Starting Point

Offering help, hope, and a voice for people with brain injury and their families

Research in Brain Injury • 2015 • Volume III
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Letter from the Executive Director

I would like to encourage everyone to visit our new website at www.bianc.net. We worked with a skilled web designer to develop a new site that is easier to navigate and provides more information about brain injury services, resources, events and activities. We will continue to add new features to the site to enhance our support for brain injury in North Carolina. We welcome your feedback about the site for future improvements.

We have very good news about funding for the new TBI Medicaid Waiver. Both the Senate and House of Representatives included $2 million in funding for the Waiver in their budgets. This will generate another $4 million in Federal funds for a total of $6 million to provide services for people with brain injuries in NC. As of this date, the final budget has not been approved, and it looks like it will take a long time before the Senate and House will agree on a compromise budget but because the TBI funds are in both budgets, they should remain in the final version.

We are gearing up for camp during the weekend of September 18-20th and our annual professional conference on October 16th. Camp will be at Camp Carefree in Stokesdale, and we are planning for a fun-filled, exciting weekend for all. The annual conference, “Preparing for a New Normal: TBI Continuity of Care”, will be in Concord at the Carolinas HealthCare Northeast Campus, just north of Charlotte. We will present information to assist with understanding the challenges of community re-entry after hospital discharge for people with brain injuries. There is additional information about camp and the conference on our new website.

As always, we appreciate the support of Corporate Sponsors, members and donors, and look forward to your feedback on our new web site and other activities.

Sandra Farmer
Are You a Member of BIANC?

By joining BIANC, you will become part of a state and national organization aimed at preventing brain injuries and creating a better future for brain injury survivors through our support, education, and advocacy efforts. By joining BIANC, you will become part of a state and national organization aimed at preventing brain injuries and creating a better future for brain injury survivors through our support, education, and advocacy efforts.

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- Our toll free family helpline
- Education, prevention, support, and advocacy programs for survivors, family members, and professionals

Membership benefits include a subscription to our quarterly newsletter, *Starting Point*, a subscription to the national newsletter *TBI Challenge*, and discounted registration for events sponsored by the Brain Injury Association of North Carolina.

**Basic Membership:** $38 a year; includes all the above benefits. Membership will not be denied to survivors and family members with limited resources.

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**Platinum Membership:** $250 a year; includes all of the above benefits, five complementary memberships to distribute to clients, a certificate suitable for framing, and recognition on our website.

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Save the Date

Camp Carefree
Stokesdale, NC
September 18-20, 2015

Annual Professional Symposium
Concord, NC
October 16, 2015

www.bianc.net || 800-377-1464
This article describes the difficulty of diagnosing traumatic brain injury (TBI), treatment protocols provided through the military, an alternative therapy with scientific evidence of its effectiveness in repairing injured brain tissue, challenges faced by brain-injured veterans seeking community reintegration, and state services that are available to help veterans.

North Carolina is home to a large number of active duty military personnel and approximately 800,000 retired or discharged veterans. Many of these service members and their families face the challenge of obtaining care for traumatic brain injuries (TBIs) or post-traumatic stress disorder (PTSD).

Since 1992, the US Department of Defense’s TBI agency has been the Defense and Veterans Brain Injury Center (DVBIC), which works to “serve active duty military, their beneficiaries, and veterans with traumatic brain injuries through state-of-the-art clinical care.” DVBIC is the designated government organization for identification, diagnosis, clinical treatment, and TBI training for providers, as well as a source of references and related materials.

DVBIC defines a TBI as “a blow or jolt to the head that disrupts the normal function of the brain”. Based on the intensity, frequency, and severity of the injury, multiple symptoms may result (see Table 1). For veterans experiencing one or more concussion(s) from a blast and/or bodily wounds, especially with accompanying unconsciousness, this injury can result in catastrophic lifetime impairment. Ross Zafonte, chair of the Department of Physical Medicine and Rehabilitation at Harvard Medical School observed that TBI is “the most complicated disease, in the most complicated organ known to man”.

### TBI Diagnosis is Complex

DVBIC offers a 3-question TBI screening tool that, when used in connection with a clinical interview, can provide an initial assessment of whether a patient meets criteria for diagnosis of TBI. In addition, clinicians may find it helpful to use diagnostic equipment such as computer-assisted tomography (CAT), magnetic resonance imaging (MRI), x-rays, and/or screening tools “that measure various areas of a person’s speech, movement, memory, and thought”.

TBI is difficult to diagnose, especially when the patient is being evaluated in or near a combat theater. This difficulty is exacerbated by the similarity between the symptoms of PTSD and those of TBI. The overlap of TBI/PTSD symptoms helps justify the discussion of both conditions. Erwin Manalo, medical director of the East Carolina University/Vidant Medical Center Brain Injury Unit, stated that he uses a battery of neuropsychological tests to assist in TBI diagnosis. He then examines these test results to assist in assessing the “level of patient dysfunction” as the starting point for treatment considerations (personal communication, November 2014). Ross Zafonte of Harvard Medical School stated, “it is more accurate to think of TBI as a disease, because its effects extend well beyond the physical injury and can unfold over long periods of time”.

### Treating the TBI Veteran

Active duty military personnel are assessed as quickly as possible after a combat injury, once the individual has regained consciousness. In the field, it may be days or weeks after the first concussion, and multiple injuries may have occurred. For most personnel demonstrating the common symptoms of PTSD and/or TBI, the PTSD checklist (eg, PCL-5) is administered to make an initial assessment.

### TABLE 1. Symptoms and Effects of Traumatic Brain Injury

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical</strong>&lt;br&gt;Headache, sleep disturbance, dizziness, balance problems, nausea and/or vomiting, fatigue, visual disturbance, photophobia, tinnitus.</td>
<td><strong>Patient</strong>&lt;br&gt;• Impaired function as family member, employee, employer, and citizen.</td>
</tr>
<tr>
<td><strong>Cognitive</strong>&lt;br&gt;Concentration problems, gaps in memory, attention deficits, slowed mentation, aphasia.</td>
<td><strong>Loss of caregiver, divorce, unemployment, homelessness.</strong></td>
</tr>
<tr>
<td><strong>Emotional</strong>&lt;br&gt;Irritability, anxiety, depression, mood disorders.</td>
<td><strong>Hopelessness, despair, suicide.</strong></td>
</tr>
</tbody>
</table>

* Federal and state government<br>**Lifetime and Social Security compensation benefits**: each individual’s benefits are estimated at $3.2 million.*<br>**Necessary local community services to support patient status.**

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* $3.2 million is the sum of Veterans Administration and Social Security Administration disability benefits paid to a 26-year-old veteran, who receives these payments to the age of 65 years.
Treatment on or near the battlefield begins with a rest period away from combat. Depending on the need, doctors may have patients evacuated to the nearest hospital. Patients are often subsequently transferred to Walter Reed National Military Medical Center in Bethesda, MD to allow access to the best care available.

Treatment for TBI and PTSD is based on symptoms. As the diagnosis becomes clearer, drugs and counseling are provided for the management and mitigation of symptoms. A number of symptoms are treated selectively through the use of approximately 40 different medications. Prescription of these drugs is based on the similarity between symptoms of TBI/PTSD and certain mental health conditions such as depression and anxiety. A list of these drugs and their potential side effects can be found in testimony to a Joint Committee of Congress.

The types of counseling and other therapy that might be provided vary widely, but cognitive behavioral therapy has been found to be effective in those instances when the trigger for a particular symptom can be identified and a therapy action plan can be implemented to address this specific trigger (Erwin Manalo, oral communication, November 2014). In addition, DVBIC recently published new clinical recommendations for TBI.

Treating the Injured Brain

None of these symptom-based therapies have evidence proving their effectiveness in the treatment of the initial injury that caused TBI or PTSD. This raises many questions, including what is known about the effectiveness of current therapies and whether or not there is a treatment that can actually restore human functions lost or impaired due to TBI or PTSD. In response to the question raised by the US Congress regarding the effectiveness of current TBI and PTSD therapies, the National Academy of Sciences published a report in the spring of 2014. The Institute of Medicine of the National Academies studied all treatments in use over the period 2010-2012. The report concluded, in part, that neither the Department of Defense (DoD) nor the Veterans Administration (VA) “knows whether its many programs and services are effective in reducing the prevalence of PTSD in service members or veterans.” The report further states that “until prevention and treatment outcome data are collected, analyzed, and evaluated at all organizational levels, it will be impossible to determine the success of any of those efforts”.

The inability of the VA and DVBIC to effectively treat TBI and PTSD veterans has been reported nationally. An article in TIME Magazine cited the results of a Congressional Budget Office report that stated that, after treatment by the VA, “nearly all troops afflicted with both ailments remain under VA’s care, after four years of care”. Recognizing the existence of such criticism, the new secretary of the VA, Robert A. McDonald, observed, “We’re in an extraordinary position. We have an opportunity to not only right the wrongs, but to reframe perceptions about [the] VA by lengthening our lead in areas where we’ve always excelled, taking the lead in service delivery areas that are lagging, and charting new ground in emerging or evolving areas of health care.” The Academy of Sciences reported the absence of data supporting the effectiveness of present PTSD therapies, leaving this question unanswered for the DoD and the VA. However, recent scientific studies published in the Journal of Neurotrauma and by the Sackler School of Medicine of Tel Aviv University report that TBI subjects with post-concussion syndrome who were treated with a regimen of hyperbaric oxygen therapy demonstrated improvement in cognitive function and quality of life. Although there is controversy about this research, these studies provide evidence to support reports from individual veterans who have experienced varying degrees of healing from this therapy.

North Carolina Veterans Face Compelling Challenges

It is extremely difficult for North Carolina veterans to access the care provided through the DoD and the VA. Table 2 lists some of the challenges families face when attempting community reintegration of a veteran with TBI or PTSD. While the challenges are substantial, there are also a number of resources available to assist families and veterans. Resources currently available in North Carolina are listed in Table 3.

<table>
<thead>
<tr>
<th>TABLE 2. Community Reintegration Challenges for Veterans With Traumatic Brain Injury (TBI) or Post-Traumatic Stress Disorder (PTSD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of or incomplete medical records transition from active duty to retired/discharged.</td>
</tr>
<tr>
<td>TBI/PTSD treatment protocols provide only partial resolution of functional impairments.</td>
</tr>
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</tr>
</tbody>
</table>

Facilitating Veterans’ Transition Into North Carolina Communities

Veterans facing retirement or discharge, especially those with injuries, should gain possession of their medical records before separation from service, as this can significantly enhance the quality and timeliness of care provided by the VA. In this regard, available transition services on most military bases provide in-depth information to assist families in accessing post-separation medical and community assistance. Another resource is NC4VETS, an online guide that provides a comprehensive source of statewide resources for veterans. NC4VETS provides access information for employment, health care, VA benefits, housing, education, and veterans courts, and it explains how to find the local management entity (LME) or managed care organization (MCO) in each county.
Each LME/MCO provides county representation for the Division of Mental Health, Developmental Disabilities, and Substance Abuse Services of the North Carolina Department of Health and Human Services. In addition, the Brain Injury Association of North Carolina offers veteran care referral services, as well as provider education and training.

**Conclusion**

Veterans with TBI or PTSD are confronted with medical care that, for most, treats the symptoms of the injury but does not attempt to repair the damaged brain tissue. Treatment protocols for these catastrophic injuries as provided by the VA for PTSD and by the DVBIC for TBI offer mitigation of injury symptoms; however, these protocols do not treat the underlying injury. The result of this situation is that veterans lose hope of restoring the human functions necessary to perform as family members, employees, and citizens. This situation also requires that the states in which these men and women reside, and the federal government, provide disability compensation and other forms of community resources necessary to sustain the lives and families of these veterans. The use of hyperbaric oxygen therapy is controversial, but there is some scientific evidence that it can lead to improvements in neuroplasticity, with concomitant improvement in body and motor function, cognition, and emotional system responses. Services provided by state and local organizations, together with assistance offered by the military in conjunction with service separation, are available to help veterans understand and deal with these circumstances.

**Acknowledgements**

The authors would like to acknowledge all those who shared their time to help with interviews for this article and those who are providing care for our veterans in North Carolina.

Potential conflicts of interest.
D.P.M. is a consultant to Blue Cross and Blue Shield of North Carolina. J.S.H. has no relevant conflicts of interest.

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**TABLE 3. Resources for North Carolina Veterans With Traumatic Brain Injury or Post-Traumatic Stress Disorder**

<table>
<thead>
<tr>
<th>Diagnosis and treatment</th>
<th>Veterans Administration</th>
<th>DVBIC</th>
<th>North Carolina Veteran Affairs</th>
<th>North Carolina LME/MCO</th>
<th>Military bases</th>
<th>BIANC</th>
<th>Social Security Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Provider referral service</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Veteran/family information</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Veteran/family support groups</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provider training and education</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial benefits</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Note. BIANC, Brain Injury Association of North Carolina; DVBIC, Defense and Veterans Brain Injury Center; LME, local management entity; MCO, managed care organization.
Source: This information comes from interviews and discussions with Janice White, TBI Program Manager, North Carolina Department of Health, Division of Mental Health, Developmental Disabilities and Substance Abuse; Robbie Lowe, SOC Coordinator, East Carolina Behavioral Health; Georgia Claxton, Communication Director, East Carolina Behavioral Health; and Benita Hathaway, Call Center Director, East Carolina Behavioral Health.
Falls are responsible for more than one-third of all traumatic brain injuries (TBIs) within the general population and more than 60% of all TBIs among people older than 65 years. Fall-related TBIs among elderly individuals are responsible for an estimated 141,998 emergency department visits, 81,500 hospitalizations, and 14,347 deaths in the United States each year. Many more people are treated in the primary care setting or do not seek treatment. Patients over age 75 years have the highest rates of both TBI-related hospitalization and death. This is a significant public health concern as the nation’s elderly population continues to increase. It also represents a challenge for clinicians across the spectrum of care, as patients with TBI are frequently encountered in the emergency department and by providers in primary care, surgical specialties, nonsurgical specialties, allied health, and neuropsychology. Thus nearly all medical professionals need to have a robust understanding of fall-related TBI care.

The evaluation and diagnosis of mild TBI, in particular, is challenging in older persons, especially those with pre-existing dementia or cognitive disorders. Because mild TBI includes any loss or alteration of consciousness, a pre-existing alteration in consciousness may obfuscate diagnosis. TBI should be high on the differential diagnosis when there is a significant mechanism or evidence of head injury, such as bruising, lacerations, or facial bone fractures. Conversely, common symptoms of brain injury—such as balance impairment, depression, and cognitive deficits—may be misattributed to other causes, especially when elderly patients experience a fall that was not witnessed by anyone. The frequent use of anticoagulants for comorbid conditions in this population leads to an increased risk of hemorrhage, even with low-velocity head trauma. A high index of suspicion for intracranial hemorrhage is thus warranted, as these patients may present with vague neurological complaints and a normal physical examination. Some patients may present days or weeks after trauma, such as may occur with subdural hemorrhage.

Initial Assessment of Brain Injury and Indications for Imaging

The initial assessment of brain injury must focus on patient stabilization and the prevention of secondary complications. Increased intracranial pressure due to bleeding or edema can lead to cerebral anoxia or infarct. These complications can often be prevented with careful clinical examination, imaging, and the appropriate use of neurosurgical interventions. Computed tomography (CT) remains the most useful initial imaging tool due to its sensitivity for acute hemorrhage and fractures. While CT lags behind magnetic resonance imaging (MRI) in sensitivity for some findings, such as the micro-hemorrhages seen in diffuse axonal injury, CT’s speed and ability to detect lesions requiring neurosurgical intervention make it the preferred initial imaging modality. It is well accepted that patients with a Glasgow Coma Scale (GCS) score of 13 or less require a CT scan after known head trauma. For patients with mild TBI and a GCS score of 14 or 15 on arrival to the emergency department, the 2008 guidelines from the American College of Emergency Physicians and the Centers for Disease Control and Prevention are often used to determine the need for imaging. According to these guidelines, any patient over 60 years of age should receive a head CT scan if they experienced loss of consciousness or post-traumatic amnesia. Imaging should also be considered for patients older than 65 years of age, even in the absence of loss of consciousness. Clinicians also need to consider the presence of neurological deficit, vomiting, severe headache, GCS score less than 15, physical signs of basilar skull fracture, coagulopathy, or a dangerous mechanism of injury (including ejection from motor vehicle, struck pedestrian, and fall from a height greater than 3 feet or 5 stairs). In an Australian study of hospitalizations related to TBI, the most likely initial imaging finding was subdural hemorrhage (42.9%). Traumatic subarachnoid hemorrhage was seen in 12.7% of patients, and concussive injury was noted in 24.1%.

It should be noted that a normal CT scan cannot completely rule out extra-axial hemorrhage or a structural brain injury. MRI with susceptibility weighted images and diffusion tensor imaging are more sensitive for hemorrhagic and nonhemorrhagic axonal injury, respectively. Furthermore, ongoing research is needed to establish the role of functional neuroimaging as well as that of serum biomarkers.

Rehabilitation of Elderly Patients with TBI

Common symptoms following TBI include cognitive impairment, fatigue, vestibular disequilibrium, sleep-wake cycle impairment, psychiatric and behavioral disturbances, headaches, and vision and hearing changes. More severe TBI may also be associated with weakness, muscle spasticity, dysphagia, seizures, speech impairment, and hormone and electrolyte changes. In addition, it is common for patients with severe TBI to experience confusion, agitation, and combativeness—particularly when emerging from a comatose state. Secondary complications can include cerebral infarct due to increased intracranial pressure, hydrocephalus, and injuries from additional falls.

Management of symptoms following TBI presents unique
challenges in elderly patients. For example, tricyclic antidepressants—which are commonly used in the treatment of post-traumatic headache—may lead to complications in elderly patients due to anticholinergic side effects. Likewise, medications commonly used to treat muscle spasticity may lead to sedation. In fact, elderly patients with TBI should be presumed to be more sensitive to any centrally acting medication. In particular, benzodiazepines and typical antipsychotics such as haloperidol should be avoided due to evidence that they impair recovery from TBI.

As budgetary constraints sometimes preclude one-on-one care in hospitals and nursing facilities, there is danger that potentially harmful sedatives will be used as a means of behavioral control. The use of enclosure beds and patient restraints are appropriate in some cases, but they are wrought with ethical concerns. An alternative is hospital sitters, who stay with patients and can help to keep them calm, but we lack evidence-based guidelines to support the use of such personnel. Several studies have failed to show that hospital sitters prevent falls or are cost-effective, and assigning hospital sitters to elderly patients may contribute to staffing shortages in other areas of the unit. However, the question of whether hospital sitters are beneficial needs to be addressed in the brain injury population, especially because symptoms of confusion, restlessness, and poor balance are often present in patients with minimal strength impairment. Clinicians should not underestimate the value of a trusted family member’s presence in the redirection of an agitated patient, and facility visitation policies should allow spouses and other visitors to fulfill this role.

Fall prevention is of paramount importance in the recovery from TBI. This is of even greater consequence among patients with intracranial hemorrhage or recent craniectomy, in whom a repeat fall can be disastrous. In addition to reducing polypharmacy, it is important to address any physical weakness, coordination impairment, or vestibular dysfunction with an appropriately tailored physical therapy program. Symptoms of orthostasis and the presence of comorbidities such as polyneuropathy, vision impairment, or benign paroxysmal positional vertigo must also be considered and addressed. Home assessment and modifications may be indicated near the time of discharge.

Given the complex medical, behavioral, physical, and cognitive sequelae of TBI, a multidisciplinary approach to treatment is often indicated. Acute inpatient rehabilitation facilities offer physical therapy, occupational therapy, speech therapy, rehabilitation nursing, and neuropsychological services. However, changes in Medicare reimbursement have resulted in stricter admission standards for acute inpatient rehabilitation facilities and have increasingly emphasized reducing length of stay and discharging patients home from the acute inpatient rehabilitation setting.

In comparing 2 studies from the TBI Model Systems Project over the 10-year period 1996-2006, average length of stay in an inpatient rehabilitation facility for older patients with TBI (mean age of 67 years) plunged by nearly 70%, from 56 days to 19 days. Patients in the earlier study were admitted with lower overall functional status as measured by the Functional Independence Measure (FIM) scale, and they were discharged with higher functional status (see Table 1). Presumably, many of these lower-functioning patients are now discharged directly to nursing facilities, where they receive less therapy, nursing care, and physician oversight. The impact of these changes on patient outcomes is unknown, and more research is needed to better guide these practices and policies.

### Table 1: Changing Trends in Inpatient Rehabilitation for Older Adults With Traumatic Brain Injury

<table>
<thead>
<tr>
<th></th>
<th>1996† (n = 50)</th>
<th>2006† (n = 267)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age, in years (SD)</td>
<td>66.8 (9.2)</td>
<td>66.6 (9.0)</td>
</tr>
<tr>
<td>Rehabilitation length of stay, in days</td>
<td>56.0</td>
<td>18.8</td>
</tr>
<tr>
<td>Admission FIM</td>
<td>52.2</td>
<td>53.6</td>
</tr>
<tr>
<td>Discharge FIM</td>
<td>90.6</td>
<td>87.8</td>
</tr>
<tr>
<td>Percent of patients discharged to community</td>
<td>82%</td>
<td>81%</td>
</tr>
</tbody>
</table>

*Notes: FIM, Functional Independence Measure; SD, standard deviation. †Data are from Cifu et al [8].

### Dementia, Chronic Traumatic Encephalopathy, and Chronic Sequelae of TBI

A growing body of evidence shows that there is a correlation between prior brain injury and subsequent development of dementia, but interpretation of these data is often difficult due to the presence of covariates such as drug and alcohol abuse or underlying medical conditions. Nonetheless, it appears that prior brain injury is a risk factor for dementia, with evidence of both higher frequency and younger onset. A recent cohort study of 825,816 men completing mandatory Swedish military service showed that a history of TBI increased risk of young-onset dementia at an average follow-up time of 33 years; this correlation was present even after controlling for covariates such as premorbid cognitive function, alcohol intoxication, blood pressure, depression, and socioeconomic status. Another recent study in California compared TBI patients age 55 years and older versus non-TBI trauma patients who presented to emergency departments. They found that the TBI patients were more likely than the non-TBI control group to have developed dementia after an average follow-up period of 6 years (8.4% versus 5.9%, respectively). This suggests that elderly individuals may be more susceptible to the sequelae of mild brain injury.

The mechanism of chronic cognitive decline has yet to be proven, and it is unclear whether brain injury initiates a neurodegenerative process or if neuronal loss from the initial injury diminishes cognitive reserve. Pathology studies of TBI-related dementia and chronic traumatic encephalopathy (CTE) may offer some hints as to the etiology of these changes. However, specific criteria for the pathological diagnosis of CTE have not yet been defined. Brain atrophy is often reported, but it has not been possible to distinguish between acute brain injury sequelae and progressive neuron loss. Deposition of tau protein neurofibrillary tangles, amyloid beta, and TAR DNA-binding protein 43 has been observed. These neuropathological features are present in a variety of dementias and neurodegenerative disorders, but it remains to be seen whether this reflects shared pathogenesis. Clinical diagnosis of CTE is even more ambiguous. However, various neuropsychiatric and behavioral symptoms have been reported, including depression, aggression, emotional lability, poor judgment, and suicidal ideation.
Neuropsychological evaluation is important for detection and classification of cognitive and behavioral symptoms in elderly patients. The diagnostic utility of neuropsychological testing is well documented in cases of TBI, but its use for diagnosis of CTE is controversial, as research findings have been inconsistent. Still, neuropsychological testing can be useful for determining the likelihood of other causes of cognitive and behavioral disturbance, such as primary psychiatric illness. Also, neuropsychological testing is useful for clinical decision making, planning, and monitoring of treatment effects. Evaluation of a patient’s cognitive abilities relates to their real-world functioning, and there is evidence that neuropsychological assessment is effective in predicting occupational and psychosocial outcomes following a concussion. In elderly patients, neuropsychological assessment can help clinicians make recommendations regarding driving ability and activities of daily living, and such assessment is recommended when there is concern about cognitive or behavioral disturbances affecting function. If the results of testing suggest a possible diagnosis of CTE or other neurodegenerative disease, then repeat testing will usually be recommended after 6-12 months to monitor for further decline or to check for treatment effects. In addition to identifying cognitive impairments, neuropsychological testing can be useful for identifying psychiatric disturbances such as depression and anxiety, which are common after TBI and are known to affect recovery. Psychotherapy, counseling, and/or psychopharmacological treatments may be recommended.

Conclusions
Falls are the most common cause of TBI among elderly individuals, and they therefore represent a significant public health concern. The treatment of fall-related TBI is complex and requires a multidisciplinary treatment approach. However, appropriate care can result in continued functional independence and discharge back to the community. Ongoing research is needed to elucidate the pathogenesis of TBI-related dementia as well as age-related differences in the sequelae of TBI.

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Traumatic Brain Injury and Behavioral Health
The State of Treatment and Policy

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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. Societal costs of TBI total at least $10 billion. 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 and contributing to disability for upwards of 5.3 million people in the United States. In North Carolina alone, there were more than 140,000 TBI-related emergency department visits during the period 2010-2011. The impact of severe TBI on patients and families is tremendous and lasts years, but even concussion, a milder form of TBI, can significantly disrupt daily living, quality of life, and family balance. 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. 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. 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.

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 and that this illness persists over a period of time. 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. These gaps in care are observed across most groups of TBI survivors, including veterans. 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. 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. 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. 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 investigatory work continues, a growing menu of evidence-based treatments will help clinicians address multiple physical, behavioral, and psychological health problems that occur following TBI. Below is a sampling of specific evidence-based treatment advances.

Acute Rehabilitation

Intensive multidisciplinary inpatient rehabilitation—the earlier, the better—has been found to consistently improve chances of recovery.

Attention, Memory, and Problem Solving

Attention. We now know that methods like cueing and cognitive behavioral therapy are effective for improving hemispatial visual inattention. For persons with mild TBI, general attention is aided by training of metacognitive skills.

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

Problem solving. Both group and individual training in executive function have been helpful for improving problem solving after TBI.

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

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.

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. 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. 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.

The CTE research has recognized 2 subgroups with the disorder; these subgroups are defined by age and deficit domains. 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.

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 emphasis 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”. 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. The TBI Coordinating Center fosters the development of both grant initiatives.

Booster 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”. 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. A few states have restructured their waiver programs and fused the HCBS waiver for TBI survivors with other waiver initiatives. Additionally, the Patient Protection and Affordable Care Act of 2010 further supports TBI populations through the expansion of Medicaid initiatives related to LTSS.

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.

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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The mission of Unmasking Brain Injury is to promote awareness of the prevalence of brain injury; to give survivors a voice and the means to educate others of what it’s like to live with a brain injury; to show others that persons living with a disability due to their brain injury are like anyone else, deserving of dignity, respect, compassion and the opportunity to prove their value as citizens in their respective communities.

To read more about this project visit: www.unmaskingbraininjury.org

**Brain Injury**

Gunshot wound resulting from a home invasion at age 19

**Explanation of mask**

Teardrop, pocket watch and infinity symbol represent: mourning of time lost, time passes so slowly now, and fear of being in this condition forever

Crack in space/time under left eye is a symbol of the past breaking through, my inability to run from it, and how Dr. Who got me through the darkest times, made me smile and showed me the man I want to be.

Forehead depicts the bullet hole, post-traumatic stress and anxiety I face. The storm in my head never calms, transfer of energy from the evil that tried to end me, and fuels my purpose to overcome this evil.
Brain Injury
Pedestrian struck by a motor vehicle at age 14

Explanation of mask:
I love nature and the sun shining down on me. Flower represents my love of spring, summer and fall when flowers are in bloom. The pack of dogs represents my desire to volunteer at a dog farm.

Brain Injury
Brain Tumor

Explanation of mask:
Patch over my eye because my vision is impaired. Fork in the road for feeling lost, abandoned and uncertain; I am not going down the path I wanted for my life, but I am still grateful for being here. Smile to remind people to never give up!

Brain Injury
Motor Vehicle Accident

Explanation of mask
I feel like I’m forever internally crying and heartbroken. I feel like I’m told I’m always wrong because people don’t understand what a brain injury does to someone.
Brain Injury
Viral Encephalitis at Age 2

Explanation of mask:
I have a two-sided mask because I used to have seizures from viral encephalitis that made me feel confused and lost in a maze. Now the seizures are gone and my mom said that the first thing I said when my vision came back was, “Look at the pretty flower”.

Brain Injury
Forceps injury during birth

Explanation of mask:
Hamster wheel because I am anxious and worry a lot, cork is for how I bottle up my feelings, tears about a broken heart, and purple representing feelings of warmth, safety, and loving myself.
Annual Traumatic Brain Injury Conference 2015
Preparing for a New Normal: TBI Continuity of Care

This conference is designed to address best practice strategies for cognitive and attention deficits after brain injury. Topics of emphasis will include sexuality following a TBI, post-acute management, military transition, and family education for living with an individual who has suffered a brain injury.

For more information visit: www.bianc.net/events/annual-tbi-conference-2015 or call the BIANC office at 919-833-9634
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Local Chapters and Support Groups

Additional information on support group meeting places and times are available at www.bianc.net

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