SAMHSA ADVISORY
Substance Abuse and Mental Health Services Administration

TREATING PATIENTS WITH TRAUMATIC BRAIN INJURY

Each year in the US traumatic brain injury (TBI) results in approximately 2.8 million emergency department visits, hospitalizations, or deaths.[1] TBIs account for almost 2% of all emergency department visits, and more than one-quarter million Americans are hospitalized each year with a TBI. Heightened public awareness of sports-related concussions and TBIs incurred in combat in Iraq and Afghanistan have contributed to a marked increase in emergency department visits over the past two decades; however, the greatest increase has been in the rate of fall-related TBIs among older adults. Potentially hundreds of thousands more individuals sustain TBI each year but are not included in the data sets used to form these estimates because they do not seek medical treatment or because they are treated in physicians' offices, urgent care clinics, or Federal, military, or Veterans Affairs hospitals.[2]

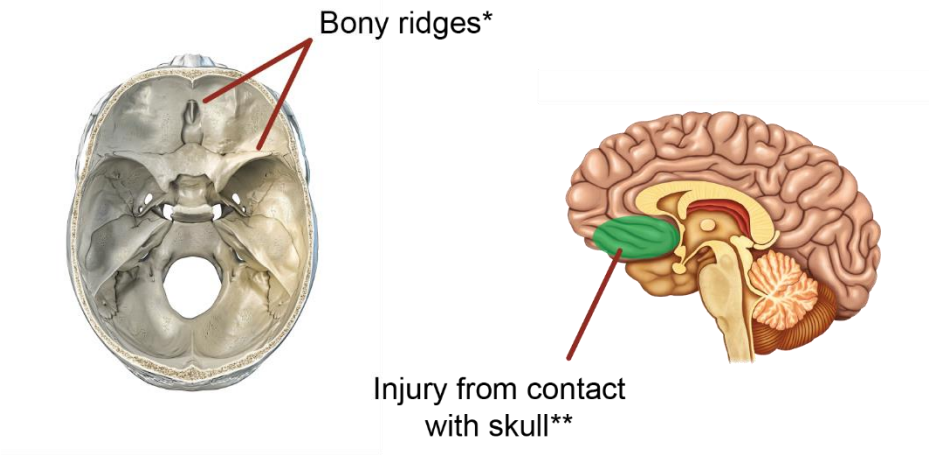
Public awareness of TBI has shifted dramatically since it was dubbed "a silent epidemic" in 1980; however, appreciation of its effects has not garnered the attention of professionals outside of medical rehabilitation. Particularly among behavioral health specialists, a gap remains in knowledge about TBI, understanding its implications for behavioral health conditions (i.e., mental illness and substance use disorders), and active consideration of treatment implications.[3] This Advisory briefly summarizes key elements of TBI and describe its relevance to behavioral health, including recommendations for how behavioral health professionals can better meet the needs of patients who have a history of TBI.

Key Messages

- Traumatic brain injury (TBI) is a common neurological condition that results from an external force altering normal brain function, whether temporarily or permanently.
- TBIs vary greatly in severity, which concomitantly creates tremendous variability in the impact on cognition, affect and emotion. A concussion is a mild TBI.
- The lasting effects of TBI also depends on whether there are multiple injuries, age at which they occur and whether a person already had another source of compromise to brain function
- The fingerprint of TBI is damage to the frontal areas of the brain, which with sufficient magnitude results in impairment of a person's ability to regulate cognition, emotion, and behavior.
- Not only does TBI cause behavioral health problems, associated deficits can affect the effectiveness of behavioral health treatments.
- Behavioral health professionals do not identify TBI among their patients.
- The consequences of TBI necessitate screening during behavioral health treatment.
- The presence of a problematic history of TBI should lead to identification of accommodations to minimize the effect on behavioral health treatment.

What Is A TBI?

A TBI is an alteration in brain function, or other evidence of brain pathology, caused by an external force.[4] External forces include the head being struck by an object; the head striking an object; the head accelerating or decelerating without direct external trauma as occurs in shaken baby syndrome or from a blast or explosion. The requirement for TBI to be due to an external force clearly separates it from other "acquired brain injuries" that occur after birth, such as strokes, anoxia/hypoxia (when the brain is denied oxygen), or electrical shock. Furthermore, the requirement that TBI include both an external force and alteration in brain function distinguishes a TBI from injury to the head alone, like abrasions or contusions to the face or scalp.



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The "fingerprint" of TBI is that frontal areas of the brain, including the frontal lobes, are the most likely to be injured, regardless the point of impact to the head. Once there is enough force from a blow to the head, shaking or a blast to cause the brain to jiggle within the cranial vault, then bony ridges on the undersurface of the skull cause damage to the frontal lobes, and anterior tips of the temporal lobes.[5,6] Shearing and tearing of neuronal pathways connecting to the prefrontal cortex also occurs if there is sufficient force.[7] Together, wherever else there may be damage to the brain, there is also damage in the frontal areas.

How Common Is TBI?

A history of having at least one TBI that caused loss of consciousness may have occurred to as many as 1 in 5 adults. And almost 1 in 20 may have had a moderate or severe TBI, a level of severity that is quite likely to have residual effects, even if not causing disability. While the prevalence of disability caused by TBI is estimated to be 1.1% among U.S. adults,[8,9] when all long-term consequences are considered, the prevalence rate is substantially higher.[10]

Prevalence of Lifetime TBI in Non institutionalized Adults in the General Population		
State	TBI with loss of consciousness	Moderate or Severe TBI
Colorado	24.4%	6.0%
Ohio	17.0%	3.2%
North Carolina	24.4%	4.4%
Average (unweighted)	*21.9%*	*4.5%*

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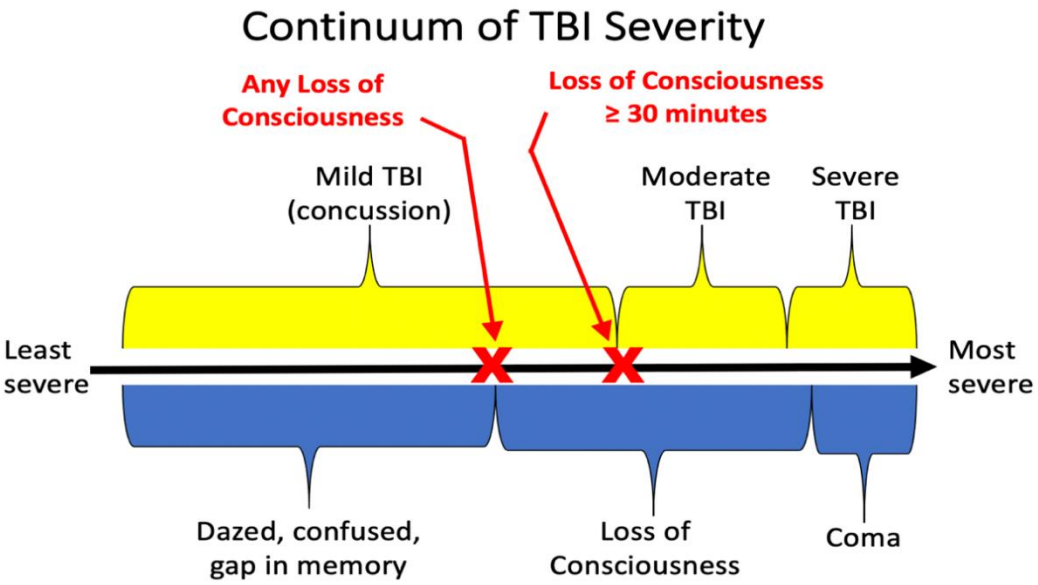
There is less known about the prevalence of TBI among children, though in Ohio state 2 of every 3 TBIs reported by adults occurred before age 20.[11] In 2013, there were approximately 640,000 TBI-related emergency department (ED) visits, 18,000 TBI-related hospitalizations, and 1,500 TBI related deaths among children 14 years of age, and younger.[12]

How Are TBIs Classified?

TBI is initially diagnosed as mild, moderate, or severe, based on how much effect there is on brain functioning. Alteration in function can range from a brief, temporary disruption in thinking that is experienced as being dazed or confused, to being in a coma during which the brain is not able to respond reflexively to pain or other strong stimuli. This range of effects parallels definitions of the severity of the injury. Mild TBI includes both being dazed or confused as well as losing consciousness (*i.e.*, knocked out) for up to 30 minutes.[13] Moderate severity ranges from 30 minutes to 24 hours of lost consciousness; while severe TBI involves being unconscious for more than 24 hours and generally includes being in a coma.[4,14] About 75 percent of all TBIs are mild.[15] Concussion is often used as a synonym for mild TBI, especially in reference to sports injuries.



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While severity of the initial injury is a major determinant of the eventual residual consequences, other characteristics of the injury can influence effects even when the injury is mild. For instance, much attention has been given to repeated mild TBI as occurs in contact sports or during combat. Incurring a second TBI,

even if mild, while the brain is still accommodating the first may create vulnerabilities that underlie long-term effects.[16,17] Another circumstance in which mild TBIs may carry greater consequence is childhood injury. Several studies have observed later consequences from very early-life TBIs;[18,19] while other studies have suggested that onset during adolescence has the greatest chance of creating later consequences.[20,21] A full list of factors that increase the likelihood that a history of TBI is affecting the person currently are shown in the table below.

Factors that increase the likelihood that there are lasting effects of a past history of TBI
The severity of any one TBI: *mild without loss of consciousness/mild with loss of consciousness/moderate or severe*
Cumulative effects: *repeated blows to the head/having a subsequent TBI while still healing from a previous*
Developmental interaction: *childhood injuries/older adult injuries*
Recent injuries: *mild TBI in recent weeks/moderate in recent months/severe in recent years*
Combined with other neurological conditions: *Hypoxia or anoxia/stroke/attention deficit/etc.*

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What Are the Effects of TBI?

In the days or weeks after a brain injury, cognitive effects may emerge involving the ability to think efficiently, multitask, and persevere at a task without becoming mentally exhausted or irritable.[22] Their sensory functions may be affected so that light levels seem too bright and normal noises too loud and distracting. These people also may have reduced capacity to read, see, or hear. The level and duration of TBI effects vary dramatically from person to person depending on the factors shown above.

Immediate Effects of TBI (including concussion)
Headaches or neck pain
Light-headedness, dizziness, or loss of balance
Difficulty remembering or concentrating
Feeling tired, having no energy or motivation
Changes in sleep patterns (sleeping a lot more or having a hard time sleeping)
Mood changes (feeling sad or angry for no reason)
Increased sensitivity to lights, sounds, or distractions
Blurred vision or eyes that tire easily
Headaches or neck pain
If symptoms do not resolve in 90 days — "Post-Concussive Syndrome"

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Because of the impact on the frontal areas of the brain, some individuals have more subtle effects that impair abilities like concentration, social judgment, self-awareness, or regulation of emotions. The frontal lobes of the brain are essential to uniquely human functions, including the "executive" functions that regulate thinking, behavior, and emotional expression (see table below). Executive functions are essential to learning a new skill, initiating behavior change or regulating one's feelings and actions. It is worth noting here that anoxic and hypoxic brain injury, such as occurs in drug overdoses or choking during intimate partner violence, also cause weaknesses in executive functions.[23]

While the "fingerprint" of TBI is damage to the frontal areas of the brain that create weaknesses in executive function, similar effects can result from hypoxia and anoxia when the brain is deprived of oxygen. Hypoxia occurs in drug overdoses and when strangled as is common in domestic violence.

Cognitive and Behavioral Abilities Often Affected by TBI	
Attention	Aside from being awake and alert, one of the most important cognitive abilities is being able to pay attention or concentrate on important things happening around us. Attention is a basic thinking ability that may set a limit on how well other "down-stream" functions work.
Processing Speed	The time it takes to think through and understand new information or concepts can be affected when a person has had a TBI. This does not mean they cannot understand - they may just need more time to understand.
Working Memory	Every day our lives are filled with activities that require us to make choices based on what we already know, newly learned information and sometimes both. Persons with TBI may have problems holding several thoughts at once or organizing several pieces of information in their mind to make a decision or take action.
Initiation	Responsibilities at home or work require the completion of a sequence of tasks. Individuals with TBI can have difficulty getting started on taking action. Sometimes a person can tell you what he or she wants to do but cannot begin the steps needed to perform that activity.
Impulsivity	Sometimes it is difficult to start behavior, and other times it is hard to stop one. Problems with impulsivity are very common in persons with TBI.
Planning & Organization	Busy schedules require us to keep track of a lot of information. Many people with TBI have difficulty planning and organizing daily activities or need assistance with a method of planning and organizing such tasks.
Mental Flexibility	Everyday life often requires us to switch gears and think on our feet. A new approach may be needed when circumstances change. When someone has difficulty with mental flexibility, he or she has trouble adjusting to changing situations and unfamiliar circumstances.
Self-Awareness	We take for granted that people know how they are being perceived or how they are coming across. Individuals with TBI often have problems seeing their own behavior and may not be aware of how they are being perceived by others.

Adapted from *Accommodating the Symptoms of TBI* by the Ohio Valley Center for Brain Injury Prevention and Rehabilitation.

What Are the Links Between Behavioral Health and TBI?

There is a well-documented association between TBI and behavioral health comorbidities, including depression, anxiety, suicide, and substance use disorders. As shown below, TBI is more prevalent in behavioral health settings, as well as among populations of persons with significant behavioral health needs.

Prevalence of Lifetime TBI in Vulnerable Populations		
	TBI with loss of consciousness	Moderate or Severe TBI
General population of non-institutionalized adults*	22%	5%
Substance use disorder treatment settings**	53%	17%
Psychiatric inpatient unit***	36%	20%
Prisoners ****	50%	14%
Homeless persons*****	47%	25%

* 3-state average (see above)

** Corrigan & Mysiw (2012[24])

*** Burg et al. (1996[25])

**** Shrioma et al (2010); Bogner & Corrigan (2007[26,27])

***** Stubbs et al. (2020); Bremner et al. (1996) Solliday-McRoy et al. (2004[28,29,30])

An exhaustive review found that incidence of major depressive and post-traumatic stress disorders exceeded population rates after TBI, commonly emerging in the first year though onset could be delayed with more severe injuries.[31] A population-based study in Denmark analyzed medical and behavioral health registries data for 1.4 million citizens and found that those with a history of TBI were 65% more likely to subsequently be diagnosed with schizophrenia, 59% more likely to be diagnosed with depression, and 28% with bipolar disorder.[32] When compared to persons who had fractures not involving the skull or spine, the likelihood of subsequent schizophrenia and depression remained significantly higher.

Children (aged 6-15y) hospitalized in a general hospital (n=42) with mild TBI versus (n=35) orthopedic controls demonstrated that there was a 35.7% prevalence rate of mood disorders at 6 months post injury vs 11.4% of the orthopedic control. Prevalence of anxiety disorders was 21.4% of mild TBI group compared to 2.8% of the orthopedic control.[33]

Substance use disorders are frequent prior to TBI and intoxication frequently leads to brain injuries.[24] While drinking may decline immediately post-injury, for many it resumes over time.[34] Further, recent studies have also suggested that childhood TBI may predispose individuals to adult high-risk substance use.[35,36] A birth cohort in New Zealand found that by age 25, those hospitalized with their first mild TBI before age six were three times more likely to have a diagnosis of either alcohol or drug dependency. Those hospitalized with the first TBI between the ages of 16-21 were three times more likely to be diagnosed with drug dependency.[37]

Adams and colleagues recently described how the opioid epidemic created a “perfect storm” for persons with TBI.[38] Persons with TBI were more likely to be prescribed opioids than those without, are at greater vulnerability to developing a Substance Use Disorder, and faced greater challenges in substance use disorder treatment (see below).

The risk for completing suicide is two to four times greater for individuals with TBI than for the general population.[39,40] Even mild brain injury increases risk. When a mental illness or substance use disorder co-occurs with TBI, the risk for attempted or completed suicide is further increased, and may remain elevated

for up to 15 years post-injury.[41,42,43] In suicide prevention, there is growing recognition that among persons with brain injury, risk assessment must focus more on opportunity and less on emotional distress.[44]

What Strategies Should Counselors Use for Patients With TBI?

Behavioral Health Treatment Should Incorporate
1. Screening for a history of TBI
2. Accommodations for neurobehavioral deficits from executive function impairments
3. Holistic approach to co-morbid conditions (e.g., substance use disorder, mental illness, chronic pain, sleep disorder)
4. Create formal and/or informal supports available during and after treatment completion

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These strategies are applicable for both children/youth and adults. However, it is important to consider the development of the child as it relates to injury recovery. TBI affects children differently than adults. An injury of any severity to the developing brain can disrupt a child's developmental trajectory and may result in restrictions in school and participation in activities.[12] To be successful, treatment planning should include the child and the parents/guardians in close collaboration with the school.

1. Behavioral health professionals should screen for lifetime exposure to TBI.

TBI has a significant interaction with the occurrence, manifestation, and recovery from behavioral health disorders. Minimally, this is a condition that requires identification by behavioral health professionals. Several brief, easy to use, reliable, valid, and standardized methods are available for eliciting a patient's lifetime history of TBI.[45] A behavioral health professional should know whether a patient's history is a "red flag" for the possibility that consequences of previous TBIs will affect treatment.

The Ohio Valley Center for Brain Injury Prevention and Rehabilitation developed a brief screening tool for use by nonexperts to identify patients who may need support in treatment because of a TBI history. The Ohio State University TBI Identification Method (OSU TBI-ID) is the most widely used screening tool, typically requiring 5-7 minutes. It can be administered by any staff with interviewing skills after brief training that is available free, online <https://tinyurl.com/osu-tbi-id>.

For children and youth, Colorado State University's Life Outcomes after Brain Injury Research Center developed the *Brain Check Survey* to screen for brain injury in children aged 5-21. This tool is a brief screen which is intended to be completed by a parent or guardian on behalf of the youth <https://tinyurl.com/Brain-Check-Survey>.

Red Flags for Histories of TBI Likely to Have Lasting Effects	
Aspect of History	**Criteria**
Worst (i.e., severity)	one moderate or severe TBI anytime in life
First (i.e., developmental)	first TBI with loss of consciousness before age 20
Multiple (i.e., cumulative effects)	2 or more TBIs close together, including a period of time when they experienced multiple blows to the head
Recent injuries	a mild TBI in the last weeks, moderate in the last months, or severe in the last years
Other sources (i.e., when combined with other disorders)	any TBI combined with another way that their brain function has been impaired

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2. Treatment should accommodate neurobehavioral deficits due to TBI.

Perhaps the single most important implication of TBI for behavioral health treatment is that professionals recognize neurobehavioral deficits that can arise from executive function impairment and accommodate these weaknesses in their treatment planning and execution. Neurobehavioral consequences of TBI do not have to undermine the ability for patients to participate in and benefit from the vast majority of conventional treatments. Behavioral health professionals do *not* require extensive additional expertise to accommodate neurobehavioral deficits in how they communicate with patients and take into account cognitive and emotional abilities in the treatment process. Some suggestions are provided below and there are resources online to guide the approach by behavioral health professionals <wexnermedical.osu.edu/TBIguide> <cokidswithbraininjury.com>.

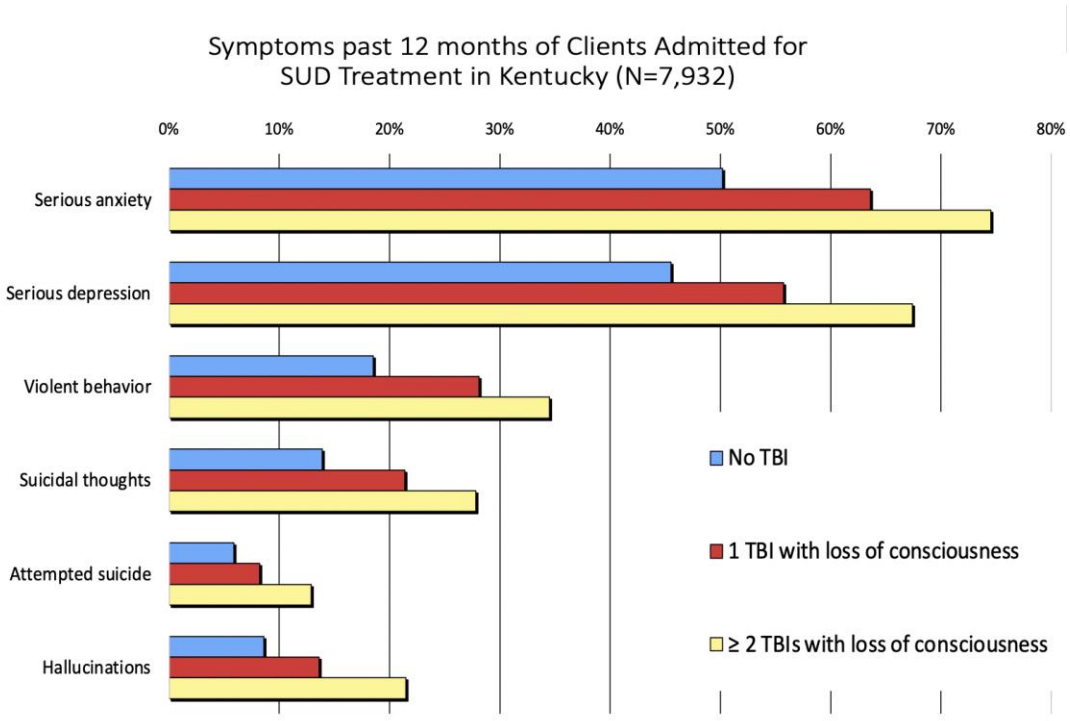
Most accommodations in treatment are simple adjustments. Among several specific issues to address is recognition of the "cognitive load" that some treatments require. What does the treatment approach expect in terms of new learning—facts, rules, or routines? How can you assist a patient with TBI who may have attention or memory problems to acquire this information, and recall it when needed? Is orally presented information reinforced with written materials? Is the environment noisy or busy, and thus a source of distraction for a patient with problems sustaining attention? How long are treatment activities, whether individual sessions or groups, do they accommodate a person with a limited attention span? Is information presented or discussed at a pace that allows someone with slower information processing abilities to stay abreast? Even though much behavioral health treatment relies on group interventions, we must assure that the structure and content remain accessible to all group members, especially those with relative weaknesses in concentration, learning, and memory.

Another consequence of not recognizing that patients may have neurobehavioral deficits is misattribution of their behavior by both peers and professionals. For instance, the patient with a TBI who is unaware that she or he talks too much in group may elicit the conclusion from a peer that "she thinks her problems are more important than mine" or "he's just trying to waste our time". We tend to assume that people recognize the impact of their behavior on others, but for patients with a history of TBI that has altered their social cognition, this awareness may not be there. The negative misattribution arises from the assumption that the patient is persisting with the behavior *despite* its impact on others. Another common misattribution among professionals is to assume that treatment non-compliance reflects a patient's motivation to change. For a person with a history of TBI, a late arrival or missed appointment could as easily result from poor memory, organization or planning, as it can from low commitment to treatment. The source of non-compliance must

be evaluated before a conclusion is reached or a consequence is determined. When non-compliance arises from executive function weaknesses, the relationship with a treating professional will be better served by problem-solving to figure out a compensatory strategy than by a consequence that presumes low motivation.

3. Treatment should be holistic in order to address co-morbid conditions.

Persons with TBI are often experiencing other medical conditions as well as multiple behavioral health disorders. Common health problems among persons with TBI include headache, fatigue, sleep disturbance, balance problems, pituitary dysfunction, seizure disorders, and vision abnormalities. It is typical for these health problems to necessitate medication, often presenting additional considerations when initiating medication-based treatment for a behavioral health problem. Further complicating the presence of multiple medications may be an increased sensitivity to side effects, such as sedation, which will in turn, have a disproportionate effect on alertness, cognitive function, and behavioral control. Many of these co-morbid medical conditions also will exacerbate with stress (*e.g.*, headache, sleep disturbance, seizure regulation), introducing additional complications during times of crisis. A holistic approach to a patient's medical presentation and, particularly, pharmacologic requirements may be essential.



Walker, M. Hiller, M. Staton and C.G. Leukefeld, Head injury among drug abusers: an indicator of co-occuring problems. J Psychoactive Drugs 35*(2003), 343-353.*

It is well-established that persons with substance use disorders and TBI are also quite likely to be experiencing other behavioral health conditions. A study was conducted in Kentucky's substance use disorder system in which all patients statewide entering treatment during a one-year period were screened for a lifetime history of loss of consciousness due to TBI.[46] For the almost 8,000 patients screened, as the number of TBIs increased, so did the likelihood of mental health conditions. Multiple studies before and since have confirmed these findings.[47,48,24,49] Consistent with this relationship, studies of persons receiving treatment who are dually diagnosed with severe mental illness and substance use disorders have been found

to have a high prevalence of TBI—60% of patients in a study of largely homeless, dually diagnosed treatment recipients had at least one TBI with loss of consciousness in their lifetime.[50]

4. Improvement gained by insight must be supplanted by other therapeutic supports

Among behavioral health providers who treat persons with TBI, it is recognized that the disconnect between the intention to change behavior and success in doing so is even greater than for patients without a history of TBI. While most treatment starts by seeking insight into the need to change behavior, behavioral health care also recognizes the importance of a person's social environment for encouraging and sustaining changed behavior, the role of internal states (impulses, drives, stress) for improving the chances of successful change, and the critical role that sustaining changed behavior plays in consolidating treatment gains.

Environmental influences, internal states and time in recovery each play an even more important role for successful behavior change for the patient with neurobehavioral deficits due to TBI. While it is good practice to identify what elements of a person's environment—social and physical—may enhance or impede improvement, this evaluation is essential for persons with TBI. Explicitly addressing these influences in treatment planning and identifying long-term natural supports that will assist with sustaining positive change must be incorporated into the treatment approach.

The corollary to the greater influence of the external environment is the recognition that patients with a history of TBI will also be more susceptible to internal states that enhance or detract from successful behavior change. The practical implications for behavioral healthcare are that medication-based treatments may be even more important. Further, more time will be required to weaken stimulus-response patterns and consolidate healthy lifestyle changes.

Conclusion

Sariaslan and colleagues estimated that in Sweden 5.5% of all behavioral health hospitalizations and 3.1% of all behavioral health visits would be eliminated if no one experienced a TBI.[20] This is a substantial public health burden. The costs to society are reason enough for behavioral health care to systematically address TBI; but the potential benefit for a substantial portion of patients is even more compelling. Recognizing that a patient has a potentially problematic history of TBI and adapting both one's style of interaction and treatment planning can greatly reduce the additional challenges this population faces when addressing a behavioral health problem.

Resources for Additional Information

- Brain Injury Association of America <www.biausa.org>
- Brainline.org <www.brainline.org>
- Centers for Disease Control and Prevention, National Center for Injury Prevention and Control Traumatic Brain Injury Page <www.cdc.gov/TraumaticBrainInjury/index.html>
- Colorado Kids with Brain Injury <cokidswithbraininjury.com>
- Department of Defense TBI Center of Excellence <TBICoE Home>
- National Association of State Head Injury Administrators <www.NASHIA.org>

- National Association of State Mental Health Program Directors White Paper on TBI <www.nasmhpd.org/content/traumatic-brain-injury-and-behavioral-health-treatment>
- Ohio Valley Center for Brain Injury Prevention and Rehabilitation <about-tbi.org>
- U.S. Brain Injury Alliance <usbia.org>

Relevant Publications From SAMHSA

TIP 29: *Substance Use Disorder Treatment for People With Physical and Cognitive Disabilities* (SMA) 08-4078 <https://store.samhsa.gov/product/TIP-29-Substance-Use-Disorder-Treatment-for-People-With-Physical-and-Cognitive-Disabilities/SMA12-4078>

SAMHSA Advisory on Mental and Substance Use Disorder Treatment for People With Physical and Cognitive Disabilities <https://store.samhsa.gov/sites/default/files/d7/priv/pep19-02-00-002_508_022620.pdf>

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