In the United States, 1.7 million people sustain a traumatic brain injury (TBI) each year, of whom 52,000 die and 275,000 are hospitalized [1]. Societal costs of TBI total at least $10 billion [2]. In this article, we review the current state of treatment and policy and make recommendations that would benefit TBI survivors with behavioral health comorbidities.

Traumatic brain injury (TBI), a leading cause of injury-related death, is a devastating disorder affecting 1.7 million US civilians per year [1] and contributing to disability for upwards of 5.3 million people in the United States [3]. In North Carolina alone, there were more than 140,000 TBI-related emergency department visits during the period 2010–2011 [4]. The impact of severe TBI on patients and families is tremendous and lasts years [5], but even concussion, a milder form of TBI, can significantly disrupt daily living, quality of life, and family balance [6, 7]. Changes in health care reimbursement have resulted in pressure to move patients quickly through intensive and acute rehabilitation, and TBI survivors with more severe injuries often return to the community with significant impairments [8]. Typical post-TBI deficits in attention, memory, self-awareness, problem solving, and behavioral control have negative effects on relationships, capacity to return to work, and quality of life [5, 9, 10]. Patients follow individual recovery trajectories with varied symptom profiles and differences in rate, pace, and degree of recovery. There are also many hurdles facing providers who treat people with brain injuries, including the complexities of neurobehavioral and cognitive symptoms, the heterogeneity of the TBI population, and resource limitations [10, 11].

TBI represents the quintessential neuropsychiatric paradigm with a combination of effects in cognition, personality, and the risk for psychiatric disorders. Cognitive deficits include frontal executive function, attention, memory, learning, speed of information processing, and speech and language functions. Personality changes include exaggeration of pre-injury traits, impulsivity, irritability, affective instability, apathy, and lack of awareness of deficits. Potential psychiatric comorbidities include depression, post-traumatic stress disorder, panic disorder, social anxiety, agoraphobia, obsessive-compulsive disorder, sleep disorders, substance abuse, psychotic syndromes, and dementia.

The severity of injury dictates the treatment protocol, but comprehensive and coordinated care is critical due to the variety of concerns caused by TBI. Research suggests that more than 20% of this population exhibits a behavioral health illness [12, 13] and that this illness persists over a period of time [14]. Even with clear evidence of comorbidity, one study observed that only 33% of TBI survivors needing psychiatric care at 12 months post-injury actually received such care [13]. These gaps in care are observed across most groups of TBI survivors, including veterans [15]. Unfortunately, this situation echoes the common story for those needing behavioral health care. Strides have been taken to ensure that appropriate care for TBI survivors is available, but—as with the behavioral health system in general—additional resources and stronger support networks are needed.

Clinical Aspects

Amidst the remarkable numbers and many challenges, there is good news with respect to treatment of TBI. Multiple research trials over the last 2 decades have brought about a compendium of evidence-based interventions [10, 11, 16-18]. Compared to the attention that has long been paid to neurobehavioral disorders such as autism or Parkinson disease, the attention to treatment of TBI is relatively new. The early brain injury literature centered mostly on epidemiology, symptom profiles, severity levels, predictors of outcomes, and measurement tools for tracking these data [19, 20]. As researchers worked through the 1990s, the first systematic reviews of the TBI treatment literature began reporting and evaluating evidence of the most effective interventions in several post-injury symptom domains [10, 11, 16-18].

While there are many good evidence-based treatment choices, the need is greater than ever for well-designed, well-conducted trials that focus on which treatments work best for which individuals. As investigative work continues,
Both group and individual training in exercise is emerging as an effective and brain-restoring activity. We now know that methods like cueing and cognitive behavioral therapy are effective for improving hemispatial visual inattention [22]. For persons with mild TBI, general attention is aided by training of metacognitive skills [23, 24].

**Memory.** Cognitive rehabilitation that promotes compensatory memory and problem-solving strategies is effective for improving function [23]. More comprehensive, holistic neuropsychological rehabilitation is also supported as an effective way to improve cognition and to promote self-efficacy after TBI [25, 26].

**Problem solving.** Both group and individual training in executive function have been helpful for improving problem solving after TBI [27, 28].

**Speech and Language**

Traditional speech therapy—as well as newer, promising methods like constraint-induced speech therapy—can improve a range of TBI-related language disorders [29].

**Sleep Disturbances**

Cognitive behavioral therapy focusing on maladaptive thinking and anxiety is effective for improving restorative sleep by reducing the frequency of sleep onset disturbance and improving sleep maintenance after TBI [30, 31].

**Depression**

While evidence for the use of medications is mixed, exercise is emerging as an effective and brain-restoring activity following brain injury [32].

**Caregiver Stress and Coping**

Recent work shows that caregivers need help as well. Both comprehensive and focused interventions have helped to improve caregiver coping and have resulted in improved recovery for the person with TBI [7, 33].

**Gaps in Care**

TBI has increasingly been in the national spotlight. Recent investigation into chronic traumatic encephalopathy (CTE) is an excellent example of the value of intensive national and scientific focus [34-38]. As a result of the media attention to this disorder (which affects athletes in high-impact sports) and the resulting research, we have learned that repetitive brain trauma has devastating and long-lasting effects on cognition, emotional status, and quality of life [34]. The suicides of such prominent football players as Junior Seau and Dave Duerson also led to increased scrutiny and research into reducing risk for players [38].

The CTE research has recognized 2 subgroups with the disorder; these subgroups are defined by age and deficit domains [34, 36, 37]. Younger patients with CTE tend to have mood and behavioral changes, while older patients tend to have primarily cognitive problems. We also know that football players who began playing before the age of 12 years and who tackled in the traditional manner are more likely to develop CTE. In addition to football players, others who are more likely to be affected by CTE include boxers, hockey players, circus clowns, and male veterans with combat exposure in either Iraq or Afghanistan [37].

Continued research is needed to further clarify the relationship between TBI and subsequent behavioral health illness. National and state efforts must address the development of several items: standardized behavioral health screening tools to ensure access to care, evidence-based protocols that emphasize quality, and coordinated delivery systems that can reduce costs. Various initiatives across the United States have emphasized these gaps and have dedicated resources to address inefficiencies in care.

**National Efforts**

**Coordinating Care and Increasing Support Networks**

Federal grant money has facilitated the development of programs to support the rehabilitation of TBI survivors. The Traumatic Brain Injury State Implementation Partnership Grant Program and the Traumatic Brain Injury Protection and Advocacy Grant Program make up the Health Resources and Services Administration (HRSA) TBI Program, which aims to provide a system of care and a voice for those suffering from these injuries. Through a competitive application process, states receive grant money for TBI-related initiatives. These financial opportunities prompt states to address key needs within the TBI community, especially the needs of TBI survivors with behavioral health concerns. For instance, the latest Traumatic Brain Injury State Implementation Partnership Grant Program requires states to address “information and referral [services], professional training, screening, and resource facilitation” [39]. States have some flexibility in addressing these 4 areas, but the funds cannot be used for direct patient care. While the Partnership Grant Program emphasizes the system of care itself, the Advocacy Grant Program encourages legal and advocacy support for this population [40]. The TBI Coordinating Center fosters the development of both grant initiatives [41].

**Boosting Access to Care**

In addition to programmatic developments, the creation of the 1915(c) Medicaid Home and Community-Based Services (HCBS) Waivers can provide financial support to
eligible individuals. The waivers cover a variety of services including “case management, homemaker, home health aide, personal care, adult day services, habilitation, and respite care” [42]. States have the ability to cover more services within their waiver programs.

Over 20 states have created TBI-specific HCBS waivers. Waiver programs differ between states; they may function to provide long-term services and supports (LTSS), or they may strive for rehabilitation and integration into the community. Even with growth in HCBS participants throughout the nation, inconsistencies remain between participating states in numbers served, spending per enrollee, and waiting list size [43]. A few states have restructured their waiver programs and fused the HCBS waiver for TBI survivors with other waiver initiatives [44]. Additionally, the Patient Protection and Affordable Care Act of 2010 further supports TBI populations through the expansion of Medicaid initiatives related to LTSS [44].

**Efforts in North Carolina**

The structure of TBI programs varies across the country, yet similarities are evident in the types of collaborating partners involved in the care delivery process, which include acute care hospitals, outpatient facilities, public and private community organizations, advocacy groups, provider organizations, and various state programs. These organizations share responsibility for providing a continuum of care for this population—from acute medical services to rehabilitation to LTSS. Within North Carolina, the state TBI program is a component of the Division of Mental Health, Development Disabilities, and Substance Abuse Services (MH/DD/SAS) of the Department of Health and Human Services (DHHS). The division contracts and closely collaborates with the Brain Injury Association of North Carolina (BIANC) for information and referral services, as well as TBI-specific training across the state. Through the support of its regional offices, BIANC works with clients and caregivers to provide appropriate direction to the care delivery system, and it educates individuals with TBI, their families, and caregivers. Additionally, the MH/DD/SAS local offices, called local management entities/managed care organizations (LME/MCOs), manage the providers who will deliver specific services for consumers with TBI. These services may be funded by Medicaid or by state dollars. Provided services include (but are not limited to) residential services, equipment, medication management, home and vehicle modifications, specific therapeutic services, respite, neurobehavioral services, and cognitive rehabilitation. DHHS also houses the Division of Vocational Rehabilitation Services, which provides employment services, independent living services, assistive technology, and a client assistance program for those with TBI.

With the support of federal grant money, North Carolina has taken steps to enhance the system of care for individuals with TBI, including paying attention to behavioral health needs. For instance, the state facilitated the development of 2 clubhouses to support persons with TBI. This structured environment helps integrate the individual back into the community and ultimately fosters a support network, which is crucial for improved behavioral health. This model of care also provides respite for caregivers. [Editor’s note: These clubhouses are discussed further in the Spotlight on the Safety Net column by Farmer on pages 123-124.]

Additionally, the state was awarded a HRSA Traumatic Brain Injury State Implementation Partnership Grant. These competitive grants are intended to build TBI infrastructure that improves delivery of services. The most recent 4-year grant focuses on information and referral, training, screening, and resource facilitation. Due to grant restrictions, the money will foster a coordinated system of care rather than funding client services directly.

The TBI program will contract with BIANC to provide an initial access point for TBI survivors and their caregivers, and a resource facilitator will help clients and caregivers navigate the system within specific pilot programs. The state will also work with the LME/MCOs to increase screening to identify TBI survivors and connect them to appropriate behavioral health treatment. Through training opportunities, the state will educate stakeholders, including behavioral health providers, on TBI and its relationships to the care they are providing. All of these aspects foster the development of a medical home for those with TBI.

**Looking Ahead**

National and local efforts continue to strengthen the care delivery system for individuals with TBI. Even with these efforts, many opportunities remain. Moving forward, TBI programs and stakeholders must continue to emphasize rehabilitative care as a core value. Continued attention to screening efforts is critical to ensure early access to services and appropriate delivery of care. Due to the multitude of stakeholders involved, strengthening collaborations among these groups will help to streamline care. Attention should also be placed on the introduction of innovative care strategies, including the use of technology as a means to increase access and to engage individuals with TBI. Lastly, sustainable sources of financing are needed to support this population over the long term; this will ultimately require advocacy, public education, and political will.

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