	Impact evaluation	India	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback; Psychotherapy (in-patient)	Depression; Anxiety
Bidzan (2020)	Impact evaluation	Poland	Non-experimental designs	ABI (non-specific)	Antipsychotics and Anticonvulsants	Aggression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Bilodeau (2021)	Impact evaluation	Canada	Non-experimental designs	TBI (non-specific)	Non-psychotropic medications	Aggression
Borg (2020)	Impact evaluation	Australia	RCTs/Experimental	ABI (non-specific)	Integrated care and case management	Depression; Anxiety
Bragstad (2020)	Impact evaluation	Norway	RCTs/Experimental	Stroke	Psychotherapy (out-patient)	Quality of life
Brenner (2018)	Impact evaluation	United States of America	RCTs/Experimental	Moderate TBI; Severe TBI	Psychotherapy (out-patient)	Depression
Brody (2020)	Clinical trial registry	United States of America	RCTs/Experimental	mTBI or concussion	Psychotherapy (out-patient); Tele-health and technology-based	Sleep and eating
Brody (2022)	Clinical trial registry	United States of America	RCTs/Experimental	mTBI or concussion	Neuromodulation and neurofeedback	Depression
Brown (2019)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Neuromodulation and neurofeedback	Depression
Bucur (2018)	Systematic review	Multiple Countries	Systematic review	Stroke	Neuromodulation and neurofeedback	Depression
Byrne (2016)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	ABI (non-specific)	Psychotherapy (out-patient)	Aggression
Cai (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Herbal medicine	Depression
Cai (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Cao (2020)	Impact evaluation	China	RCTs/Experimental	Stroke	Antidepressants	Depression
Carrick (2015)	Impact evaluation	United States of America	Lower-tier quasi-experimental designs	TBI (non-specific)	Tele-health and technology-based	Trauma and stress related
Carvalho (2020)	Clinical trial registry	Brazil	RCTs/Experimental	TBI (non-specific)	Neuromodulation and neurofeedback	Anxiety; Depression
Chalmers (2019)	Impact evaluation	New Zealand	Upper-tier quasi-experimental designs	Stroke	Psychotherapy (out-patient)	Depression; Anxiety; Quality of life
Chan (2021)	Impact evaluation	China	RCTs/Experimental	Stroke	Music and art	Depression
Chan (2021)	Published study protocol	China	RCTs/Experimental	Stroke	Music and art	Depression; Quality of life
Chan (2022)	Systematic review	Multiple Countries	Systematic review	TBI (non-specific)	Integrated care and case management	Depression; Trauma and stress related
Chang (2020)	Impact evaluation	Taiwan	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback	Somatic symptoms
Chen (2020)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	mTBI or concussion	Psychotherapy (out-patient)	Cognition
Chen (2020)	Impact evaluation	China	RCTs/Experimental	Stroke	Acute in-patient services	Depression
Chen (2020)	Systematic review	Multiple Countries	Systematic review	Stroke	Integrated care and case management	Depression; Anxiety

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Chen (2022)	Published study protocol	China	RCTs/Experimental	Stroke	Acute in-patient services	Depression
Chen (2022)	Published study protocol	China	RCTs/Experimental	Stroke	Acupuncture and massage	Depression
Cheng (2018)	Clinical trial registry	China	RCTs/Experimental	Stroke	Patient-caregiver interventions	Depression
Cheng (2018)	Impact evaluation	China	RCTs/Experimental	Stroke	Cognitive training/rehabilitation	Cognition; Anxiety; Depression
Cheng (2021)	Impact evaluation	China	RCTs/Experimental	Stroke	Mindfulness and meditation	Depression
Cheng (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	TBI (non-specific)	Acute in-patient services; Psychotherapy (in-patient)	Depression
Chippala (2020)	Impact evaluation	India	RCTs/Experimental	Stroke	Acute in-patient services; Exercise and movement-based	Depression; Anxiety
Chiu (2022)	Clinical trial registry	Taiwan	RCTs/Experimental	TBI (non-specific)	Psychotherapy (out-patient)	Sleep and eating
Choi (2022)	Impact evaluation	South Korea	RCTs/Experimental	Stroke	Psychotherapy (in-patient)	Depression; Anxiety
Choo (2022)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Patient-caregiver interventions	Anxiety; Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Chun (2018)	Systematic review	Multiple Countries	Systematic review	Stroke	Psychotherapy (out-patient); Antidepressants; Anxiolytics	Anxiety
Chun (2018)	Published study protocol	United Kingdom	RCTs/Experimental	Stroke	Tele-health and technology-based	Anxiety
Chun (2020)	Published study protocol	United Kingdom	RCTs/Experimental	Stroke	Psychotherapy (out-patient); Mindfulness and meditation	Anxiety
Clay (2019)	Systematic review	Multiple Countries	Systematic review	TBI (non-specific)	Antidepressants; Non-psychotropic medications	Depression
Cui (2018)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Antidepressants	Depression
Cullen (2018)	Published study protocol	Scotland	RCTs/Experimental	ABI (non-specific)	Psychotherapy (in-patient)	Depression; Quality of life
D'Anci (2019)	Systematic review	Multiple Countries	Systematic review	Stroke	Exercise and movement-based	Physical activity; Quality of life
Dayuan (2022)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Music and art	Depression
DaSilva (2019)	Impact evaluation	Brazil	Non-experimental designs	Stroke	Neuromodulation and neurofeedback	Depression
DeGraba (2021)	Impact evaluation	United States of America	Lower-tier quasi-experimental designs	TBI (non-specific)	Integrated care and case management	Trauma and stress related; Anxiety

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Deb (2018)	Published study protocol	United Kingdom	RCTs/Experimental	TBI (non-specific)	Antipsychotics and Anticonvulsants	Aggression
Dehvan (2018)	Clinical trial registry	Iran	RCTs/Experimental	Stroke	Acupuncture and massage	Anxiety
Deng (2017)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Antidepressants	Depression
Deng (2018)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Antidepressants	Depression
Dewi (2020)	Impact evaluation	Indonesia	Upper-tier quasi-experimental designs	Stroke	Psychotherapy (in-patient)	Quality of life
Dickey (2021)	Clinical trial registry	Canada	RCTs/Experimental	mTBI or concussion	Mindfulness and meditation; Tele-health and technology-based	Depression; Anxiety
Dindo (2019)	Clinical trial registry	United States of America	RCTs/Experimental	TBI (non-specific)	Psychotherapy (out-patient)	Anxiety; Depression; Community engagement
Dindo (2020)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Psychotherapy (out-patient)	Trauma and stress related
Ding (2021)	Published study protocol	China	RCTs/Experimental	Stroke	Herbal medicine	Depression
Dolbow (2020)	Systematic review	Multiple Countries	Systematic review	TBI (non-specific)	Exercise and movement-based	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Doshi (2019)	Clinical trial registry	Singapore	RCTs/Experimental	Stroke	Mindfulness and meditation; Home-based care	Depression; Anxiety
Duan (2023)	Impact evaluation	China	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback; Mindfulness and meditation	Depression
Elbogen (2019)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Patient-caregiver interventions ; Tele-health and technology-based; Cognitive training/rehabilitation	Trauma and stress related; Cognition
Elbogen (2021)	Impact evaluation	United States of America	Non-experimental designs	TBI (non-specific)	Neuromodulation and neurofeedback	Somatic symptoms; Trauma and stress related
Ellis-Hill (2019)	Impact evaluation	United Kingdom	RCTs/Experimental	Stroke	Music and art	Depression; Self-awareness and self-efficacy
Evans (2018)	Clinical trial registry	United States of America	RCTs/Experimental	Stroke	Psychotherapy (out-patient)	Depression; Anxiety; Community engagement
Fang (2017)	Impact evaluation	China	RCTs/Experimental	Stroke	Psychotherapy (in-patient)	Depression; Anxiety
Fann (2015)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Tele-health and technology-based; Psychotherapy (in-patient)	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Fann (2017)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Antidepressants	Depression
Feng (2018)	Meta analysis	Multiple Countries	Meta analysis	Stroke	Antidepressants	Depression
Feng (2022)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Antidepressants	Depression
Gao (2017)	Impact evaluation	China	RCTs/Experimental	Stroke	Psychotherapy (out-patient); Antidepressants	Depression
Gao (2019)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	TBI (non-specific)	Antidepressants	Depression
Gao (2021)	Clinical trial registry	China	RCTs/Experimental	Stroke	Integrated care and case management	Anxiety
Gao (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Acute in-patient services	Depression
Gertler (2015)	Systematic review	Multiple Countries	Systematic review	TBI (non-specific)	Psychotherapy (out-patient)	Depression
Ghaffari (2022)	Impact evaluation	Iran	RCTs/Experimental	Stroke	Exercise and movement-based	Sleep and eating; Depression; Activities of daily living/life skills
Gladwyn-Khan (2023)	Impact evaluation	United Kingdom	RCTs/Experimental	Stroke	Psychotherapy (out-patient)	Quality of life

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Glintborg (2016)	Impact evaluation	Denmark	Non-experimental designs	ABI (non-specific)	Integrated care and case management	Quality of life; Depression; Community engagement
Golding (2016)	Impact evaluation	United Kingdom	RCTs/Experimental	Stroke	Mindfulness and meditation	Anxiety
Golding (2017)	Impact evaluation	United Kingdom	RCTs/Experimental	Stroke	Mindfulness and meditation	Anxiety; Depression
Golding (2018)	Impact evaluation	United Kingdom	RCTs/Experimental	Stroke	Mindfulness and meditation	Depression
González (2021)	Clinical trial registry	Spain	RCTs/Experimental	Stroke	Tele-health and technology-based	Anxiety; Depression
Grabowska-Fudala (2018)	Impact evaluation	Poland	Upper-tier quasi-experimental designs	Stroke	Acute in-patient services	Depression
Graven (2016)	Impact evaluation	United States of America	RCTs/Experimental	Stroke	Home-based care	Depression
Gregory (2019)	Clinical trial registry	United States of America	RCTs/Experimental	Stroke	Exercise and movement-based	Depression; Physical activity
Griffin-Musick (2021)	Impact evaluation	United States of America	Lower-tier quasi-experimental designs	Stroke	Cognitive training/rehabilitation	Depression
Gros (2017)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Psychotherapy (in-patient)	Trauma and stress related; Addiction-related

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Gu (2017)	Impact evaluation	Republic of Korea	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback	Depression
Gu (2018)	Impact evaluation	China	RCTs/Experimental	Stroke	Acute in-patient services	Quality of life; Anxiety; Depression
Gu (2020)	Meta analysis	Multiple Countries	Meta analysis	Stroke	Antidepressants	Depression
Guillaumier (2019)	Published study protocol	Australia	RCTs/Experimental	Stroke	Tele-health and technology-based	Quality of life
Guo (2022)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Acupuncture and massage	Depression
Hadidi (2015)	Impact evaluation	United States of America	RCTs/Experimental	Stroke	Psychotherapy (out-patient)	Depression
Haire (2021)	Impact evaluation	Canada	RCTs/Experimental	Stroke	Music and art	Depression; Cognition
Hammond (2015)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Non-psychotropic medications	Aggression
Hammond (2018)	Impact evaluation	United States of America	Non-experimental designs	TBI (non-specific)	Non-psychotropic medications	Somatic symptoms; Self-awareness and self-efficacy
Han (2018)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Cognitive training/rehabilitation	Depression
Han (2023)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Mindfulness and meditation	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Handayani (2020)	Impact evaluation	Indonesia	Upper-tier quasi-experimental designs	Stroke	Social support programs	Depression
Hang (2021)	Meta analysis	Multiple Countries	Meta analysis	Stroke	Acupuncture and massage	Depression
Hao (2023)	Systematic review	Multiple Countries	Systematic review	Stroke	Neuromodulation and neurofeedback	Depression
Harch (2017)	Impact evaluation	United States of America	RCTs/Experimental	mTBI or concussion	Acute in-patient services	Trauma and stress related; Depression
Hart (2019)	Published study protocol	United States of America	RCTs/Experimental	TBI (non-specific)	Tele-health and technology-based	Depression
Hart (2020)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Tele-health and technology-based	Depression; Community engagement
Henderson (2017)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Neuromodulation and neurofeedback	Depression
Herrold (2019)	Clinical trial registry	United States of America	RCTs/Experimental	mTBI or concussion	Neuromodulation and neurofeedback	Quality of life
Hicks (2020)	Systematic review	Multiple Countries	Systematic review	TBI (non-specific)	Non-psychotropic medications	Somatic symptoms; Self-awareness and self-efficacy
Hicks (2021)	Systematic review	Multiple Countries	Systematic review	TBI (non-specific)	Antidepressants	Anxiety

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Hill (2019)	Published study protocol	United Kingdom	RCTs/Experimental	Stroke	Psychotherapy (out-patient); Home-based care	Depression; Anxiety; Activities of daily living/life skills
Hoffmann (2015)	Published study protocol	Australia	RCTs/Experimental	Stroke	Psychotherapy (in-patient)	Depression; Anxiety
Holleman (2018)	Impact evaluation	Netherlands	Upper-tier quasi-experimental designs	ABI (non-specific)	Psychotherapy (out-patient)	Quality of life; Depression; Anxiety
Hong (2021)	Impact evaluation	China	RCTs/Experimental	ABI (non-specific)	Acute in-patient services	Depression; Quality of life
Hordacre (2021)	Impact evaluation	Australia	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback	Depression
Hoy (2019)	Impact evaluation	Australia	RCTs/Experimental	TBI (non-specific)	Neuromodulation and neurofeedback	Depression
Hsin-Tung (2022)	Clinical trial registry	Taiwan	RCTs/Experimental	Stroke	Acupuncture and massage	Depression
Hu (2015)	Impact evaluation	China	RCTs/Experimental	Stroke	Non-psychotropic medications	Depression
Huang (2017)	Meta analysis	Multiple Countries	Meta analysis	Stroke	Home-based care	Depression
Huang (2021)	Published study protocol	China	RCTs/Experimental	Stroke	Acupuncture and massage; Herbal medicine	Sleep and eating; Anxiety

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Hung (2019)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Acupuncture and massage	Cognition; Depression
Hwang (2021)	Systematic review	Multiple Countries	Systematic review	Stroke	Tele-health and technology-based	Self-awareness and self-efficacy
Jackson (2019)	Impact evaluation	United States of America	Non-experimental designs	TBI (non-specific)	Psychotherapy (out-patient)	Trauma and stress related
Jak (2015)	Published study protocol	United States of America	RCTs/Experimental	TBI (non-specific)	Psychotherapy (out-patient)	Trauma and stress related
Jak (2019)	Impact evaluation	United States of America	RCTs/Experimental	mTBI or concussion	Psychotherapy (out-patient)	Trauma and stress related; Cognition
Janak (2017)	Impact evaluation	United States of America	RCTs/Experimental	mTBI or concussion	Integrated care and case management; Psychotherapy (out-patient)	Somatic symptoms; Trauma and stress related
Jani (2018)	Impact evaluation	United Kingdom	RCTs/Experimental	Stroke	Mindfulness and meditation	Depression
Jiali (2018)	Clinical trial registry	China	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback	Depression
Jiancheng (2021)	Clinical trial registry	China	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback	Depression
Jiang (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Psychotherapy (in-patient)	Trauma and stress related
Jiang (2023)	Impact evaluation	China	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback	Trauma and stress related

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Jin (2018)	Meta analysis	Multiple Countries	Meta analysis	Stroke	Herbal medicine	Depression
Johansson (2017)	Impact evaluation	Sweden	Upper-tier quasi-experimental designs	mTBI or concussion	Psychostimulants	Sleep and eating; Depression; Anxiety
Jorge (2016)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Antidepressants	Depression
Jurick (2020)	Impact evaluation	United States of America	RCTs/Experimental	mTBI or concussion	Psychotherapy (in-patient)	Cognition; Trauma and stress related
Kalbouneh (2022)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Antidepressants	Depression; Anxiety
Kang (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Tele-health and technology-based	Depression
Keenan (2022)	Clinical trial registry	United States of America	RCTs/Experimental	Stroke	Tele-health and technology-based	Cognition
Kennedy (2022)	Impact evaluation	United States of America	Non-experimental designs	mTBI or concussion	Cognitive training/rehabilitation	Depression; Somatic symptoms
Kerr (2018)	Impact evaluation	Australia	RCTs/Experimental	Stroke	Psychotherapy (out-patient)	Depression
Kim (2017)	Impact evaluation	South Korea	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback	Depression; Quality of life; Somatic symptoms
Kim (2017)	Impact evaluation	Republic of Korea	RCTs/Experimental	Stroke	Antidepressants	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Kim (2020)	Impact evaluation	South Korea	Upper-tier quasi-experimental designs	Stroke	Tele-health and technology-based	Depression; Quality of life
Kim (2022)	Impact evaluation	South Korea	RCTs/Experimental	Stroke	Tele-health and technology-based	Sleep and eating
King (2023)	Impact evaluation	United States of America	Non-experimental designs	mTBI or concussion	Cognitive training/rehabilitation	Depression; Trauma and stress related
Kiper (2022)	Impact evaluation	Poland	RCTs/Experimental	Stroke	Tele-health and technology-based	Depression
Kirkevold (2018)	Published study protocol	Norway	RCTs/Experimental	Stroke	Psychotherapy (out-patient)	Quality of life
Kirkness (2017)	Impact evaluation	United States of America	RCTs/Experimental	Stroke	Psychotherapy (out-patient)	Depression
Kitzmuller (2019)	Impact evaluation	Norway	Non-experimental designs	Stroke	Psychotherapy (out-patient)	Quality of life
Klyce (2018)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Withdrawal management centres	Activities of daily living/life skills
Knapp (2017)	Systematic review	Multiple Countries	Systematic review	Stroke	Anxiolytics; Mindfulness and meditation; Antidepressants	Anxiety
Kongkasuwan (2016)	Impact evaluation	Thailand	RCTs/Experimental	Stroke	Music and art; Mindfulness and meditation	Cognition; Anxiety; Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Konigsberg (2021)	Impact evaluation	Multiple Countries	RCTs/Experimental	Stroke	Acute in-patient services	Depression
Kootker (2016)	Impact evaluation	Netherlands	RCTs/Experimental	Stroke	Psychotherapy (out-patient)	Depression
Kotov (2020)	Published study protocol	Russia	RCTs/Experimental	Stroke	Exercise and movement-based	Anxiety
Kreitzer (2019)	Meta analysis	Multiple Countries	Meta analysis	TBI (non-specific)	Antidepressants	Depression
Krese (2020)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Exercise and movement-based	Sleep and eating; Anxiety
Kreutzer (2018)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Social support programs	Self-awareness and self-efficacy
Kristofersson (2016)	Impact evaluation	United States of America	Non-experimental designs	TBI (non-specific)	Mindfulness and meditation	Anxiety
Kucukakgun (2022)	Clinical trial registry	Turkey	RCTs/Experimental	Stroke	Social support programs	Cognition; Sleep and eating; Depression
Kusec (2020)	Published study protocol	United Kingdom	RCTs/Experimental	ABI (non-specific)	Social support programs	Depression
Kwon (2019)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	mTBI or concussion	Neuromodulation and neurofeedback	Depression
Kwon (2019)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Herbal medicine	Depression
Kwon (2021)	Impact evaluation	South Korea	RCTs/Experimental	Stroke	Antidepressants	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Künzi (2018)	Impact evaluation	Switzerland	RCTs/Experimental	ABI (non-specific)	Psychotherapy (in-patient)	Anxiety
LIU (2020)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage	Anxiety
Lai (2022)	Impact evaluation	Taiwan	RCTs/Experimental	Stroke	Exercise and movement-based	Depression
Lanctot (2020)	Clinical practice guideline	Canada	Clinical practice guideline	Stroke	Integrated care and case management	Cognition; Sleep and eating; Depression
Large (2020)	Impact evaluation	United Kingdom	Lower-tier quasi-experimental designs	Stroke	Psychotherapy (in-patient)	Healthcare utilization
Lavu (2022)	Systematic review	Multiple Countries	Systematic review	Stroke	Antidepressants	Depression
Lawrence (2017)	Impact evaluation	United States of America	Lower-tier quasi-experimental designs	TBI (non-specific)	Social support programs	Activities of daily living/life skills; Self-awareness and self-efficacy
LeDanseur (2019)	Impact evaluation	United States of America	RCTs/Experimental	Stroke	Music and art	Anxiety; Depression
Lee (2016)	Impact evaluation	South Korea	Lower-tier quasi-experimental designs	Stroke	Psychotherapy (out-patient)	Addiction-related
Lee (2018)	Impact evaluation	South Korea	RCTs/Experimental	TBI (non-specific)	Neuromodulation and neurofeedback	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Lee (2019)	Impact evaluation	South Korea	RCTs/Experimental	Stroke	Exercise and movement-based; Tele-health and technology-based	Depression
Lee (2019)	Systematic review	Multiple Countries	Systematic review	Stroke	Social support programs	Depression; Quality of life
Lee (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Exercise and movement-based; Neuromodulation and neurofeedback; Withdrawal management centres	Depression
Lenzo (2019)	Impact evaluation	Italy	RCTs/Experimental	Stroke	Long-term in-patient services	Anxiety; Depression
Levitt (2019)	Clinical trial registry	United States of America	RCTs/Experimental	Stroke	Antidepressants	Depression
Levy (2021)	Impact evaluation	Canada	RCTs/Experimental	Moderate TBI; Severe TBI	Peer-to-peer programs	Community engagement
Li (2015)	Impact evaluation	China	RCTs/Experimental	Stroke	Tele-health and technology-based	Depression
Li (2017)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage	Depression
Li (2018)	Clinical trial registry	China	RCTs/Experimental	Stroke	Tele-health and technology-based	Depression; Cognition

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Li (2018)	Impact evaluation	China	RCTs/Experimental	Stroke	Herbal medicine	Depression
Li (2018)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Acupuncture and massage	Depression
Li (2019)	Impact evaluation	China	RCTs/Experimental	Stroke	Acute in-patient services	Anxiety; Depression
Li (2020)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Antidepressants	Depression
Li (2020)	Meta analysis	Multiple Countries	Meta analysis	Stroke	Antidepressants	Depression
Li (2020)	Impact evaluation	China	RCTs/Experimental	Stroke	Acute in-patient services	Quality of life
Li (2021)	Impact evaluation	China	RCTs/Experimental	Stroke	Acute in-patient services	Depression
Li (2022)	Impact evaluation	Ireland	RCTs/Experimental	Stroke	Psychotherapy (out-patient)	Depression; Anxiety; Cognition
Li (2022)	Meta analysis	Multiple Countries	Meta analysis	Stroke	Exercise and movement-based	Depression
Li (2022)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Neuromodulation and neurofeedback	Depression
Li (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback	Depression
Li (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Li (2022)	Published study protocol	China	RCTs/Experimental	Stroke	Acupuncture and massage	Anxiety
Liang (2019)	Impact evaluation	China	RCTs/Experimental	Stroke	Herbal medicine	Depression
Liang 202	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Acute in-patient services	Depression
Liang (2022)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Neuromodulation and neurofeedback; Antidepressants	Depression
Lin (2017)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage; Music and art	Depression
Lin (2018)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage; Exercise and movement-based	Depression
Lin (2019)	Impact evaluation	Taiwan	RCTs/Experimental	Stroke	Social support programs	Depression
Lin (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Acute in-patient services	Self-awareness and self-efficacy
Linder (2015)	Impact evaluation	United States of America	RCTs/Experimental	Stroke	Home-based care; Exercise and movement-based	Depression; Activities of daily living/life skills
Linton (2020)	Impact evaluation	United States of America	Upper-tier quasi-experimental designs	TBI (non-specific)	Integrated care and case management	Depression; Quality of life

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Little (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	TBI (non-specific)	Psychotherapy (in-patient)	Anxiety
Liu (2018)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	TBI (non-specific)	Psychotherapy (in-patient)	Depression; Anxiety; Quality of life
Liu (2019)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Neuromodulation and neurofeedback	Depression
Liu (2020)	Impact evaluation	China	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback; Antidepressants	Depression
Liu (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Acupuncture and massage	Depression
Lo (2021)	Published study protocol	China	RCTs/Experimental	Stroke	Social support programs	Relationships; Depression
Love (2019)	Systematic review	Multiple Countries	Systematic review	Stroke	Mindfulness and meditation; Exercise and movement-based	Depression; Anxiety; Quality of life
Lu (2017)	Impact evaluation	Taiwan	Lower-tier quasi-experimental designs	Stroke	Acupuncture and massage	Depression
Lu (2019)	Published study protocol	China	RCTs/Experimental	Stroke	Acupuncture and massage	Depression
Lu (2020)	Impact evaluation	China	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback; Antidepressants	Cognition; Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Luaut (2016)	Clinical practice guideline	France	Clinical practice guideline	TBI (non-specific)	Social support programs	Quality of life
Lundstrom (2021)	Impact evaluation	Sweden	RCTs/Experimental	Stroke	Antidepressants	Depression
Luo (2015)	Impact evaluation	China	Lower-tier quasi-experimental designs	TBI (non-specific)	Antidepressants; Psychotherapy (out-patient)	Depression
Luo (2022)	Impact evaluation	China	Upper-tier quasi-experimental designs	Stroke	Patient-caregiver interventions	Quality of life
Luo (2022)	Published study protocol	China	RCTs/Experimental	Stroke	Acupuncture and massage	Depression
Lv (2022)	Impact evaluation	China	Non-experimental designs	Stroke	Non-psychotropic medications	Depression; Anxiety
Ma (2018)	Impact evaluation	China	RCTs/Experimental	Stroke	Antidepressants	Depression; Anxiety
Maksimowski (2016)	Systematic review	Multiple Countries	Systematic review	TBI (non-specific)	Psychostimulants	Cognition; Depression
Manu (2019)	Clinical trial registry	India	RCTs/Experimental	Stroke	Herbal medicine	Depression
Mavaddat (2017)	Impact evaluation	United Kingdom	Non-experimental designs	Stroke	Mindfulness and meditation	Depression
Mayo (2015)	Impact evaluation	Canada	RCTs/Experimental	Stroke	Social support programs; Exercise and movement-based	Community engagement

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
McCarron (2019)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Social support programs	Activities of daily living/life skills
McGeary (2022)	Impact evaluation	United States of America	RCTs/Experimental	mTBI or concussion	Psychotherapy (out-patient)	Trauma and stress related
Mead (2022)	Impact evaluation	United Kingdom	RCTs/Experimental	Stroke	Psychotherapy (out-patient)	Depression; Anxiety
Meek (2021)	Impact evaluation	Canada	RCTs/Experimental	mTBI or concussion	Neuromodulation and neurofeedback	Somatic symptoms; Depression
Mehta (2022)	Clinical trial registry	Canada	RCTs/Experimental	Stroke	Tele-health and technology-based; Psychotherapy (out-patient)	Depression; Anxiety
Mercier (2020)	Published study protocol	Canada	RCTs/Experimental	mTBI or concussion	Exercise and movement-based	Somatic symptoms
Messina (2020)	Impact evaluation	Italy	Upper-tier quasi-experimental designs	Stroke	Psychotherapy (in-patient); Patient-caregiver interventions	Self-awareness and self-efficacy; Quality of life; Physical activity
Mikolic (2019)	Systematic review	Multiple Countries	Systematic review	TBI (non-specific)	Psychotherapy (out-patient)	Trauma and stress related
Minshall (2020)	Impact evaluation	United Kingdom	RCTs/Experimental	Stroke	Psychotherapy (out-patient)	Quality of life
Mohabbat (2021)	Clinical trial registry	United States of America	RCTs/Experimental	Stroke	Psychotherapy (in-patient)	Anxiety; Depression; Quality of life

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Moriarty (2021)	Clinical trial registry	United States of America	RCTs/Experimental	TBI (non-specific)	Psychotherapy (out-patient); Exercise and movement-based	Depression
Morris (2019)	Impact evaluation	United Kingdom	RCTs/Experimental	Stroke	Music and art	Depression; Activities of daily living/life skills; Self-awareness and self-efficacy
Mou (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Patient-caregiver interventions	Quality of life
Mroczkowska (2019)	Impact evaluation	Poland	Lower-tier quasi-experimental designs	Stroke	Psychotherapy (out-patient); Cognitive training/rehabilitation	Depression
Mueller (2022)	Clinical trial registry	United States of America	RCTs/Experimental	TBI (non-specific)	Non-psychotropic medications	Cognition
Muresanu (2022)	Impact evaluation	Romania	RCTs/Experimental	Moderate TBI; Severe TBI	Non-psychotropic medications	Anxiety; Depression
Narapareddy (2020)	Systematic review	Multiple Countries	Systematic review	TBI (non-specific)	Neuromodulation and neurofeedback	Depression
Neumann (2017)	Impact evaluation	United States of America	Lower-tier quasi-experimental designs	Moderate TBI; Severe TBI	Mindfulness and meditation	Self-awareness and self-efficacy
Neumann (2018)	Clinical trial registry	United States of America	RCTs/Experimental	TBI (non-specific)	Psychotherapy (out-patient)	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Ng (2017)	Impact evaluation	Australia	RCTs/Experimental	Stroke	Psychotherapy (in-patient)	Quality of life; Depression
Niu (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Psychotherapy (in-patient)	Depression
Novakovic-Agopian (2021)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Cognitive training/rehabilitation	Cognition; Trauma and stress related
Oh (2022)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Psychotherapy (out-patient)	Quality of life; Depression; Anxiety
Olukolade (2017)	Impact evaluation	Nigeria	RCTs/Experimental	Stroke	Cognitive training/rehabilitation	Depression
Özakgül (2018)	Impact evaluation	Turkey	RCTs/Experimental	Stroke	Patient-caregiver interventions	Depression
Ozen (2016)	Impact evaluation	Canada	RCTs/Experimental	TBI (non-specific)	Mindfulness and meditation	Depression
Palumbo (2022)	Impact evaluation	United States of America	RCTs/Experimental	Stroke	Music and art	Depression; Quality of life
Paraschakis (2017)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	TBI (non-specific)	Antidepressants	Depression
Parkinson (2022)	Impact evaluation	United Kingdom	Non-experimental designs	Stroke	Patient-caregiver interventions; Mindfulness and meditation; Tele-health and technology-based	Anxiety; Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Payne (2020)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Social support programs	Quality of life; Community engagement
Pennington (2020)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Antipsychotics and Anticonvulsants	Addiction-related
Pennington (2022)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Exercise and movement-based; Tele-health and technology-based	Addiction-related
Peppel (2020)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Moderate TBI; Severe TBI	Antidepressants; Psychotherapy (out-patient)	Depression
Perez-Rodriguez (2021)	Impact evaluation	Spain	Upper-tier quasi-experimental designs	ABI (non-specific)	Exercise and movement-based	Depression
Perez-de la Cruz (2020)	Impact evaluation	Spain	RCTs/Experimental	Stroke	Exercise and movement-based	Quality of life; Somatic symptoms
Perovic (2017)	Impact evaluation	Montenegro	Non-experimental designs	Stroke	Acute in-patient services	Anxiety; Depression
Perry (2020)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	TBI (non-specific)	Exercise and movement-based	Depression
Philip (2023)	Impact evaluation	United States of America	Lower-tier quasi-experimental designs	mTBI or concussion	Neuromodulation and neurofeedback	Trauma and stress related; Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Phyland (2023)	Impact evaluation	Australia	RCTs/Experimental	TBI (non-specific)	Antipsychotics and Anticonvulsants	Aggression
Plantier (2016)	Systematic review	Multiple Countries	Systematic review	TBI (non-specific)	Antipsychotics and Anticonvulsants; Non-psychotropic medications	Aggression; Psychosis-related
Ponsford (2016)	Impact evaluation	Australia	RCTs/Experimental	TBI (non-specific)	Psychotherapy (in-patient)	Depression; Anxiety
Ponsford (2020)	Impact evaluation	Australia	Upper-tier quasi-experimental designs	TBI (non-specific)	Psychotherapy (in-patient)	Cognition; Depression; Anxiety
Pui Kei (2020)	Published study protocol	Australia	RCTs/Experimental	Stroke	Home-based care	Self-awareness and self-efficacy; Anxiety
Qian (2015)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage; Antidepressants	Depression
Qin (2018)	Meta analysis	Multiple Countries	Meta analysis	Stroke	Antidepressants	Depression
Qin (2021)	Systematic review	Multiple Countries	Systematic review	Stroke	Cognitive training/rehabilitation; Social support programs	Quality of life; Anxiety
Qiqi (2021)	Meta analysis	Multiple Countries	Meta analysis	Stroke	Psychotherapy (out-patient)	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Quinn (2020)	Impact evaluation	United States of America	RCTs/Experimental	mTBI or concussion	Neuromodulation and neurofeedback; Cognitive training/rehabilitation	Depression
Rafiq (2020)	Impact evaluation	Pakistan	Upper-tier quasi-experimental designs	Stroke	Psychotherapy (out-patient)	Depression; Anxiety
Raglio (2017)	Impact evaluation	Italy	RCTs/Experimental	Stroke	Music and art	Quality of life; Depression; Anxiety
Raikes (2020)	Impact evaluation	United States of America	RCTs/Experimental	mTBI or concussion	Tele-health and technology-based	Sleep and eating; Depression
Rao (2019)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Neuromodulation and neurofeedback	Depression
Rash (2022)	Published study protocol	Canada	RCTs/Experimental	Stroke	Tele-health and technology-based	Depression; Physical activity
Rauwenhoff (2019)	Published study protocol	Netherlands	RCTs/Experimental	ABI (non-specific)	Psychotherapy (out-patient)	Depression; Anxiety
Raya-Ruiz (2022)	Published study protocol	Spain	RCTs/Experimental	ABI (non-specific)	Social support programs	Quality of life
Reyes (2019)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	TBI (non-specific)	Antidepressants	Depression; Quality of life
Rice (2022)	Impact evaluation	Tanzania	Upper-tier quasi-experimental designs	Stroke	Antidepressants	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Richter (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Antidepressants	Depression
Rodrigues (2020)	Impact evaluation	Brazil	RCTs/Experimental	Moderate TBI; Severe TBI	Neuromodulation and neurofeedback	Anxiety
Ross (2023)	Impact evaluation	United States of America	RCTs/Experimental	Stroke	Exercise and movement-based; Neuromodulation and neurofeedback	Physical activity; Depression
Roy (2022)	Impact evaluation	United States of America	RCTs/Experimental	mTBI or concussion	Psychotherapy (out-patient); Tele-health and technology-based	Trauma and stress related
Rushing (2022)	Impact evaluation	United States of America	Upper-tier quasi-experimental designs	Stroke	Music and art	Depression
Ryan (2022)	Systematic review	Multiple Countries	Systematic review	Stroke	Psychotherapy (out-patient)	Anxiety
Rzezak (2015)	Impact evaluation	Brazil	Lower-tier quasi-experimental designs	TBI (non-specific)	Exercise and movement-based	Anxiety
Saha (2022)	Clinical practice guideline	India	Clinical practice guideline	ABI (non-specific)	Antipsychotics and Anticonvulsants; Antidepressants	Psychosis-related; Depression; Anxiety
Salter (2016)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	TBI (non-specific)	Antidepressants	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Sander (2021)	Impact evaluation	United States of America	RCTs/Experimental	Moderate TBI	Psychotherapy (out-patient)	Depression
Sarkamo (2021)	Impact evaluation	Finland	RCTs/Experimental	Severe TBI	Exercise and movement-based	Cognition; Physical activity
Sasaki (2017)	Impact evaluation	Japan	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback	Depression
Scheenen (2017)	Impact evaluation	Netherlands	RCTs/Experimental	mTBI or concussion	Tele-health and technology-based; Psychotherapy (in-patient)	Anxiety; Depression; Trauma and stress related
Schy (2023)	Clinical trial registry	United States of America	RCTs/Experimental	mTBI or concussion	Neuromodulation and neurofeedback; Cognitive training/rehabilitation	Depression
Setiyowati (2019)	Impact evaluation	Taiwan	Lower-tier quasi-experimental designs	Stroke	Exercise and movement-based	Depression
Shabani (2022)	Impact evaluation	Iran	RCTs/Experimental	Stroke	Antidepressants	Quality of life
Shao (2020)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Herbal medicine	Depression
Shao (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Neuromodulation and neurofeedback	Depression
Shaw (2021)	Clinical trial registry	United States of America	RCTs/Experimental	TBI (non-specific)	Tele-health and technology-based;	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
					Psychotherapy (out-patient)	
Shek (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Tele-health and technology-based	Depression
Shen (2017)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Neuromodulation and neurofeedback	Depression
Shen (2022)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Neuromodulation and neurofeedback	Depression
Shin (2015)	Impact evaluation	South Korea	RCTs/Experimental	Stroke	Tele-health and technology-based	Physical activity; Depression
Shirvani (2021)	Impact evaluation	Iran	RCTs/Experimental	mTBI or concussion	Neuromodulation and neurofeedback; Mindfulness and meditation	Sleep and eating; Quality of life; Aggression
Si (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Patient-caregiver interventions	Quality of life
Sianturi (2018)	Impact evaluation	Indonesia	Lower-tier quasi-experimental designs	Severe TBI	Psychotherapy (in-patient)	Depression
Siddiqi (2019)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Neuromodulation and neurofeedback	Depression
Siddiqi (2023)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Neuromodulation and neurofeedback	Depression
Silverberg (2021)	Clinical trial registry	Canada	RCTs/Experimental	mTBI or concussion	Acute in-patient services	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Silverberg (2022)	Published study protocol	Canada	RCTs/Experimental	mTBI or concussion	Social support programs	Depression; Anxiety
Simblett (2017)	Impact evaluation	United Kingdom	RCTs/Experimental	Stroke	Psychotherapy (out-patient); Tele-health and technology-based	Anxiety; Depression; Activities of daily living/life skills
Skidmore (2015)	Impact evaluation	United States of America	RCTs/Experimental	Stroke	Acute in-patient services	Depression
Slowinski (2019)	Meta analysis	Multiple Countries	Meta analysis	TBI (non-specific)	Antidepressants	Depression
Smeets (2017)	Impact evaluation	Netherlands	Non-experimental designs	ABI (non-specific)	Integrated care and case management; Psychotherapy (out-patient)	Self-awareness and self-efficacy
Song (2021)	Impact evaluation	China	Non-experimental designs	Stroke	Acupuncture and massage	Sleep and eating
Song (2022)	Impact evaluation	China	Non-experimental designs	Stroke	Acute in-patient services	Depression; Anxiety
Srisurapanont (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	TBI (non-specific)	Tele-health and technology-based	Sleep and eating
Stahl (2022)	Impact evaluation	United Kingdom	Upper-tier quasi-experimental designs	Stroke	Social support programs	Depression
Stiekema (2020)	Published study protocol	Netherlands	RCTs/Experimental	ABI (non-specific)	Integrated care and case management	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Storm (2019)	Systematic review	Multiple Countries	Systematic review	Stroke	Exercise and movement-based	Depression; Self-awareness and self-efficacy
Su (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Acupuncture and massage	Depression
Suarilah (2022)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	TBI (non-specific)	Tele-health and technology-based	Depression; Self-awareness and self-efficacy
Sullan (2021)	Impact evaluation	Other	RCTs/Experimental	TBI (non-specific)	Psychotherapy (in-patient)	Sleep and eating; Trauma and stress related
Sumakul (2020)	Impact evaluation	Indonesia	Upper-tier quasi-experimental designs	Stroke	Music and art	Depression
Sun (2017)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Antidepressants	Depression
Sun (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Exercise and movement-based	Depression
Sun (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Psychotherapy (out-patient)	Depression
Tadayon (2022)	Published study protocol	Iran	RCTs/Experimental	Stroke	Tele-health and technology-based	Physical activity; Activities of daily living/life skills; Quality of life

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Tan (2015)	Meta analysis	Multiple Countries	Meta analysis	Stroke	Antidepressants	Depression
Tan (2022)	Impact evaluation	Singapore	RCTs/Experimental	Stroke	Non-psychotropic medications	Depression; Anxiety
Tang (2018)	Published study protocol	China	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback	Depression; Somatic symptoms; Cognition
Tao (2021)	Published study protocol	China	RCTs/Experimental	Stroke	Acupuncture and massage	Depression
Tao (2022)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Mindfulness and meditation	Depression
Tao (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage	Depression
Tay (2022)	Impact evaluation	United Kingdom	RCTs/Experimental	Stroke	Antidepressants	Depression
Tay (2022)	Impact evaluation	United Kingdom	RCTs/Experimental	Stroke	Antidepressants	Depression
Taylor-Piliae (2021)	Impact evaluation	United States of America	Non-experimental designs	Stroke	Exercise and movement-based	Depression; Sleep and eating
Tazopoulou (2016)	Impact evaluation	France	Non-experimental designs	Hypoxic-anoxic	Long-term in-patient services	Cognition; Community engagement; Depression
TerMors (2019)	Systematic review	Multiple Countries	Systematic review	ABI (non-specific)	Non-psychotropic medications	Aggression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Terrill (2022)	Impact evaluation	United States of America	RCTs/Experimental	Stroke	Patient-caregiver interventions	Depression
The University of Hong Kong (2022)	Clinical trial registry	China	RCTs/Experimental	Stroke	Tele-health and technology-based	Depression
Thomas (2019)	Impact evaluation	United Kingdom	RCTs/Experimental	Stroke	Psychotherapy (in-patient)	Depression
Tian (2022)	Impact evaluation	China	Non-experimental designs	Stroke	Antidepressants; Psychotherapy (in-patient)	Depression
Tornas (2016)	Impact evaluation	Norway	RCTs/Experimental	ABI (non-specific)	Cognitive training/rehabilitation	Cognition
Torrisi (2021)	Impact evaluation	Italy	RCTs/Experimental	Stroke	Non-psychotropic medications	Depression; Self-awareness and self-efficacy
Torrisi (2022)	Impact evaluation	Italy	Non-experimental designs	Stroke	Acute in-patient services	Depression; Cognition
Towfighi (2017)	Systematic review	Multiple Countries	Systematic review	Stroke	Integrated care and case management	Depression
Trihandini (2018)	Impact evaluation	Indonesia	Upper-tier quasi-experimental designs	Stroke	Acute in-patient services	Anxiety
Trofimova (2021)	Impact evaluation	Russia	RCTs/Experimental	Stroke	Antidepressants; Non-psychotropic medications	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Tsai (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	TBI (non-specific)	Neuromodulation and neurofeedback	Depression
Tsai (2022)	Impact evaluation	Taiwan	Upper-tier quasi-experimental designs	Stroke	Integrated care and case management	Depression; Quality of life
Tsaousides (2017)	Impact evaluation	United States of America	Lower-tier quasi-experimental designs	TBI (non-specific)	Tele-health and technology-based; Psychotherapy (out-patient)	Self-awareness and self-efficacy; Quality of life
Tseng (2017)	Impact evaluation	Taiwan	Lower-tier quasi-experimental designs	Stroke	Acupuncture and massage	Depression
Tulip (2020)	Impact evaluation	United Kingdom	Non-experimental designs	ABI (non-specific)	Psychotherapy (out-patient)	Self-awareness and self-efficacy
Uchida (2020)	Published study protocol	Japan	RCTs/Experimental	Stroke	Tele-health and technology-based	Depression
Uzdavines (2021)	Published study protocol	United States of America	RCTs/Experimental	TBI (non-specific)	Psychotherapy (out-patient)	Depression; Anxiety
Valiengo (2017)	Impact evaluation	Brazil	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback	Depression
Vallury (2015)	Systematic review	Multiple Countries	Systematic review	Stroke	Patient-caregiver interventions	Depression
van Eeden (2015)	Impact evaluation	Netherlands	RCTs/Experimental	Stroke	Psychotherapy (in-patient); Exercise and movement-based	Depression; Anxiety

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Vasu (2020)	Impact evaluation	Malayasia	Lower-tier quasi-experimental designs	Stroke	Exercise and movement-based	Depression
Vasu (2021)	Published study protocol	Malaysia	RCTs/Experimental	Stroke	Mindfulness and meditation; Exercise and movement-based	Anxiety; Depression
Verberne (2019)	Systematic review	Multiple Countries	Systematic review	ABI (non-specific)	Psychotherapy (out-patient)	Anxiety; Aggression
Verberne (2022)	Impact evaluation	Netherlands	RCTs/Experimental	Stroke	Integrated care and case management	Depression; Anxiety; Activities of daily living/life skills
Visser (2016)	Impact evaluation	Belgium	RCTs/Experimental	Stroke	Psychotherapy (out-patient)	Quality of life; Self-awareness and self-efficacy
von Mensenkampff (2015)	Impact evaluation	Ireland	Non-experimental designs	ABI (non-specific)	Psychotherapy (out-patient)	Trauma and stress related
Vujkovic (2022)	Impact evaluation	Other	Lower-tier quasi-experimental designs	Stroke	Non-psychotropic medications	Anxiety; Depression
Wang (2018)	Impact evaluation	China	Lower-tier quasi-experimental designs	Stroke	Acupuncture and massage; Antidepressants	Depression
Waid-Ebbs (2022)	Clinical trial registry	United States of America	RCTs/Experimental	TBI (non-specific)	Cognitive training/rehabilitation	Cognition; Community engagement

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Wallace (2022)	Impact evaluation	United States of America	RCTs/Experimental	mTBI or concussion	Tele-health and technology-based	Trauma and stress related
Wallace (2022)	Impact evaluation	United States of America	Lower-tier quasi-experimental designs	mTBI or concussion	Integrated care and case management	Depression; Sleep and eating
Wan (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Peer-to-peer programs; Patient-caregiver interventions	Somatic symptoms; Depression
Wan (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Herbal medicine	Depression
Wan (2022)	Published study protocol	China	RCTs/Experimental	Stroke	Peer-to-peer programs; Patient-caregiver interventions	Relationships; Self-awareness and self-efficacy
Wang (2018)	Impact evaluation	China	Upper-tier quasi-experimental designs	Stroke	Acupuncture and massage; Antidepressants	Depression; Anxiety
Wang (2018)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Psychotherapy (out-patient)	Depression
Wang (2019)	Meta analysis	Multiple Countries	Meta analysis	Stroke	Herbal medicine	Depression
Wang (2020)	Impact evaluation	Taiwan	RCTs/Experimental	Stroke	Home-based care	Depression
Wang (2020)	Impact evaluation	China	RCTs/Experimental	Stroke	Mindfulness and meditation	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Wang (2020)	Published study protocol	China	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback	Depression
Wang (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Acupuncture and massage; Non-psychotropic medications	Depression
Wang (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Acupuncture and massage	Depression
Wang (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage	Depression
Wang (2022)	Clinical trial registry	China	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback; Acupuncture and massage	Depression
Wang (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Psychotherapy (in-patient)	Sleep and eating; Depression; Anxiety
Wang (2022)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Herbal medicine	Depression
Ward (2016)	Impact evaluation	Australia	RCTs/Experimental	Stroke	Psychotherapy (out-patient); Patient-caregiver interventions	Depression
Weaver (2018)	Impact evaluation	United States of America	RCTs/Experimental	mTBI or concussion	Acute in-patient services	Trauma and stress related; Quality of life
Wei (2021)	Impact evaluation	China	RCTs/Experimental	Stroke	Psychotherapy (in-patient)	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Weinstein (2017)	Impact evaluation	United States of America	Upper-tier quasi-experimental designs	TBI (non-specific)	Exercise and movement-based	Depression; Anxiety
Whiting (2020)	Impact evaluation	Australia	RCTs/Experimental	Severe TBI	Psychotherapy (out-patient)	Depression; Anxiety
Whiting (2021)	Published study protocol	Australia	RCTs/Experimental	Severe TBI	Psychotherapy (out-patient)	Depression; Anxiety
Wiart (2016)	Systematic review	Multiple Countries	Systematic review	TBI (non-specific)	Psychotherapy (out-patient)	Cognition; Depression; Aggression
Wichowicz (2017)	Impact evaluation	Poland	RCTs/Experimental	Stroke	Psychotherapy (out-patient)	Depression; Anxiety
Wilkie (2021)	Impact evaluation	United Kingdom	Non-experimental designs	ABI (non-specific)	Tele-health and technology-based	Quality of life
Wilkie (2022)	Impact evaluation	United Kingdom	Non-experimental designs	ABI (non-specific)	Exercise and movement-based	Depression; Anxiety
Williamson (2019)	Systematic review	Multiple Countries	Systematic review	TBI (non-specific)	Psychostimulants; Anxiolytics; Antidepressants	Aggression
Winkens (2019)	Impact evaluation	Netherlands	Non-experimental designs	ABI (non-specific)	Acute in-patient services	Aggression
Winter (2020)	Impact evaluation	United States of America	Non-experimental designs	TBI (non-specific)	Home-based care; Patient-caregiver interventions	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Wium-Andersen (2017)	Impact evaluation	Denmark	RCTs/Experimental	Stroke	Non-psychotropic medications	Depression
Wolf (2015)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Psychotherapy (in-patient)	Trauma and stress related; Depression
Wolf (2018)	Impact evaluation	United States of America	RCTs/Experimental	TBI (non-specific)	Psychotherapy (out-patient)	Trauma and stress related; Somatic symptoms; Self-awareness and self-efficacy
Woranush (2021)	Systematic review	Multiple Countries	Systematic review	Stroke	Antidepressants; Psychotherapy (out-patient)	Depression
Wrapson (2022)	Impact evaluation	New Zealand	Upper-tier quasi-experimental designs	Stroke	Mindfulness and meditation	Depression; Anxiety
Wu (2017)	Impact evaluation	China	RCTs/Experimental	Stroke	Acute in-patient services	Depression; Anxiety
Wu (2021)	Impact evaluation	China	RCTs/Experimental	Stroke	Acute in-patient services	Quality of life
Wu (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Tele-health and technology-based	Depression
Wu (2022)	Meta analysis	Multiple Countries	Meta analysis	Stroke	Herbal medicine	Depression
Xiao (2021)	Impact evaluation	China	RCTs/Experimental	Stroke	Antidepressants	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Xie (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Herbal medicine; Acupuncture and massage	Sleep and eating; Anxiety
Xu (2016)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Antidepressants	Depression
Xu (2018)	Impact evaluation	China	RCTs/Experimental	Stroke	Antidepressants	Depression
Xu (2019)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Herbal medicine	Depression
Yan (2015)	Impact evaluation	China	RCTs/Experimental	Stroke	Acute in-patient services; Antidepressants	Depression
Yang (2022)	Impact evaluation	China	Lower-tier quasi-experimental designs	Stroke	Acupuncture and massage	Depression
Yao (2021)	Impact evaluation	China	RCTs/Experimental	Stroke	Antidepressants	Depression
Yao (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Herbal medicine	Depression
Yilmaz (2020)	Clinical trial registry	Turkey	RCTs/Experimental	Stroke	Acupuncture and massage	Anxiety
Yin (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage	Depression
You (2020)	Impact evaluation	China	RCTs/Experimental	Stroke	Acute in-patient services	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
You (2020)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage; Antidepressants	Depression; Quality of life
Yu (2019)	Impact evaluation	China	RCTs/Experimental	Stroke	Cognitive training/rehabilitation	Cognition; Depression; Anxiety
Yu (2019)	Impact evaluation	China	RCTs/Experimental	Stroke	Patient-caregiver interventions	Depression; Anxiety; Cognition
Yu (2021)	Impact evaluation	China	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback	Depression
Yu (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Psychotherapy (out-patient)	Depression
Yuan (2023)	Impact evaluation	China	RCTs/Experimental	Stroke	Antidepressants	Depression
Yue (2017)	Meta analysis	Multiple Countries	Meta analysis	TBI (non-specific)	Antidepressants	Depression
Zeng (2016)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Non-psychotropic medications	Depression
Zeng (2017)	Systematic review	Multiple Countries	Systematic review	Stroke	Herbal medicine	Depression
Zeng (2022)	Clinical trial registry	China	RCTs/Experimental	Stroke	Antidepressants	Depression
Zeng (2022)	Clinical trial registry	China	RCTs/Experimental	Stroke	Acupuncture and massage	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Zhang (2016)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage; Antidepressants	Depression
Zhang (2017)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage	Depression
Zhang (2019)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage; Antidepressants	Depression
Zhang (2019)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Acupuncture and massage	Depression
Zhang (2020)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage	Depression
Zhang (2020)	Impact evaluation	China	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback; Non-psychotropic medications	Depression; Quality of life
Zhang (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Tele-health and technology-based	Cognition; Depression
Zhang (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Acupuncture and massage; Antidepressants	Depression
Zhang (2021)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Acupuncture and massage; Antidepressants	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Zhang (2021)	Meta analysis	Multiple Countries	Meta analysis	Stroke	Herbal medicine	Depression
Zhang (2021)	Impact evaluation	China	RCTs/Experimental	Stroke	Psychotherapy (out-patient); Exercise and movement-based	Depression; Activities of daily living/life skills
Zhang (2022)	Meta analysis	Multiple Countries	Meta analysis	Stroke	Antidepressants; Acupuncture and massage	Depression
Zhang (2021)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage	Depression; Anxiety
Zhao (2018)	Published study protocol	China	RCTs/Experimental	Stroke	Herbal medicine	Depression
Zhao (2018)	Clinical practice guideline	China	Clinical practice guideline	Stroke	Antidepressants; Psychotherapy (out-patient)	Depression
Zhao (2019)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage	Depression
Zhao (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Exercise and movement-based; Music and art	Depression
Zhen (2022)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Herbal medicine	Depression
Zhi (2021)	Impact evaluation	China	RCTs/Experimental	Stroke	Acupuncture and massage	Depression

First Author (Year)	Publication Type	Country	Study Design	Type of ABI	Intervention Category(s)	Outcome Category(s)
Zhou (2020)	Meta analysis	Multiple Countries	Meta analysis	Stroke	Antidepressants	Depression
Zhou (2022)	Published study protocol	China	RCTs/Experimental	Stroke	Acute in-patient services	Anxiety
Zhu (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Non-psychotropic medications	Depression
Zhu (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Non-psychotropic medications	Depression
Zhu (2022)	Impact evaluation	China	RCTs/Experimental	Stroke	Neuromodulation and neurofeedback; Antidepressants	Depression
Zou (2018)	Systematic review with meta-analysis	Multiple Countries	Systematic review with meta-analysis	Stroke	Exercise and movement-based	Depression; Activities of daily living/life skills; Physical activity

Note. Records are listed in alphabetical order (first author surname).

Supplementary Table 5.

AMSTAR-2 Ratings for Included Systematic Reviews.

First Author (Year)	Systematic Review Title	AMSTAR-2 Rating			
		Critically Low	Low	Moderate	High
Acabchuk (2021)	Therapeutic Effects of Meditation, Yoga, and Mindfulness-Based Interventions for Chronic Symptoms of Mild Traumatic Brain Injury: A Systematic Review and Meta-Analysis.		✔		
Ackland (2019)	Effectiveness and harms of mental health treatments in service members and veterans with deployment-related mild traumatic brain injury.		✔		
Ahrens (2022)	Cognitive-behavioral therapy for managing depressive and anxiety symptoms after stroke: a systematic review and meta-analysis.	✔			
Allida (2019)	Pharmaceutical interventions for emotionalism after stroke.				✔
Allida (2020)	Pharmacological, psychological and non-invasive brain stimulation interventions for preventing depression after stroke.				✔
Baker (2018)	A systematic review of rehabilitation interventions to prevent and treat depression in post-stroke aphasia.		✔		
Bang-Jiang (2018)	Assessment of meta-analysis: Systematic review on acupuncture therapy for post stroke depression (PSD)	✔			
Baylan (2016)	The effects of music listening interventions on cognition and mood post-stroke: a systematic review.		✔		

First Author (Year)	Systematic Review Title	AMSTAR-2 Rating			
		Critically Low	Low	Moderate	High
Beedham (2020)	The management of depression following traumatic brain injury: A systematic review with meta-analysis.			✔	
Bucur (2018)	A systematic review of noninvasive brain stimulation for post-stroke depression.		✔		
Byrne (2016)	The effectiveness of psychological interventions for aggressive behavior following acquired brain injury: A meta-analysis and systematic review.	✔			
Cai (2021)	Efficacy and safety of modified Sini San for treating poststroke depression: A meta-analysis of randomized controlled trials.	✔			
Chan (2022)	A systematic review on integrated care for traumatic brain injury, mental health, and substance use.		✔		
Chen (2020)	Development of a Care Bundle for Stroke Survivors with Psychological Symptoms: Evidence Summary and Delphi Study.			✔	
Chen (2020)	Effects of cognitive behavioral therapy for adults with post-concussion syndrome: A systematic review and meta-analysis of randomized controlled trials.		✔		
Cheng (2021)	Therapeutic benefits of pharmacologic and nonpharmacologic treatments for depressive symptoms after traumatic brain injury: a systematic review and network meta-analysis.			✔	
Choo (2022)	Effectiveness of caregiver-mediated exercise interventions on activities of daily living, anxiety and depression post-stroke rehabilitation: A systematic review and meta-analysis.				✔

First Author (Year)	Systematic Review Title	AMSTAR-2 Rating			
		Critically Low	Low	Moderate	High
Chun (2018)	A systematic review of anxiety interventions in stroke and acquired brain injury: Efficacy and trial design.		✔		
Clay (2019)	Prophylaxis Pharmacotherapy to Prevent the Onset of Post-Traumatic Brain Injury Depression: A Systematic Review.			✔	
Cui (2018)	Efficacy and Safety of Citalopram for the Treatment of Poststroke Depression: A Meta-Analysis.	✔			
D'Anci (2019)	Treatments for Poststroke Motor Deficits and Mood Disorders: A Systematic Review for the (2019) U.S. Department of Veterans Affairs and U.S. Department of Defense Guidelines for Stroke Rehabilitation.	✔			
Dayuan (2022)	The effect of music as an intervention for post-stroke depression: A systematic review and meta-analysis.		✔		
Deng (2017)	Interventions for management of post-stroke depression: A Bayesian network meta-analysis of 23 randomized controlled trials.	✔			
Deng (2018)	Efficacy and tolerability of pharmacotherapy for post-stroke depression: a network meta-analysis.		✔		
Dolbow (2020)	The effects of physical exercise on depression for individuals with traumatic brain injury: A systematic review	✔			
Feng (2022)	Efficacy of escitalopram for poststroke depression: a systematic review and meta-analysis.	✔			

First Author (Year)	Systematic Review Title	AMSTAR-2 Rating			
		Critically Low	Low	Moderate	High
Gao (2019)	The influence of sertraline on depressive disorder after traumatic brain injury: A meta-analysis of randomized controlled studies.	✔			
Gertler (2015)	Non-pharmacological interventions for depression in traumatic brain injury				✔
Guo (2022)	Moxibustion for treating patients with post-stroke depression: a systematic review and meta-analysis.		✔		
Han (2023)	Mindfulness- and Acceptance-Based Interventions for Stroke Survivors: A Systematic Review and Meta-Analysis			✔	
Hao (2023)	Transcranial direct current stimulation for the treatment of post-stroke depression: A systematic review				✔
Hicks (2020)	Pharmacotherapy for the Pseudobulbar Affect in Individuals Who Have Sustained a Traumatic Brain Injury: a Systematic Review.		✔		
Hicks (2021)	Efficacy and Harms of Pharmacological Interventions for Anxiety after Traumatic Brain Injury: Systematic Review.		✔		
Hung (2019)	Overview of systematic reviews with meta-analyses on acupuncture in post-stroke cognitive impairment and depression management.		✔		
Hwang (2021)	Telehealth Interventions to Support Self-Management in Stroke Survivors: A Systematic Review.		✔		
Kalbouneh (2022)	Safety and Efficacy of SSRIs in Improving Poststroke Recovery: A Systematic Review and Meta-Analysis.	✔			

First Author (Year)	Systematic Review Title	AMSTAR-2 Rating			
		Critically Low	Low	Moderate	High
Knapp (2017)	Interventions for treating anxiety after stroke.			✔	
Kwon (2019)	Efficacy and safety of Sihogayonggolmoryeo-tang (Saikokaryukotsuboreito, Chai-Hu-Jia-Long-Gu-Mu-Li-Tang) for post-stroke depression: A systematic review and meta-analysis.				✔
Kwon (2019)	Herbal medicine for post-stroke anxiety: A systematic review and meta-analysis of randomized controlled trials.	✔			
Lavu (2022)	Evaluation and Treatment of Depression in Stroke Patients: A Systematic Review.	✔			
Lee (2019)	Content and Effectiveness of Interventions Focusing on Community Participation Poststroke: A Systematic Review.	✔			
Lee (2021)	Effectiveness of non-pharmacological interventions for treating post-stroke depressive symptoms: Systematic review and meta-analysis of randomized controlled trials.				✔
Li (2018)	Clinical effects and safety of electroacupuncture for the treatment of post-stroke depression: a systematic review and meta-analysis of randomised controlled trials.		✔		
Li (2020)	Comparative efficacy of nine antidepressants in treating Chinese patients with post-stroke depression: A network meta-analysis.		✔		
Li (2022)	Effects of transcranial direct current stimulation for post-stroke depression: A systematic review and meta-analysis.		✔		
Liang (2022)	Effects of Noninvasive Brain Stimulation Combined With Antidepressants in Patients With Poststroke Depression: A Systematic Review and Meta-Analysis.	✔			

First Author (Year)	Systematic Review Title	AMSTAR-2 Rating			
		Critically Low	Low	Moderate	High
Liang 202	Hyperbaric oxygen therapy for post-stroke depression: A systematic review and meta-analysis		✔		
Little (2021)	The effectiveness of cognitive behaviour therapy for reducing anxiety symptoms following traumatic brain injury: A meta-analysis and systematic review.			✔	
Liu (2018)	Neuropsychological rehabilitation and psychotherapy of adult traumatic brain injury patients with depression: a systematic review and meta-analysis.	✔			
Liu (2019)	Efficacy and Safety of High-Frequency Repetitive Transcranial Magnetic Stimulation for Poststroke Depression: A Systematic Review and Meta-analysis.		✔		
Liu (2021)	Acupuncture for post-stroke depression: a systematic review and meta-analysis.		✔		
Love (2019)	Mind-Body Interventions, Psychological Stressors, and Quality of Life in Stroke Survivors: A Systematic Review	✔			
Maksimowski (2016)	Efficacy of stimulants for psychiatric symptoms in individuals with traumatic brain injury.		✔		
Mikolic (2019)	Treatment for posttraumatic stress disorder in patients with a history of traumatic brain injury: A systematic review.	✔			
Mou (2021)	Effectiveness of dyadic psychoeducational intervention for stroke survivors and family caregivers on functional and psychosocial health: A systematic review and meta-analysis			✔	
Narapareddy (2020)	Treatment of Depression After Traumatic Brain Injury: A Systematic Review Focused on Pharmacological and Neuromodulatory Interventions.	✔			

First Author (Year)	Systematic Review Title	AMSTAR-2 Rating			
		Critically Low	Low	Moderate	High
Oh (2022)	The effectiveness of self-management interventions with action-taking components in improving health-related outcomes for adult stroke survivors: a systematic review and meta-analysis.		✔		
Paraschakis (2017)	Antidepressants for Depression Associated with Traumatic Brain Injury: A Meta-analytical Study of Randomised Controlled Trials.	✔			
Peppel (2020)	Pharmacological and Non-Pharmacological Interventions for Depression after Moderate-to-Severe Traumatic Brain Injury: A Systematic Review and Meta-Analysis.	✔			
Perry (2020)	The effectiveness of physical exercise as an intervention to reduce depressive symptoms following traumatic brain injury: A meta-analysis and systematic review.			✔	
Plantier (2016)	Drugs for behavior disorders after traumatic brain injury: Systematic review and expert consensus leading to French recommendations for good practice.	✔			
Qin (2021)	Environmental enrichment for stroke and other non-progressive brain injury			✔	
Reyes (2019)	Efficacy of sertraline in post-traumatic brain injury (post-TBI) depression and quality of life: A systematic review and meta-analysis of randomized controlled trials.		✔		
Richter (2021)	Selective Serotonin Reuptake Inhibitors for the Prevention of Post-Stroke Depression: A Systematic Review and Meta-Analysis	✔			
Ryan (2022)	A systematic review of non-drug interventions to prevent and treat anxiety in people with aphasia after stroke.			✔	

First Author (Year)	Systematic Review Title	AMSTAR-2 Rating			
		Critically Low	Low	Moderate	High
Salter (2016)	Pharmacotherapy for Depression Posttraumatic Brain Injury: A Meta-analysis.	✔			
Shao (2020)	Effectiveness and safety of the Xuefu Zhuyu Tang for post-stroke depression: A systematic review and meta-analysis		✔		
Shao (2021)	Efficacy of repetitive transcranial magnetic stimulation for post-stroke depression: a systematic review and meta-analysis of randomized clinical trials.				✔
Shek (2021)	Technology-based interventions for mental health support after stroke: A systematic review of their acceptability and feasibility.	✔			
Shen (2017)	Repetitive transcranial magnetic stimulation for the treatment of post-stroke depression: A systematic review and meta-analysis of randomized controlled clinical trials.		✔		
Shen (2022)	Repetitive Transcranial Magnetic Stimulation and Transcranial Direct Current Stimulation as Treatment of Poststroke Depression: A Systematic Review and Meta-Analysis.	✔			
Srisurapanont (2021)	Blue-wavelength light therapy for post-traumatic brain injury sleepiness, sleep disturbance, depression, and fatigue: A systematic review and network meta-analysis.		✔		
Storm (2019)	The Effectiveness of Mental Practice Interventions on Psychological Health in Stroke Patients: A Systematic Review	✔			
Su (2021)	A Meta-Analysis of the Effect of Abdominal Acupuncture on Post-Stroke Depression.		✔		

First Author (Year)	Systematic Review Title	AMSTAR-2 Rating			
		Critically Low	Low	Moderate	High
Suarilah (2022)	Effectiveness of telehealth interventions among traumatic brain injury survivors: A systematic review and meta-analysis.	✔			
Sun (2017)	Comparative efficacy and acceptability of antidepressant treatment in poststroke depression: a multiple-treatments meta-analysis.		✔		
Tao (2022)	Effectiveness of mindfulness-based stress reduction and mindfulness-based cognitive therapy on depression in poststroke patients-A systematic review and meta-analysis of randomized controlled trials.		✔		
TerMors (2019)	Efficacy of amantadine on behavioural problems due to acquired brain injury: A systematic review.		✔		
Towfighi (2017)	Poststroke Depression: A Scientific Statement for Healthcare Professionals From the American Heart Association/American Stroke Association.	✔			
Tsai (2021)	Effect of repetitive transcranial magnetic stimulation on depression and cognition in individuals with traumatic brain injury: a systematic review and meta-analysis.	✔			
Vallury (2015)	Do family-oriented interventions reduce poststroke depression? A systematic review and recommendations for practice.				✔
Verberne (2019)	Psychological interventions for treating neuropsychiatric consequences of acquired brain injury: A systematic review.	✔			
Wan (2021)	Effects of peer support interventions on physical and psychosocial outcomes among stroke survivors: A systematic review and meta-analysis.	✔			

First Author (Year)	Systematic Review Title	AMSTAR-2 Rating			
		Critically Low	Low	Moderate	High
Wan (2021)	Efficacy and Safety of Chaihu Jia Longgu Muli Decoction in the Treatment of Poststroke Depression: A Systematic Review and Meta-Analysis.				✔
Wang (2018)	Cognitive behavioral therapy for post-stroke depression: A meta-analysis.		✔		
Wang (2021)	Meta-analysis of the clinical effectiveness of combined acupuncture and Western Medicine to treat post-stroke depression.	✔			
Wang (2021)	Is Electroacupuncture an Effective and Safe Treatment for Poststroke Depression? An Updated Systematic Review and Meta-Analysis.	✔			
Wang (2022)	Efficacy and Safety of Xiaoyao Recipe in the Treatment of Poststroke Depression: A Systematic Review and Meta-Analysis.		✔		
Wiart (2016)	Non pharmacological treatments for psychological and behavioural disorders following traumatic brain injury (TBI). A systematic literature review and expert opinion leading to recommendations.	✔			
Williamson (2019)	Pharmacological interventions for agitated behaviours in patients with traumatic brain injury: a systematic review.		✔		
Woranush (2021)	Preventive Approaches for Post-Stroke Depression: Where Do We Stand? A Systematic Review.		✔		
Xu (2016)	Efficacy and feasibility of antidepressant treatment in patients with post-stroke depression.	✔			
Xu (2019)	Clinical efficacy and safety of xiaoyao pill in post-stroke depression: A systematic review and meta-analysis of randomized controlled trials	✔			

First Author (Year)	Systematic Review Title	AMSTAR-2 Rating			
		Critically Low	Low	Moderate	High
Zeng (2016)	Is adjunctive treatment with medication of liver-soothing-oriented method beneficial for depression after cerebrovascular accident?: A PRISMA-compliant meta-analysis.	✔			
Zeng (2017)	Role of Medicinal Plants for Liver-Qi Regulation Adjuvant Therapy in Post-stroke Depression: A Systematic Review of Literature.		✔		
Zhang (2019)	The effectiveness of acupuncture therapy in patients with post-stroke depression: An updated meta-analysis of randomized controlled trials.	✔			
Zhang (2021)	Impact of Virtual Reality-Based Therapies on Cognition and Mental Health of Stroke Patients: Systematic Review and Meta-analysis		✔		
Zhang (2021)	Comparison between acupuncture and antidepressant therapy for the treatment of poststroke depression: Systematic review and meta-analysis.	✔			
Zhang (2021)	Does acupuncture combined with antidepressants have a better therapeutic effect on post-stroke depression? A systematic review and meta-analysis.			✔	
Zhen (2022)	Efficacy and safety of Buyang Huanwu Decoction in the treatment of post-stroke depression: A systematic review and meta-analysis of 15 randomized controlled trials.		✔		
Zou (2018)	Effects of Mind-Body Exercises for Mood and Functional Capabilities in Patients with Stroke: An Analytical Review of Randomized Controlled Trials.	✔			

Chapter 3:

Ten Priorities for Research Addressing the Intersections of Brain Injury, Mental Health, & Addictions: A Stakeholder Driven Priority Setting Process

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Author Note

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Abstract

Objectives: The purpose of this study was to engage key stakeholders in a health research priority-setting process to identify, prioritize, and produce a community-driven list of research questions addressing intersectional issues on mental health and addictions (MHA) in acquired brain injury (ABI).

Methods: A multi-phasic health research priority-setting process was co-designed and executed with community-based stakeholders, including researchers, health professionals, clinicians, service providers, representatives from brain injury associations, policy makers, and people with lived experience of ABI and MHA, including patients and their family members. Stakeholders' ideas led to the generation of research questions which were prioritized at a one-day workshop.

Results: Fifty-nine stakeholders participated in the priority-setting activity during the workshop, resulting in a rank-ordered list of the top ten questions for research addressing the intersections of ABI and MHA. Questions identified touched on several pressing issues (e.g., opioid crisis, homelessness), encompassed multiple sub-types of ABI (e.g., hypoxic-ischemic, mild traumatic), and involved different domains (e.g., identification, intervention) of health research.

Conclusions: This community-driven health research priority-setting study identified and prioritized research questions addressing the intersections of ABI and MHA. Researchers and funding agencies should use this list to inform their agendas and address stakeholders' most urgent needs, fostering meaningful improvements to clinical services.

Patient or Public Contribution: An eleven person working group comprised of people with lived experience, service providers, researchers, healthcare professionals and other key stakeholders collaboratively developed the scope, design, methodology, and interpretation of this

study. Over fifty community-based stakeholders contributed to the research priority-setting activity.

Introduction

Acquired brain injury (ABI), the umbrella term referring to a wide array of neurological insult and injury, including traumatic brain injury (TBI), cerebro-vascular accidents (stroke and other ischemic events), hydrocephalus, cerebral infections, tumors, hypoxia/anoxia, and more, is a highly prevalent condition affecting well over 80 million people each year and costing the global economy upwards of 900 billion (US) dollars annually.[1–5] *Mental health and addictions* (MHA) problems, such as anxiety, depression, and substance use disorders are common following ABI.[6–9] For example, approximately one-third of stroke survivors experience post-stroke depression,[10] including feelings of apathy, irritability, and sleep disturbance, which are known to impede rehabilitation and negatively affect survivors' quality of life.[11] In general, the risk of developing any MHA disorder is increased two-fold following ABI[12] and is associated with significant morbidity and mortality.[13,14]

Changes in psychosocial well-being, physical mobility, autonomy, and underlying neural circuitry all contribute to how a person responds after ABI.[6,9,15,16] One such post-injury coping response is the use of illicit substances[17] or misuse of prescription medication,[18,19] which can lead to problematic substance use in the form of addiction.[17,19,20] Therefore, people who experience ABI are at an elevated risk for developing drug addiction after their injuries,[17,21,22] even for those who sustain their injuries in childhood.[22] Moreover, substance intoxication is also the leading contributor to accident-related brain injury,[9,23] making it not only an outcome, but also a predictor for ABI.[6,9,23] Despite being the third most common psychiatric outcome, research on substance use and addiction-related disorders in ABI populations is sparse in comparison to depression, anxiety, and other behavioral problems.

In general, epidemiological data on MHA problems after ABI are hindered by several issues. For one, recognition of MHA problems in ABI populations can be challenging as both issues share many common symptoms (e.g., headache, dizziness, fatigue, irritability), making it difficult for healthcare providers to disentangle overlapping symptomatology.[9,24] Secondly, some populations known to have high rates of ABI are also disproportionately affected by MHA, such as people who are experiencing homelessness[25–28] or who experience intimate partner violence,[29–31] confounding the recognition and cause-and-effect issues. In Canada, ABI is not tracked by the Chronic Disease Surveillance System, resulting in a lack of longitudinal data on multimorbidity and long-term outcomes.[32]

Understanding the intricate links between MHA and ABI remains a complex challenge. Indeed, bettering the lives of the populations they study should be researchers' foremost aspiration, but stakeholder guidance is needed to produce meaningful research with practical utility for knowledge-end users. *Research priority-setting* refers to "a range of activities that involve identifying, prioritizing, and achieving consensus on the research areas or questions of importance to stakeholders."[33] These activities aim to ascertain what knowledge is most valued by patients, practitioners, or the public as they become experts in their own health care experiences.[34] Several large organizations have established approaches with this purpose in mind, such as the James Lind Alliance[35] or the Global Evidence Mapping (GEM) Initiative.[36,37] Research groups have taken differing approaches in their grounding frameworks, methodological designs and levels of stakeholder engagement, often devising novel methods which are best suited to their own objectives and needs.[34,38–40] Leaders in the field suggest that frameworks, stakeholder engagement, approaches to prioritization, and desired outcomes will depend largely on the topics of interest and the specific stakeholder groups involved.[33,42] While there is no gold

standard approach to research priority-setting,[41] all exist under the assumption that patients and the public should have a say in determining research priorities and decision-making processes.

In the field of ABI, the limited number of health research priority-setting studies have involved different stakeholder groups for different purposes. For example, the GEM initiative[36,37] sought to understand patients and clinicians priorities for TBI and spinal cord injury rehabilitation to guide their series of knowledge syntheses; Canadian researchers Poulin et al.[43] surveyed ABI clinicians only in an effort to better understand their priorities towards ABI rehabilitations. Varying methods have also been used to set priorities. Solbakken et al.[40] developed and executed their own approach inspired by the James Lind Alliance[35], involving a broad group of stakeholders through a series of surveys to identify a top-ten list of research needs regarding transitional care for patients with acute stroke. Using the World Café method, Nalder and colleagues[44] hosted a workshop to collaboratively set priorities among different stakeholder groups for optimizing long-term community integration after TBI. Although providing key fundamental data, these studies did not use a holistic approach with broad stakeholder engagement, and the perspectives of people with lived experience were underrepresented.

Many reviews have concluded that more research is needed to better understand the complex interconnections between ABI and MHA,[9–12,22,24] and an environmental scan of the evidence base shows that this need is more than justified.[45] However, exactly *what* questions need answering is less clear. Health research priority-setting processes have been applied to various forms of disease and disability including MHA[46–48] and ABI[36,37,40,40,43,44] related issues, yet, until now, no priority-setting study has been conducted to understand stakeholders' priorities for future research addressing the intersections of ABI and MHA. The lack of collaborative priorities set by representatives of diverse stakeholder groups, especially people with lived

experience, represents a significant evidence gap. Meaningful inclusion of people with lived experience in health research priority-setting is crucial for formulating purposeful and equitable research with high community and clinical impact. Therefore, the purpose of this study was to engage key stakeholder groups, including multidisciplinary researchers, clinicians, health professionals, service providers, brain injury association representatives, policy makers, health administrators, brain injury survivors and their caregivers or family members, in a health research priority-setting process to identify, rank, and produce a community-driven list of priorities to guide future research addressing the intersections of ABI and MHA.

Methods

Study Design

The Council on Health Research for Development (COHRED) framework for priority-setting in research for health was used to inform the design of the current study.[49] In addition to the COHRED framework, Viergever et al.'s checklist for good practice in health research priority-setting[50] and Tong et al.'s REPRISE guidelines[33] were applied and followed. Additionally, several techniques and procedures were adapted from the GEM Initiative's method for research priority-setting in the fields of TBI and spinal cord injury.[36,37] All recruitment processes followed the best practices in equity, diversity, and inclusion in research as recommended by the New Frontiers in Research Fund and the Canadian Research Coordinating Committee. Approval for this study was obtained from the University of [MASKED] (#22-0614) and the University of [MASKED] (#H22-03403) Human Research Ethics Boards.

Working Group

The working group was established to both contribute to the goals of the priority-setting process and to oversee its development, delivery, and dissemination. The eleven person group was comprised of three people with lived experience (two survivors of brain injury and one

family member), three service providers, six scientist-practitioners (i.e., psychologist, neuropsychologist, neuropsychologist trainee, two occupational therapists, registered clinical counsellor) and two other community-based stakeholders. This composition was intentional to ensure equitable representation from different stakeholder groups (several members identified with more than one stakeholder group). Importantly, knowledge from lived experiences and knowledge from more traditional forms of expertise through research and academia were valued equally. The group met monthly (or more frequently, as needed) for over one year and was responsible for: (1) determining scope, (2) informing study design, (3) generating initial questions and contributing to question generation activities, (4) reviewing and consulting on revised questions for prioritization, and (5) confirming the final list of research priorities. Members who identified as people with lived experience (i.e., survivors and family members) were compensated for their time according to BC Centre for Disease Control (CDC) Peer Payment Standards.[51]

Participants

Purposeful sampling was used. Participants were stakeholders of diverse backgrounds and experiences. In this study, 'stakeholders' included researchers of varying status and expertise, multidisciplinary health professionals, service providers, leaders and representatives from community brain injury organizations, survivors of brain injury, policy makers, including politicians and health administration government officials, and family members of those affected by concurrent ABI and MHA related complications. We sought to include a broad cross-section of stakeholders as each group possesses unique insights that must be considered. Therefore, their inclusion was essential for setting priorities which are diversified, accessible, and representative.

Participants were recruited through our network of community partners and invited to attend *Consensus on Brain Injury Day*, a one-day workshop organized by our team as part of the *BC Consensus on Brain Injury, Mental Health, and Addiction* research project (hereafter referred to as the *BC Consensus on Brain Injury*). Event invitations were made selectively and thoughtfully, to ensure equal representation of groups across the broader stakeholder population, with particular focus on inclusion of equity-deserving groups, such as persons with disabilities, members of Indigenous groups, and members of the LGBTQ2IA+ community, as these groups have been largely underrepresented in ABI research. There were no explicit exclusion criteria, other than no relation to our topic(s) of interest.

Priority-Setting Procedures

The following section describes the multi-phasic, multi-step, multi-informant, and multi-format priority-setting process used in this study. As previously mentioned, our procedures were adapted from and informed by several pre-established methods. In line with previous priority-setting research,[34,38,40–42,44] a range of components of different methods were incorporated and several elements were uniquely devised to create an approach that was best suited to fit our guiding principles, study objectives, topic of interest, and desired level of stakeholder engagement.

Step 1: Expert Consultation

To inform the beginning stages of this study, it was important to first get a grasp on the intersections of ABI and MHA from experts in the field. In congruence with the community-engaged approach to this study, ‘experts’ were researchers, service providers, clinicians, and people with lived experience, many of whom were members of the working group. For our purposes, ‘consultation’ involved meetings, informal conversations, and review of previous

works within our network. In addition, a University of Victoria librarian with experience in these fields and expertise in systematic literature searching was consulted. While intangible and diversified, expert consultation was a critical step in determining the scope, parameters, and methodology for developing the research questions. Presented here as the first step, expert consultation carried throughout the entire course of this study and was a fundamental component to its success.

Step 2: Preliminary Literature Review

The purpose of the literature review was to inform the development of a preliminary list of broad research topics described as priority areas or knowledge gaps in the existing literature. To build from knowledge gathered during expert consultation, key articles addressing ABI in the context of MHA were identified and reviewed to determine the specific language and variations in terminology related to the intersection of these topics. Common search phrases were identified and relevant subject headings and key terms were mined from seed articles and adapted as required across information sources. Two major databases, MEDLINE (Ovid) and PsycINFO (EBSCOhost) were searched for relevant articles. To limit publication bias and identify 'non-elitist' information, we also conducted an informal search of grey literature. Based on topics, authors, key ideas, and terms identified in both the literature searches, manual (hand) searching was also conducted to identify additional reports of relevance. After reviewing and familiarizing ourselves with the literature, we extracted relevant 'calls to action', knowledge gaps, and recommendations for future research from existing and emerging evidence. Table 1 illustrates examples of calls to action, knowledge gaps, and recommendations for future research that were extracted from relevant articles and used to inform the next steps.

Step 3: Topic Generation

The purpose of the topic generation phase was to formulate a list of priority research topics combining ideas from the literature with stakeholders' priorities. First, raw text excerpts of identified knowledge gaps and calls to action were synthesized and collated in NVivo 12.[52] Synthesis was an iterative process, such that redundancies were eliminated and terminology was changed for consistency across research topics. In contrast to questions, 'topics' are broad ideas addressing research. For our purposes, topics served as somewhat discrete areas for stakeholders to focus their priorities around. The initial list of topics was distributed to the working group, who were first tasked with reviewing the list; revising, critiquing, or rephrasing based on their knowledge and personal experiences. They were then instructed to add their own priorities, or eliminate ones from the list, at their discretion. Revisions and feedback from this process were compiled, leading to the generation of a finalized list of priority research topics to inform the next step, question generation.

Step 4: Question Generation

The purpose of the question generation phase was to gather and formulate research questions based on stakeholders' needs, opinions, and of course, priorities. To facilitate this process, the finalized list of priority research topics created during the previous step was circulated to the working group along with comprehensive instructions as well a research question generation worksheet to help structure the task. To generate targeted and poignant research questions, stakeholders were encouraged to use the popular PICO ('Population', 'Intervention', 'Comparator', 'Outcome') format. The PICO format allows for structured research questions and has been used in research priority-setting activities with stakeholders, including those conducted by the GEM initiative.[36,37,53] Along with the question generation

worksheet, a ‘PICO Guide’ was created and circulated to the working group as supplemental material to help them formulate their questions. Use of the PICO format was encouraged, but not mandatory, and assistance from research personnel was made available to stakeholders.

Step 5: Question Development

The purpose of the question development phase was to transform responses into a list of ‘answerable’ research questions that best reflects stakeholders’ collective priorities. Responses from the question generation phase led to a large volume of unstructured data, with numerous individual written responses in the form of questions, ideas, and statements all varying in their language, format, and areas of emphasis. Translating heterogenous and unstructured ideas expressing broad stakeholder perspectives into answerable questions is a challenge that has been recognized by researchers engaging in priority-setting processes. To do so, the GEM method of transforming PICO fragments was adapted and applied.[36,37] By adopting a systematic approach to question development, we ensured that the integrity of stakeholders’ ideas was maintained across the synthesis process. Following and expanding upon the GEM method, we used a nine-step systematic process to transform data into structured research questions (see Table 2). As a result of this process, over 80 question fragments were independently coded by two researchers using over 60 ICF and ICD codes in the qualitative analysis software NVivo 12,[52] and a list of 12 research questions was produced. The list contains perspectives and ideas from a broad range of information sources emerging from the extensive procedures described in steps one through five.

Step 6: Question Prioritization

Participants attended the *BC Consensus on Brain Injury* workshop on October 14, 2022, in British Columbia, Canada. The purpose of the question prioritization activity was to understand stakeholders’ priority assessment of the identified research questions; that is, what

questions they would like to see answered first. The twelve research questions were mounted to a web-based survey in preparation for the workshop. The survey contained two major sections from which data was collected. The first section, *'ranking'*, required participants to rank-order the research questions by priority. The second section, *'rating'*, required participants to rate each research question based on its level of (1) *clinical importance* (how important the question is for improving health/healthcare), (2) *novelty* (how much the question represents an emerging field of interest or attention), and (3) *controversy* (the level of disagreement regarding opinion and/or practice for the question) on a sliding Likert scale of 1 to 5 ('not at all' to 'high'). This rating procedure was adapted from the GEM method for research question prioritization.[36,37,53] Question prioritization was facilitated during the second half of the workshop and took approximately 20 minutes to complete. Participants were provided with instructions prior to starting the activity and facilitators were present to support them as needed.

Data Analysis

Descriptives were computed for participant demographics such as age, sex, gender, sexual orientation, education, and ethnicity to understand the overall sample composition. Descriptive statistics were also computed for ranking and rating responses and cases with >75% missing data were dropped from all statistical analyses. Multiple imputation was used to fill any remaining missing values as this method provides more validity than other ad hoc approaches to addressing missing data by using all available data to result in unbiased estimates.[54] For each participant (*n*), individual question (*k*) ranking and rating scores are combined to formulate the *Question Priority Composite* (*QPC*) score. The *QPC* equation was created by the research team and driven by our imperatives for comprehensively understanding stakeholders' priorities. To effectively do so, we felt that having multiple sources of input (i.e., rankings *and* ratings) was

important for determining the level of priority for each question. Rather than relying on ranking or rating scores alone, we believe that incorporating both variables produces a more robust score that considers the nuances of participants' priority evaluation of each research question. With these foundational goals in mind, the *QPC* formula was created and is as follows:

$$QPC_{n,k} = x_{rank} + x_{rate}$$

The first component of the *QPC* equation, x_{rank}, represents participants' ranking scores. Within the x_{rank} equation, '*rank*' signifies the position which participants ranked each question (i.e., 1 = highest priority, 2 = second highest priority, etc.), 'q' is the total number of research questions, and '$q + 1$' (numerator) serves to reverse score rankings, such that higher scores reflect higher priority. The denominator, number of questions *(q),* reflects the highest possible ranking value and serves to balance the equation. x_{rank} is computed as follows:

$$x_{rank} = \frac{\{(q\ +\ 1)\ - rank)\}}{q}$$

The second component of the *QPC* equation, x_{rate}, represents participants' rating scores. Within the x_{rate} equation, clinical importance (*CI*), novelty (*nov*), and controversy (*cont*) are weighted. The decision to weight these was guided by the GEM method for question prioritization, whereby they classified 'high priority questions' as those which participants rated clinical importance as 'high' AND novelty OR controversy as 'high' or 'moderate'.[36] Expanding upon this categorical classification method, we computationally weighted these elements. The denominator reflects the highest possible rating value, in our case, five (i.e., scale of 0–5), and serves to balance the equation. x_{rate} is computed as follows:

$$x_{rate} = \frac{CI(0.5) + nov(0.25) + cont(0.25)}{5}$$

Calculated x_{rank} and x_{rate} scores were imputed into the *QPC* score equation ($QPC_{n,k} = x_{rank} + x_{rate}$). Following which, *QPC* scores for each question were then summed across participants, creating a *Total Question Priority Composite (Total QPC)* score for each question. The *Total QPC* score is computed as follows:

$$Total\ QPC = \sum_{k=q}^{k=1} QPC_k$$

Using this operation, the question with the highest *Total QPC* score is identified as the first priority (i.e., 'number one' on the list), the question with the second highest *Total QPC* score is identified as the second priority (i.e., 'number two' on the list), and so on and so forth, for all the questions. Lastly, questions falling below the tenth-place position were dropped, resulting in a ranked-ordered list of the top-ten priority questions for research addressing the intersections of ABI and MHA. All analyses were conducted using the statistical computing environment 'R Studio' version 1.2.1335.

Results

Participants

A total of 59 stakeholders participated in the research question prioritization activity. After removing those with >75% missing data, the final sample included 53 participants. One participant did not consent to the use of their demographic data and therefore was excluded from all sample demographic analyses. Participants ranged from 22 to 70 years of age (*M* = 46.71 years, *SD* = 15.13 years). Majority (78%) reported female sex at birth and 80% self-identified their gender as female (*n*=3 participants did not disclose sex at birth). Nine (16%) stakeholders reported male sex and gender, and one identified as non-binary or Indigenous Two-Spirit. Forty-one (77%) participants identified as heterosexual, four (8%) identified as homosexual, four (8%) identified as bisexual, one identified as Indigenous Two-Spirit, and two participants did not to

disclose their sexual orientation. Majority (*n*=39, 73%) of stakeholders reported their ethnicity as White (British, French, German, North or South American of European background). The average education level was a bachelor's degree, although stakeholders' levels of educational attainment ranged from less than high school and up to doctoral degrees. Slightly under half (44%) of the sample was comprised of people with lived experience. Table 3 is a detailed summary of our sample's sociodemographic characteristics, and Table 4 outlines the participants in our sample organized by type of stakeholder group (e.g., survivor or brain injury, researcher, etc.).

Question Prioritization

Question ranking and ratings were analyzed and QPC scores were calculated. Figure 1 describes the average rank position for each question and Figure 2 depicts participants' mean ratings of each question across the three variables. On average, clinical importance was rated highest, followed by novelty, then controversary across each of the research questions. Table 5 contains the top ten unanswered research questions addressing the intersections of ABI and MHA. Ordered by stakeholders' evaluations of priority, the questions appear by highest to lowest QPC scores and reflect stakeholders' combined priority ranking and rating scores. The two questions with the lowest QPC scores, *"Are 'younger' people (e.g., aged 15 to 30) who experience brain injury at higher risk for developing mood and addiction-related disorders, compared to middle aged and older adults who experience brain injury?"* and *"Do personal factors (including age, sex, sexuality, and gender) influence the effectiveness of treatment for people with concurrent brain injury, mental health, and addiction disorders?"*, were dropped from the list, resulting in the top ten research questions. The questions were reviewed by the working group and all unanimously agreed on the outcomes.

Discussion

The results of this health research priority-setting process identified the question, ***"****What are the experiences of concurrent brain injury, mental health, and addiction for homeless or marginally housed people, and how do their experiences differ from people who have stable housing?"* as the top priority for future research. Globally, the disproportionately high prevalence of MHA disorders has been well documented in populations without housing.[25] Far less research has examined ABI in the unhoused. In their systematic review, Stubbs and colleagues[28] identified 22 global studies examining TBI prevalence in homeless and marginally housed individuals. Using random-effects modeling, the pooled estimate for lifetime history of TBI of any severity, and moderate to severe TBI, was 53.1% and 22.5%, respectively.[28] In a cross-sectional survey of 500 homeless individuals residing in three major cities in British Columbia, Song et al.[27] found similar prevalence rates, with 63.6% of participants reporting a lifetime history of TBI. Notably, these rates are approximately 2.5 to 4-times for any TBI severity and ten-times higher for moderate to severe TBI than the general population.[55] Others have examined the occurrence and morbidity of cerebrovascular accidents in this population, uncovering similar patterns of disproportionately high rates.[56,57] No study has examined the experiences of concurrent ABI and MHA amongst people who are homeless or marginally housed. Understanding the unique experiences of this vulnerable population may unveil crucial information for removing barriers to effective psychosocial rehabilitation.

The second and third highest priority research questions both pertain to non-fatal opioid overdose-related hypoxic/anoxic (hereafter referred to as hypoxic-ischemic) brain injury. Notably, the opioid crisis is an especially pertinent issue in the region where this study was conducted: With over 2500 unregulated drug deaths in 2023 alone, toxic drug poisoning has

claimed the lives of over 10,000 British Columbians since the public health emergency declaration was first made in April 2016, making it the province's longest standing public health crisis to date.[58] In cases of non-fatal drug poisoning events, opioid-induced respiratory depression can lead to hypoxic-ischemic brain injury—a type of ABI caused by restricted oxygen supply—leaving survivors with long-term mental and physical disability.[59] Certain neurons are especially vulnerable to this type of injury (e.g., hippocampal pyramidal cells and cerebellar purkinje cells) and relate to why learning, memory, and spatial coordination deficits are seen amongst survivors.[59] Neuronal damage may also lower self-awareness, increase disinhibition, and reduce self-efficacy among survivors which, presumably, would make seeking and engaging with treatment exponentially more difficult. However, these assumptions remain un-investigated.

It is clear that stakeholders in our sample are highly motivated to see researchers examine the interconnections of ABI with substance use, drug poisoning/overdose, and opioid addiction. In addition to questions two and three, question eight also alludes to this need, calling for research on the prevalence of opioid addiction after TBI and alternative forms for pain management to reduce the risk of opioid addiction post-injury. Chronic pain affects approximately 50% of those with TBI and is commonly treated through opioid prescription receipt,[60,61] heightening the risk for developing opioid use disorder.[18,62] Several alternative forms of pain management have been researched for chronic pain, but these are yet to be tested amongst TBI patients. The need is urgent, as people with brain injuries are disproportionately represented among those with opioid use disorder,[63] and longitudinal data suggests that individuals with history of TBI are ten-times more likely to die from drug poisoning than the general public.[13] Certain groups, such as those who are unhoused, could be expected to be at

very high risk for overdose-related ABI given their combined prevalence rates of TBI and opioid-use,[26,28] although the nature of this vulnerability remains largely understudied. The limited research on these issues in isolation, paired with the results of this research priority-setting study, demonstrate the urgent need for researchers to take an intersectional approach in their design of studies on substance use as it relates to both traumatic and non-traumatic forms of ABI.

Three questions emphasize the importance of ABI recognition and diagnosis. Question six is the only of the ten which focuses specifically on mild TBI. Much of the literature pertaining to mild TBI exists within the sports arena, from which we have learned a great deal about the invisibility and diagnostic difficulty unique to this common form of ABI. Growing in concern is the role which mild TBI may have in more marginalized groups. For instance, it is estimated that TBI occurs in 50–90% of reported intimate partner violence cases, equating to roughly 250,000 brain injuries each year in Canada.[5,29] Concerningly, intimate partner violence can also lead to hypoxic-ischemic brain injury through strangulation,[29] meaning victims are at risk for suffering both traumatic and non-traumatic forms of ABI. Screening measures have been created and adapted in an effort to increase recognition of intimate partner violence related brain injury,[29] yet widespread clinical uptake and implementation is far from achievement.

Indeed, concurrent MHA concerns, which are inherently high amongst those who experience violence,[30] further complicate matters, as post-concussion symptoms are non-specific to mild TBI and overlap with common MHA symptoms such as headache, dizziness, fatigue, depression, anxiety, or irritability, making it difficult for both patients and clinicians to disentangle symptomatology and render accurate diagnoses.[9,24,29,31] As question seven alludes to, it is thought among stakeholders that the consequences of living with undiagnosed ABI might

including higher risk for MHA problems; however, this relationship remains unsubstantiated. Timely and accurate identification of ABI should remain a priority for service providers. To support their efforts, researchers should continue to develop targeted diagnostic and treatment measures to address the unique clinical presentations and service needs of people experiencing concurrent conditions, violence, marginalization, and social isolation.

Four of the ten research priorities are directly aimed at intervention. Previous research has examined different forms of psychotherapy for ABI survivors with MHA disorders.[64] In relation to question nine, trauma-informed interventions have shown to be efficacious for mood and trauma and stress-related disturbances in the general public,[65] but their use after ABI has not been extensively researched. A large body of evidence supports the bi-directional link between post-traumatic stress disorder and TBI[66] and, to a lesser extent, non-traumatic[67] ABI, and trauma-informed interventions have been developed with this purpose, yet they remain far from widespread clinical implementation.[68] Additionally, studies on the influence of concurrent substance use among these groups are limited, and their comparison to traditional approaches are needed given the strong relationship between trauma, substance use, and ABI.[9,17,20,24,66] Notably, current clinical practice guidelines do not provide guidance for addressing trauma after ABI.[69] While aspects of question nine have been addressed through previous works, the extant findings are largely ungeneralizable to the broader ABI population, the efficacy of trauma-informed counselling for substance use in particular after ABI remains largely unknown, and greater empirical support is needed to achieve widespread uptake in clinical practice.

As question four suggests, impaired self-awareness may decrease survivors' ability to self-advocate and seek help for MHA concerns,[70] while neurocognitive deficits, including impaired planning, organization, decision-making, inhibition, memory, and communication may

make it difficult to engage with and maintain treatment.[16,24,71] Anecdotal reports of individuals being ‘too brain injured for mental health care’ while ‘too mentally ill for brain injury care’ are common, but researchers have yet to comprehensively formulate and evaluate effective solutions to this real-world problem. Relating to question ten, this lack of adequate and comprehensive care can lead to family members becoming informal caregivers, the burden of which has been negatively associated with quality of life for both ABI patients and their caregivers.[72,73] Question ten calls for greater study of interventions for informal caregivers of those with concurrent ABI and MHA and their potential for promoting quality of life, a promising line of inquiry that has yet to be established.

Question five is arguably the intervention-focused question with the most previous research. However, the current knowledge base is largely limited to traumatic forms of ABI and strategies are yet to be discovered for integrating care at the population and systems levels.[74] In their systematic review, Chan and colleagues[74] reviewed fifteen articles reporting on barriers and/or facilitators to integrated TBI and mental health/substance use care. Barriers included a lack of education, limited access to care, healthcare providers' hesitancy, and difficulties with technology, and facilitators included implementation of compensatory strategies for cognitive challenges, education for patients and healthcare professionals, inclusion of family or caregivers in the treatment process, and collaboration between individuals and health professionals. Of note, none of the articles reviewed specifically addressed the needs of underserved or marginalized populations, underscoring the importance of questions one and six. We strongly believe that understanding unique treatment needs and identifying barriers and facilitators to community-based integrated care for all types of brain injury is the first step in breaking down soiled

healthcare services, and that partnerships between government and researchers are crucial for promoting effective systems level change.

Methodological Reflections

The methods employed to generate and prioritize these questions were novel such that they built on previous research priority-setting approaches in two key ways. One, we combined expert knowledge from multiple sources (i.e., literature and stakeholders) to generate the priority research questions. Two, we are the first to apply a comprehensive ranking and rating strategy to assess stakeholders' evaluations of priority for each question. Although some studies have used both ranking and rating,[42] their use of each was sequential and required multi-phase surveys of separate samples, demanding more time and resources from participants and research personnel. We believe that our method is more efficient, cost effective, and that it reduces participation demands by capturing all required data at one time point. In this regard, the creation of the QPC formula is one of the most notable strengths. Researchers can use this formula in their own research priority-setting investigations, across any and all fields of study, to gain a more robust and nuanced understanding for stakeholders' evaluations of priority. We encourage future researchers to utilize the QPC method of priority-setting in their studies and to explore other applications for this unique contribution to the scientific community.

Limitations

This study it is not without its limitations. First, people with lived experience may have had personal challenges (e.g., cognitive, physical, psychosocial, or functional difficulties) that made fully engaging with the priority-setting activity more difficult. To support accessible participation, there was approximately one facilitator for every six participants who were able to provide assistance during the activity. Second, because our sample is primarily from one

geographical region, it is probable that their experiences and perspectives may not represent those of stakeholders from other areas of Canada, or the world at large. Instead of setting a broader scope, we chose to focus on meaningful stakeholder engagement and were therefore limited by our means to accommodate in-person participation. However, our sample size is comparably larger than that of several other priority-setting studies with in-person workshops.[38,43,47] Lastly, it is our opinion that the priorities identified in this study are not isolated to any specific region, they are in fact global issues that should be addressed worldwide.

It is possible that our findings might not reflect those of people who are actively struggling with the more severe consequences of ABI and MHA, particularly those currently experiencing homelessness. Several actions were taken to promote inclusion of more marginalized and lower-income stakeholders, including compensating people with lived experience for their time to participate, as well as covering other costs associated with attending the event, such as travel, accommodation, and childcare. While we did not ask participants for information on their income, we did capture their level of education (an indicator of socio-economic status), which revealed most of the sample had a college diploma at minimum; however, inclusion of expert researchers and clinicians likely influenced this positive skew. To better understand the priorities of those most disproportionately affected by the psychosocial consequences of concurrent ABI and MHA, we encourage researchers to build equitable, collaborative relationships with marginalized communities.

Conclusions

The purpose of this study was to engage a broad range of diverse stakeholders in a health research priority-setting process to identify, rank, and produce a community-driven list of priorities to guide future research addressing the intersections of ABI and MHA. Our work

builds upon previous health research priority-setting processes by including stakeholders at the earliest stages, evaluating priority though a combination of both ranking and rating assessments, developing the QPC equation to analyze priority appraisals—a unique contribution that can be applied in future priority setting studies on any topic—and that people with lived experience made up just under half of our overall sample, a group which has been largely underrepresented in ABI priority-setting research. To help fill the gap in related literature on marginalized communities, we made notable efforts to involve stakeholders from underserved populations in order to generate priorities that are equitable and diversified. The results of this study provide researchers with an agenda to focus their efforts on critical and urgent issues currently being experienced by stakeholders. Future research should strive to answer these questions, in addition to producing new and more targeted lines of inquiry as the scientific and stakeholder communities continue to work towards addressing the intersections of brain injury, mental health, and addictions.

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Tables

Table 1.

Example of Extracted Raw Text Excerpts

Study author(s) (yr.)	Key recommendations and identified evidence gaps
Adams (2020)	"The importance and timeliness of elucidating unique risk factors, barriers to treatment, prevention opportunities, and treatment accommodations for those with TBI at risk for OUD cannot be understated." (p. 213)
Colantonio et al. (2015)	"Improving the health of people with TBI requires moving beyond generalized care intervention methods and focusing more on training caregivers to provide for their needs across care settings." (p. 28)
Mejia-Lancheros et al. (2020)	"Effective interventions and policies to reduce the risk of TBI among people experiencing homelessness are needed" (p. 5).
Winstanley et al. (2021)	"Additional research is needed to establish the incidence of overdose-related brain injuries and the potential impact on functioning, as well as engagement in treatment of substance use disorders" (p.1).

Note. Example of extracted raw text excerpts during preliminary literature review.

Table 2.

Steps for Transforming Question Fragments.

Step	Description of tasks involved
1.	Entering the data into an electronic database (Microsoft Excel).
2.	Coding PICO fragments and ideas using codes from the International Classification of Functioning, Disability and Health (ICF) and the International Classification of Diseases (ICD) in NVivo 12.
3.	Organizing the coded data to identify the range and frequency of all codes. Examining for overlap among fragments, reducing redundancies.
4.	Constructing initial questions from coded PICO fragments.
5.	Coding each question as one of the following: diagnosis, prognosis, interventions, or service delivery and organization.
6.	Inter-coder consultation to reduce number of questions and ensure equal representation across the four categories (above).
7.	Refining questions, ensuring consistent terminology and using layperson language whenever possible.
8.	Consulting with the working group to further refine the questions.
9.	Producing the final list of questions for prioritization.

Note. Adapted from the GEM method of transforming PICO fragments.[36,37]

Table 3.

Participant Sociodemographic Characteristics.

Characteristic	n(%) of sample[a]
Age, mean (SD) years	46.71 (15.13)
Sex[b]	
Female	41 (79%)
Male	9 (17%)
Prefer not to say	2 (4%)
Gender[c]	
Female	42 (81%)
Male	9 (17%)
Non-binary or Indigenous Two-Spirit	1 (2%)
Sexual orientation	
Heterosexual	41 (79%)
Homosexual	4 (8%)
Bisexual	4 (8%)
Prefer not to say	2 (4%)
Indigenous Two-Spirit	1 (2%)
Race or ethnic background	
White (e.g., British, French, German, European background)	39 (75%)
East Asian (e.g., Chinese, Korean, Japanese, Taiwanese)	2 (4%)
Indigenous Person (e.g., First Nations, Métis, Inuit, Coast Salish)	2 (4%)
South Asian (e.g., Indian, Pakistani, Punjabi, Tamil)	1 (2%)
Mixed White and Indigenous	3 (6%)
Mixed White and East Asian	1 (2%)
Mixed Black and East Asian	1 (2%)
Mixed White and Indo-Caribbean	1 (2%)
Prefer not to say	2 (4%)
Education	
Less than high school	1 (2%)
Some high school	2 (4%)
Highschool diploma	4 (8%)
Some post-secondary education	8 (15%)
College diploma	10 (19%)
Bachelor's degree	19 (37%)
Master's degree	5 (10%)
Doctoral degree	3 (6%)

Note. [a]One participant did not consent to the collection of their demographic information and is not represented here. [b]Sex at birth. [c]Current gender identity.

Table 4.

Participants Organized by Type of Stakeholder and Years of Experience in Roles.

Type of stakeholder	n(%) of sample[a]	Years in role, mean (SD)[b]
Survivor of brain injury	14 (26%)	15.92 (9.10)
Family member	11 (21%)	15.6 (8.71)
Service provider	18 (34%)	7.82 (9.44)
Researcher	7 (13%)	4.17 (3.13)
Government representative	3 (6%)	19 (14.93)
Public safety worker	3 (6%)	5 (2.83)
Health care professional	15 (28%)	16.6 (12.79)
Administration	6 (11%)	21.4 (9.32)
Occupational therapist (OT)	2 (4%)	22 (5.66)
Registered nurse (RN)	1 (2%)	38 (n/a)
Physician (MD)	1 (2%)	10 (n/a)
Neurorehabilitation consultant	1 (2%)	40 (n/a)
Recreation therapist	1 (2%)	13 (n/a)
Community support worker	2 (4%)	3.5 (0.71)
Case manager	1 (2%)	5 (n/a)
Other[c]	2 (4%)	Not reported

Note. [a]Many participants identified as more than one type of stakeholder and therefore the number of stakeholder types exceeds the overall sample size. [b]Average (mean) number of years in occupation or years affected by ABI (for people with lived experience). *SD* = standard deviation. [c]Other, not specified.

Table 5.

List of the Top Ten Research Questions.

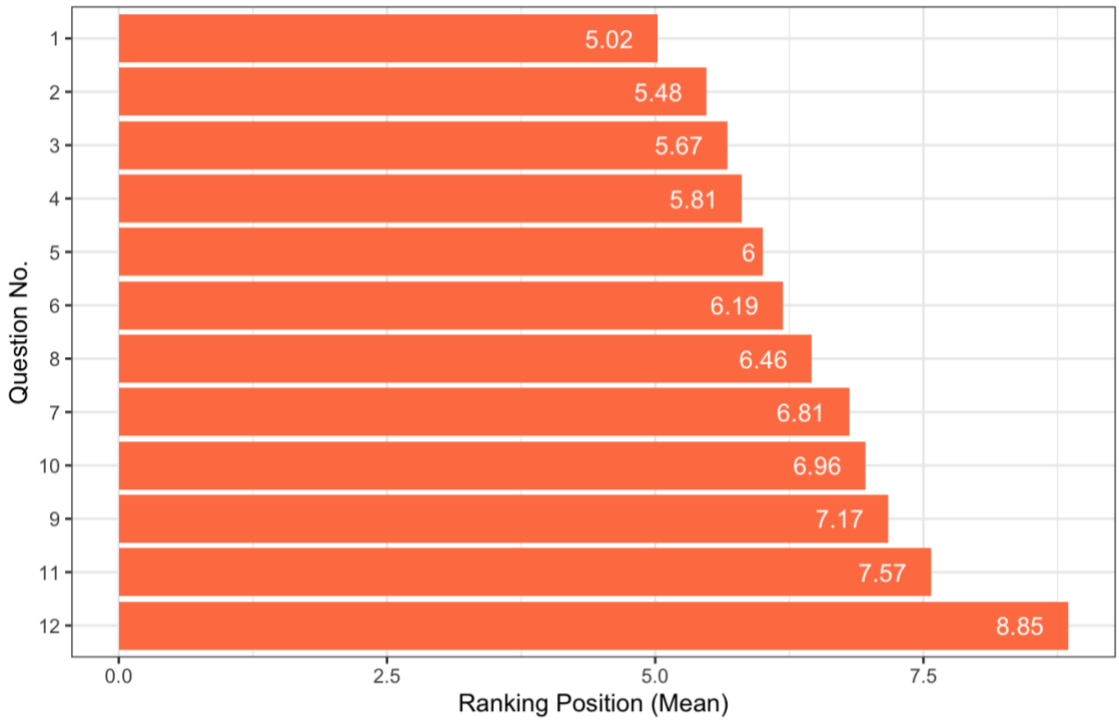
No.	Question
1	What are the experiences of concurrent brain injury, mental health, and addiction for homeless or marginally housed people, and how do their experiences differ from people who have stable housing?
2	What is the incidence and prevalence of (non-fatal) opioid overdose-related hypoxic/anoxic brain injury, and how do we best identify and support people who suffer this type of brain injury?
3	What are the specific long-term cognitive consequences of (non-fatal) opioid overdose-related hypoxic/anoxic brain injury (e.g., problems with attention, memory, communication, etc.)?
4	How do the cognitive (e.g., problems with attention, memory, etc.) and psychosocial (e.g., relationship and family stress, grief, etc.) consequences of brain injury influence survivors' ability to access, engage with, and benefit from mental health and addiction treatment services?
5	What are the barriers and facilitators to effective community-based integrated mental health and addiction treatment for people with concurrent brain injury, mental health, and addiction concerns?
6	What are the tools and who is best suited to identify and assess mild-traumatic brain injury (concussion) in marginalized people struggling with mental health, addiction, trauma, and violence?
7	What are the consequences of living with undiagnosed brain injury, and do they include higher risk for developing mental health and addiction disorders compared to people who receive accurate and timely diagnosis?
8	What is the prevalence of opioid addiction after traumatic brain injury, and what alternative forms of pain management are effective at reducing the risk of opioid addiction after traumatic brain injury?
9	How effective is trauma-informed counselling for treating people with concurrent brain injury and mental health and addiction disorders, and how does it compare to more traditional mental health and addictions treatments (e.g., alcoholics/narcotics anonymous or behavioural therapies)?
10	What interventions are most effective in promoting quality of life for family members/caregivers of people with concurrent brain injury, mental health, and addictions concerns?

Note. Questions are rank ordered above by priority.

Figures

Figure 1.

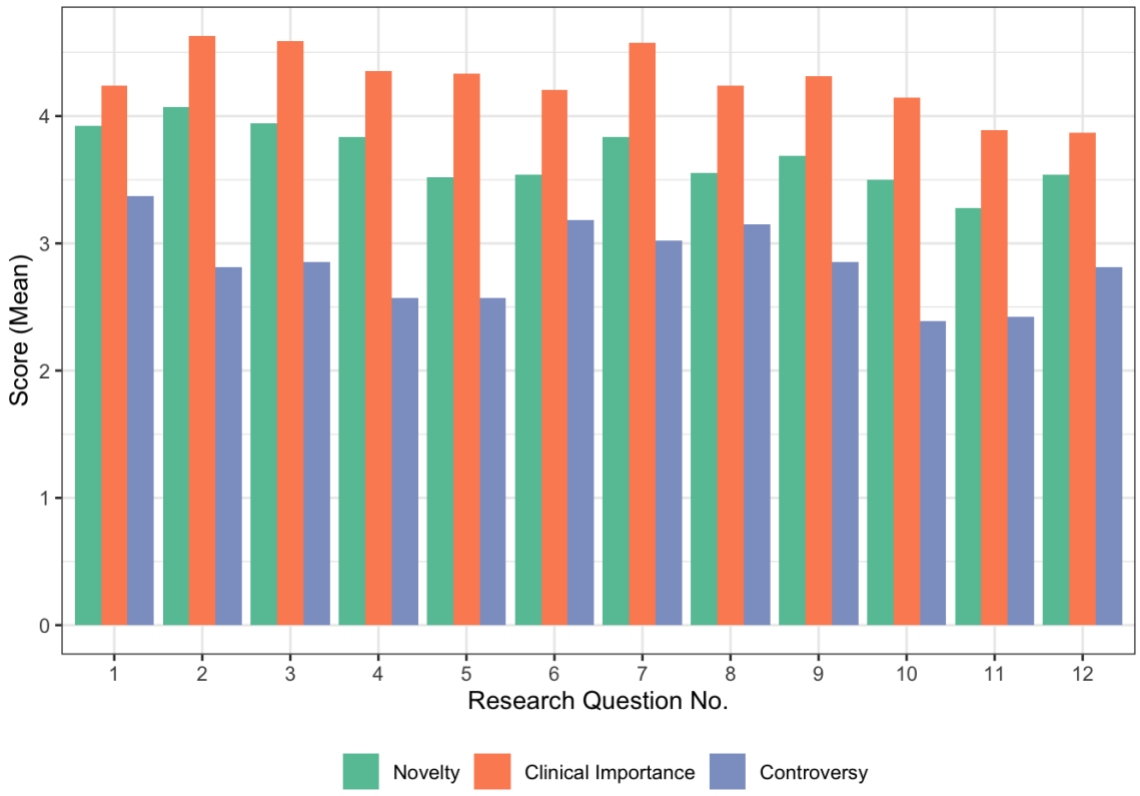
Average Ranking Position by Research Question.



Note. Question numbers (no.) are labeled here to reflect the order in which they are presented in Table 5, as opposed to the order in which they were originally presented to participants. Values reflect the mean position in which the questions were ranked, with lower values indicating higher priority (i.e., 1 = top priority, 12 = last priority).

Figure 2.

Average Rating Scores by Research Question.



Note. Research question numbers (no.) correspond to Table 5.

Chapter 4: Conclusions

The thesis presented here involved two innovative community-engaged studies that examined the intersections of ABI and MHA. At the foundation of each investigation laid the guiding principle for improving the current state of empirical knowledge and clinical care. Approximately 60% of the over 80 million people who experience ABI each year are diagnosed with a concurrent MHA related disorder, equating to well over forty million people worldwide annually (de Robles et al., 2015; Dewan et al., 2018; Feigin et al., 2022; Gould et al., 2011; Kim et al., 2007; Ponsford et al., 2018). Individuals with concurrent ABI and MHA related difficulties face numerous challenges when accessing and engaging with healthcare services (Chan et al., 2022), which may explain why this population is disproportionately affected by severe disability and pre-mature death (Harrison-Felix et al., 2015; Madsen et al., 2018; Ponsford, 2013). Despite the sheer magnitude, comorbidity, and societal impact of these conditions, researchers have predominantly examined them in isolation. Indeed, the importance of understanding the intersections of ABI and MHA cannot be understated.

Chapter 2 detailed a systematic evidence map of diverse treatment modalities for MHA in ABI populations. To the best of our knowledge, this is the first review undertaken to capture and describe this breadth of information, encompassing 485 evidence sources involving 735,203 people with ABI, all within one knowledge synthesis study. Not only does DECISION–MAP represent a first in ABI and MHA research, the diversity of types of evidence renders it a first in the field of health-related knowledge synthesis as well. Additionally, our team developed the DECISION–MAP user interface as a knowledge mobilization resource. Our goal was to provide an interactive and dynamic tool with tangible practical utility to enable stakeholders and knowledge users with the information required to make evidence-based decisions in the realm of

ABI and MHA research, clinical practice, and policy making. Our team tailored this tool to maximize its utility, allowing knowledge users to filter evidence based on desired features (e.g., patient characteristics, type and quality of evidence, open-access or standard subscription literature) to meet their information needs. With innumerable practical applications, including treatment planning, research priority-setting, systematic review and meta-analysis planning, funding and grant resource allocation, policy decision-making, and more, the implications of DECISION–MAP are tremendous.

Chapter 3 detailed a study that engaged a broad range of stakeholders in a health research priority-setting process to identify, rank, and produce a community-driven list of priorities to guide future research addressing the intersections of ABI and MHA. Studies involving diverse cross-sections of stakeholders are absent in this area, and people with lived experience have been largely excluded when setting research agendas. We made considerable efforts to include people with lived experience, with just under half of our overall sample comprised of survivors of brain injury and their family members. Further expanding on previous research, we created a comprehensive evaluation criteria that allowed for a more robust, nuanced, and cost-effective analysis of priority. The creation of the QPC formula is an invaluable contribution to the scientific community that can be utilized for priority-setting investigations on any and all topics. However, the true cornerstone of the priority-setting study was that it provided stakeholders an opportunity to inform the direction of future research, co-designing the blueprint for improving the multitude of struggles currently being experienced by the ABI and MHA communities.

The common thread of foci across the two investigations was the concept of priority. Evidence gaps identified in Chapter 2 and the ten questions detailed in Chapter 3 converge on three notable areas of priority: (1) understanding the experiences of concurrent ABI and MHA

amongst people experiencing homelessness, and the need for developing effective housing-focused interventions for this population; (2) exploring ABI, particularly hypoxic-ischemic injuries, as it relates to overdose and toxic drug poisoning, and fostering greater attention towards substance use and addictions post-ABI, including the innovation and advancement of efficacious interventions; and (3) the necessity of long-term, integrated healthcare services and the development of best practice guidelines for the treatment of concurrent ABI and MHA. The convergence of findings from these independent investigations speak to just how urgent it is that these issues be addressed. Researchers and policy makers have the greatest responsibility to answer these calls to action, which can only be achieved through coordinated efforts between the two branches. Indeed, it is only through partnership that meaningful change is made.

At present, our team is answering these calls to action through coordinated efforts and continued collaboration with community-based stakeholders. We are in the midst of launching a combined knowledge mobilization and evaluation study for DECISION–MAP, with the goal of putting this information in the hands of people that need it the most while gathering insights from knowledge users to maximize the utility of the tool. The BC Consensus on Brain Injury team is approaching its third year, committed to understanding the role of housing and homelessness at the nexus of ABI and MHA. Our continued dedication to this work is a testament to its importance and our belief in the impact it will have on society overall. While we have made major strides, much work still lies ahead.

The enclosed examination of the intersections of ABI of MHA accentuates the complexly entangled essence of these public health crises. Concurrent ABI and MHA is very common, yet current practices in clinical care do not account for the neurocognitive and psychosocial challenges that pose as barriers to accessible, efficacious, and equitable service provision.

Moreover, the empirical drive of precision and delineation has resulted in a knowledge base that does not reflect the frequently interactional nature of these phenomena. Our findings underscore just how underserved this population truly is, and the dire need for paradigm shifts in how we address ABI and MHA in the healthcare and research systems.

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Appendix

Appendix A: Demographics Questionnaire

How old are you?

▼ [select age]

What sex were you assigned at birth (i.e., on your original birth certificate)?

- ○ Male (1)
- ○ Female (2)
- ○ Prefer not to say (3)

Which best describes your current gender identity?

- ○ Male (1)
- ○ Female (2)
- ○ Transgender male (3)
- ○ Transgender female (4)
- ○ Non-binary or Indigenous Two-Spirit (5)
- ○ Prefer not to answer (6)
- ○ If not listed, my gender identity is: (7) _____

What are your pronouns?

- ○ He/Him (1)
- ○ She/Her (2)
- ○ They/Their (3)
- ○ Prefer not to answer (4)
- ○ Other: (5) _____

Which best describes your current sexual orientation?

- ○ Heterosexual (1)
- ○ Homosexual (2)
- ○ Bisexual (3)
- ○ Indigenous Two-Spirit (4)
- ○ Asexual (5)
- ○ Prefer not to answer (6)
- ○ If not listed, my sexual identity is: (7)
  _____

With which ethnic group do you identify the most? (Okay to choose more than one)

- ☐ Black (e.g., African American, African)
- ☐ East Asian (e.g., Chinese, Korean, Japanese, Taiwanese, Mongolian)
- ☐ Filipino
- ☐ Indigenous Person (e.g., First Nations, Métis, Inuit, Coast Salish)
- ☐ Latinx/Hispanic (e.g., Mexican, Argentinian, Cuban)
- ☐ South Asian (e.g., Indian from India or Uganda, Pakistani, Punjabi, Tamil)
- ☐ South East Asian (e.g., Vietnamese, Thai, Laotian)
- ☐ West Asian or North African (e.g., Armenian, Moroccan)
- ☐ Middle Eastern (e.g., Syrian, Egyptian, Iranian, Saudi Arabian)
- ☐ White (e.g., British, French, German, North or South American of European background)
- ☐ Prefer not to answer
- ☐ Other (specify): _____

What is your highest level of education achieved? (Choose one)

- ○ Less than high school
- ○ Some high school
- ○ Highschool diploma
- ○ Some post-secondary education
- ○ College diploma
- ○ Bachelor's degree
- ○ Master's degree
- ○ Doctoral degree

Which health authority serves the region you live in? (Choose one)

- ○ Vancouver Island Health
- ○ Vancouver Coastal Health
- ○ Fraser Health
- ○ Interior Health
- ○ Northern Health
- ○ Prefer not to answer

I am a (Okay to select more than one):

- ☐ Survivor of brain injury
- ☐ Family member supporting an individual with a brain injury
- ☐ Service provider
- ☐ Healthcare professional
- ☐ Government representative (Provincial, Federal, Municipal)
- ☐ Researcher
- ☐ Public safety worker
- ☐ Prefer not to answer
- ☐ Other (specify): _____

Roughly how many years of experience do you have working in your current occupation/field? (Survivors and family members can ignore this question)

▼ [select number of years]

Select which best describes your occupation:

- ○ Nurse (RN, nurse practitioner, etc.)
- ○ Physician (MD)
- ○ Clinical Psychologist (R. Psych)
- ○ Speech-Language Pathologist (SLP)
- ○ Occupational Therapist (OT)
- ○ Community Support Worker
- ○ Outreach worker
- ○ Administration/Corporate
- ○ Prefer not to answer
- ○ Other (specify): _____

How many years ago were you first affected by brain injury?

▼ [select number of years]

Would you like to be informed about the outcomes of this project as well as future Consensus Building events?

- ○ Yes (1)
- ○ No (2)

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Appendix B: Question Generation Worksheet

PRIORITY TOPICS FOR FORMING RESEARCH QUESTIONS

Instructions: Below are a number of different research topics. With your help, we are going to turn them into research questions. To do this, please read each topic, think about what it means to you, and start thinking about what questions you'd like to see answered. Then, keeping the PICO method in mind, write your research question(s) below each topic. The key here is that the questions you come up with are ones which you think should be a priority for researchers to address, that is, what is most important for us to study right now. Here is an example of this process using an unrelated topic:

Example topic. Understanding the relationship between mental health, exercise, and COVID-19.

- How does COVID-19 affect peoples' mental health and daily amount of exercise?
- Do people with mental health disorders have more symptoms of COVID if they run every day compared to those who don't exercise at all?

Please try your best to keep the PICO method in mind when forming your research questions, but however you wish to create and structure your questions is up to you. You also do not need to address every aspect of the topic in your question, we want your questions to reflect your opinions and values. Lastly, you do not need to write questions for every topic on the list if you do not wish to do so.

Once you are done writing your research questions, please save this document and send it back to me (colekennedy@uvic.ca) before October 7th. If you are having any trouble coming up with your research questions, or if you have any questions about this process, I am more than happy to meet with you and assist in any way I can.

Topic 1. Understanding the influence of personal factors such as age, sex, sexuality, and gender on treatment effectiveness and long-term outcomes of individuals with concurrent brain injury and mental health/addiction disorders.

-

-

Topic 2. Identifying barriers and facilitators to effective community-based integrated treatment services for individuals with concurrent brain injury and mental health/addiction concerns.

-

-

Topic 3. Understanding the neurological, cognitive, and behavioural consequences of non-fatal opioid overdose-related hypoxic/anoxic brain injury.

-

-

Topic 4. Understanding how the neurobehavioral consequences of brain injury (e.g., problems with attention, memory, language, etc.) affect survivors' ability to access, engage with, and benefit from mental health/addiction treatment services.

-

-

Topic 5. Developing effective mild-traumatic brain injury (concussion) assessment tools and best practice guidelines for use in marginalized populations struggling with mental health/addiction, trauma, and violence.

-

-

Topic 6. Understanding brain injury in individuals who are homelessness or marginally housed as it intersects with mental health/addiction and overdose.

-

-

Topic 7. Evaluating interventions to reduce long-term misuse of opioids in persons with traumatic brain injury, including examining outcomes of opioid prescription.

-

-

Topic 8. Developing methods, measures, and best practice guidelines for accurately identifying and treating hypoxic/anoxic brain injury (i.e., temporary partial or total lack of oxygen to the brain) following non-fatal opioid-related overdose.

-

-

Appendix C: PICO Guide

To form more specific research questions, we can use the "PICO" method, which means identifying:

P = Population/Patient/Problem - How would I describe the problem, or a group of people with that problem?

I = Intervention - What main intervention?

C = Comparison - Is there an alternative to compare with the intervention?

O = Outcome - What do I hope to accomplish, measure, improve or affect?

The P-I-C-O elements don't have to be in order, and some questions might use all letters, while others might not. This method can also be used to create different types of questions, that address different things (see table below).

	P	I	C	O
Question type	**Person, Problem, or Population**	**Intervention**	**Comparison**	**Outcomes**
Questions about treatment	The person, the group of people, or the problem	Some form of treatment; E.g., therapy, medication, community-based care, etc.	Different kind of treatment, intervention, or therapy	E.g., symptoms, quality of life, etc.
Questions about prevention	Risk factors and general health condition	A preventative measure; e.g., lifestyle change, safety equipment, etc.	*May not be applicable*	How many people get the condition, its impact, etc.
Questions about diagnosis	The target disease or condition	A diagnostic test, tool, measure, or procedure	The current "gold standard" test or guidelines for the problem	E.g., test's ability to recognize a condition; effectively and accurately diagnosing;
Questions about cause (Etiology)	The person's risk factors, current health, or condition/disease	The treatment or intervention of interest	*May not be applicable*	E.g., rates of new cases, number of people suffering a condition

Here is an example:

Topic: "Understanding the relationship between mental health, exercise, and COVID-19"

At first, the question could be as simple as "what is the relationship between mental health, exercise, and COVID-19?". Using the PICO method, you might come up with more refined questions like:

- "Does exercise (**I**) help people with COVID (**P**) protect their mental health (**O**) while in self-isolation?"
- Do people with mental health disorders (**P**) have less symptoms when they get COVID (**O**) if they exercise daily (**I**), compared to people with mental health disorders who don't exercise at all (**C**)?

If you would like some help using the PICO method to form your questions, please don't hesitate to reach me at colekennedy@uvic.ca and I will be happy to assist.

Appendix D: Prioritization Survey

The following activity is to help us as researchers understand what questions you want us to answer first. To get started please fill in your name*, then press the arrow in the bottom right corner to continue.

First name

_____

Last name

_____

*Like all other research components of this event, your personal information will not be reported and your responses will remain completely anonymous.

Instructions

Rank the research questions in order of priority (1 = top priority, 12 = last priority) by dragging and dropping each selection. Please note that while you may feel having answers to all of them is important, this activity requires you to order the questions by priority, so that researchers know which questions are the most urgent to address, and where they should first focus their efforts.

_____ What interventions are most effective in promoting quality of life for family members/caregivers of people with concurrent brain injury, mental health, and addictions concerns?

_____ What are the consequences of living with undiagnosed brain injury, and do they include higher risk for developing mental health and addiction disorders compared to people who receive accurate and timely diagnosis?

_____ What are the specific long-term cognitive consequences of (non-fatal) opioid overdose-related hypoxic/anoxic brain injury (e.g., problems with attention, memory, communication, etc.)?

_____ What are the experiences of concurrent brain injury, mental health, and addiction for homeless or marginally housed people, and how do their experiences differ from people who have stable housing?

_____ What are the tools and who is best suited to identify and assess mild-traumatic brain injury (concussion) in marginalized people struggling with mental health, addiction, trauma, and violence?

_____ What is the prevalence of opioid addiction after traumatic brain injury, and what alternative forms of pain management are effective at reducing the risk of opioid addiction after traumatic brain injury?

_____ Do personal factors (including age, sex, sexuality, and gender) influence the effectiveness of treatment for people with concurrent brain injury, mental health, and addiction disorders?

_____ Are 'younger' people (e.g., aged 15 to 30) who experience brain injury at higher risk for developing mood and addiction-related disorders, compared to middle aged and older adults who experience brain injury?

_____ What are the barriers and facilitators to effective community-based integrated mental health and addiction treatment for people with concurrent brain injury and mental health and addiction concerns?

_____ How effective is trauma-informed counselling for treating people with concurrent brain injury and mental health and addiction disorders, and how does it compare to more traditional mental health and addictions treatments (e.g., alcoholics/narcotics anonymous or behavioural therapies)?

_____ What is the incidence and prevalence of (non-fatal) opioid overdose-related hypoxic/anoxic brain injury, and how do we best identify and support people who suffer this type of brain injury?

_____ How do the cognitive (e.g., problems with attention, memory, etc.) and psychosocial (e.g., relationship and family stress, grief, etc.) consequences of brain injury influence survivors' ability to access, engage with, and benefit from mental health and addiction treatment services?

Instructions

For each research question, individually rate the question based on its level of: (1) clinical importance (how important the question is for improving health/healthcare), (2) novelty (how much the question represents an emerging field of interest or attention), and (3) controversy (the level of disagreement regarding opinion and/or practice for the question).

"What interventions are most effective in promoting quality of life for family members/caregivers of people with concurrent brain injury, mental health, and addictions concerns?"

	not at all	a little	moderate	high
	1	2	3	4	5
1. Clinical importance - 'How clinically important is this question?' ()				
2. Novelty - 'Does this question represent an emerging area of interest?' ()				
3. Controversy - 'What is the level of disagreement regarding opinion and/or practice for this question?' ()				

Optional Any additional thoughts about this question?

_____

"What are the consequences of living with undiagnosed brain injury, and do they include higher risk for developing mental health and addiction disorders compared to people who receive accurate and timely diagnosis?"

not at all	a little	moderate	high
1	2	3	4	5

1. Clinical importance - 'How clinically important is this question?' ()	
2. Novelty - 'Does this question represent an emerging area of interest?' ()	
3. Controversy - 'What is the level of disagreement regarding opinion and/or practice for this question?' ()	

Optional Any additional thoughts about this question?

_____

"What are the specific long-term cognitive consequences of (non-fatal) opioid overdose-related hypoxic/anoxic brain injury (e.g., problems with attention, memory, communication, etc.)?"

	not at all	a little	moderate	high
	1	2	3	4	5
1. Clinical importance - 'How clinically important is this question?' ()					
2. Novelty - 'Does this question represent an emerging area of interest?' ()					
3. Controversy - 'What is the level of disagreement regarding opinion and/or practice for this question?' ()					

Optional Any additional thoughts about this question?

_____

"What are the experiences of concurrent brain injury, mental health, and addiction for homeless or marginally housed people, and how do their experiences differ from people who have stable housing?"

	not at all 1	a little 2	moderate 3	4	high 5
1. Clinical importance - 'How clinically important is this question?' ()					
2. Novelty - 'Does this question represent an emerging area of interest?' ()					
3. Controversy - 'What is the level of disagreement regarding opinion and/or practice for this question?' ()					

Optional Any additional thoughts about this question?

_____

"What are the tools and who is best suited to identify and assess mild-traumatic brain injury (concussion) in marginalized people struggling with mental health, addiction, trauma, and violence?"

	not at all 1	a little 2	moderate 3	4	high 5
1. Clinical importance - 'How clinically important is this question?' ()					
2. Novelty - 'Does this question represent an emerging area of interest?' ()					
3. Controversy - 'What is the level of disagreement regarding opinion and/or practice for this question?' ()					

Optional Any additional thoughts about this question?

_____

"What is the prevalence of opioid addiction after traumatic brain injury, and what alternative forms of pain management are effective at reducing the risk of opioid addiction after traumatic brain injury?"

	not at all	a little	moderate	high
	1	2	3	4 5
1. Clinical importance - 'How clinically important is this question?' ()				
2. Novelty - 'Does this question represent an emerging area of interest?' ()				
3. Controversy - 'What is the level of disagreement regarding opinion and/or practice for this question?' ()				

Optional Any additional thoughts about this question?

_____

"Do personal factors (including age, sex, sexuality, and gender) influence the effectiveness of treatment for people with concurrent brain injury, mental health, and addiction disorders?"

not at all	a little	moderate	high
1	2	3	4 5

1. Clinical importance - 'How clinically important is this question?' ()	
2. Novelty - 'Does this question represent an emerging area of interest?' ()	
3. Controversy - 'What is the level of disagreement regarding opinion and/or practice for this question?' ()	

Optional Any additional thoughts about this question?

_____

"Are ‘younger’ people (e.g., aged 15 to 30) who experience brain injury at higher risk for developing mood and addiction-related disorders, compared to middle aged and older adults who experience brain injury?"

	not at all	a little	moderate	high
	1	2	3	4	5
1. Clinical importance - 'How clinically important is this question?' ()				
2. Novelty - 'Does this question represent an emerging area of interest?' ()				
3. Controversy - 'What is the level of disagreement regarding opinion and/or practice for this question?' ()				

Optional Any additional thoughts about this question?

_____

"What are the barriers and facilitators to effective community-based integrated mental health and addiction treatment for people with concurrent brain injury, mental health, and addiction concerns?"

	not at all / a little / moderate / high 1 2 3 4 5
1. Clinical importance - 'How clinically important is this question?' ()	
2. Novelty - 'Does this question represent an emerging area of interest?' ()	
3. Controversy - 'What is the level of disagreement regarding opinion and/or practice for this question?' ()	

Optional Any additional thoughts about this question?

_____

"How effective is trauma-informed counselling for treating people with concurrent brain injury and mental health and addiction disorders, and how does it compare to more traditional mental health and addictions treatments (e.g., alcoholics/narcotics anonymous or behavioural therapies)?"

	not at all / a little / moderate / high 1 2 3 4 5
1. Clinical importance - 'How clinically important is this question?' ()	
2. Novelty - 'Does this question represent an emerging area of interest?' ()	
3. Controversy - 'What is the level of disagreement regarding opinion and/or practice for this question?' ()	

Optional Any additional thoughts about this question?

_____

"What is the incidence and prevalence of (non-fatal) opioid overdose-related hypoxic/anoxic brain injury, and how do we best identify and support people who suffer this type of brain injury?"

	not at all	a little	moderate		high
	1	2	3	4	5
1. Clinical importance - 'How clinically important is this question?' ()					
2. Novelty - 'Does this question represent an emerging area of interest?' ()					
3. Controversy - 'What is the level of disagreement regarding opinion and/or practice for this question?' ()					

Optional Any additional thoughts about this question?

_____

"How do the cognitive (e.g., problems with attention, memory, etc.) and psychosocial (e.g., relationship and family stress, grief, etc.) consequences of brain injury influence survivors' ability to access, engage with, and benefit from mental health and addiction treatment services?"

not at all	a little	moderate		high
1	2	3	4	5

1. Clinical importance - 'How clinically important is this question?' ()	
2. Novelty - 'Does this question represent an emerging area of interest?' ()	
3. Controversy - 'What is the level of disagreement regarding opinion and/or practice for this question?' ()	

Optional Any additional thoughts about this question?

_____

Future Research... How?* For this final question, we would like to get your input on how researchers should investigate these questions. For instance, what approaches should researchers use? Who should be involved in their studies? What factors are important to consider? Etc.

_____

*This question is optional

Thank you. The research team greatly appreciates you sharing your opinions, priorities, and values with us. Your responses today are important for us to develop our agenda for future research to address the intersection of brain injury, mental health, and addictions in BC and beyond.

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