Traumatic Brain Injury in North Carolina

Also in this issue:
- Impact of North Carolina’s motorcycle helmet law on traumatic brain injuries
- A model of care for the uninsured population of Southeastern North Carolina
- 2014 North Carolina Child Health Report Card
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Motorcycling is a popular and fuel-efficient means of commuter transportation, and it provides a social focus for communities of recreational motorcyclists. From a traffic safety perspective, however, motorcyclists are a high-risk population of road users. Relative to passenger car occupants, motorcyclists are more than 26 times as likely to be killed and 5 times as likely to be nonfatally injured, per vehicle mile traveled [1]. A variety of factors contribute to this disparity. Motorcycles are less conspicuous than passenger vehicles [2, 3] and are thus more likely to be involved in traffic crashes; motorcycles provide less protection from crash forces because of their open design; and motorcyclists are over-represented in alcohol-related and speed-related fatal crashes [1].

Traumatic brain injuries (TBIs) are a leading cause of motorcycle-related deaths and are among the most severe and costly nonfatal motorcyclist injuries [4, 5]. Nonfatal TBIs consume significant medical resources in the acute phase of treatment, and patients with nonfatal TBIs may also require extensive rehabilitation [4]. Helmets that meet federal safety standards are the most effective way to reduce the risk of head trauma in a motorcycle crash [6]. Helmets are estimated to be 42% effective at preventing death and 69% effective at preventing head injury when a crash occurs [7].

Universal helmet laws, defined as laws that require all motorcycle riders to wear a helmet, are effective for sustaining high levels of helmet use [8, 9]. Currently, 19 states and the District of Columbia have universal helmet laws [10]. Among the remainder of states, 3 states have no helmet law, and 28 states have partial helmet laws. Partial helmet laws require only certain subgroups of motorcycle riders to wear a helmet, usually those under the age of 18 or 21 years. Multiple studies have reported that when states repeal a universal helmet law or weaken their universal helmet law to a partial helmet law, helmet use decreases and motorcycle-related deaths and head injuries increase [9, 11-14].

The purpose of this study was to estimate the impact of North Carolina’s universal motorcycle helmet law on the incidence and burden of motorcycle-related TBIs to North Carolina residents. North Carolina has high levels of helmet use, and the state’s motorcycle injury and death rates are below those of Southeastern states without universal helmet laws, such as South Carolina and Florida [15-17]. However, an analysis of the impact of North Carolina’s universal helmet law has not previously been conducted. This study focused on hospital admissions and charges for the initial period of care for North Carolina motorcyclists with TBIs who were treated as inpatients in the state’s hospitals.
Methods

This study examined hospital charges for North Carolina residents admitted to the state's hospitals in calendar year 2011 (January 1, 2011 to December 31, 2011). We quantified the health care impact of the state's universal helmet law by comparing the observed (actual) incidence and charges for these patients with those of a hypothetical (counterfactual) scenario in which North Carolina had no universal helmet law in 2011. The counterfactual concept is used to compare health outcomes in a given population under 2 different scenarios. For example, one could compare disease incidence in an exposed population to the incidence in the same population in an unexposed condition [18]. Clearly, 1 of these 2 scenarios is hypothetical and therefore unobservable [18]. The unobservable scenario is called the “counterfactual condition,” as it is counter-to-fact (or counter-to-reality) [18]. For this study, our “exposure” was North Carolina’s universal motorcycle helmet law, and our “exposed” scenario was the actual and observable hospital charges. To estimate hospital charges in the “unexposed” counterfactual condition (ie, North Carolina without a universal helmet law), we used discharge data from North Carolina hospitals combined with results from published evaluations from other states that have weakened or repealed helmet laws [9, 12, 13].

Actual Inpatient Incidence and Hospital Charges for 2011

Data on motor vehicle traffic-related injuries sustained by North Carolina motorcyclists admitted to the state’s hospitals in 2011 were abstracted from the North Carolina Hospital Discharge Data (HDD) system. HDD are abstracted from hospital administrative claim forms used to bill payers. Hospitalized motorcyclists were identified using International Classification, 9th Revision, Clinical Modification (ICD-9-CM) external cause of injury codes (E-codes) in the range E810–E819 with a fourth digit of .2 or .3. Among these discharge records, motorcyclists suffering a TBI were identified using ICD-9-CM diagnosis codes 800.0–810.9, 803.0–804.9, 850–854.19, 950.1–950.3, 959.01, or 995.55; these codes are consistent with the definition of TBI proposed by the Centers for Disease Control and Prevention (CDC). Total hospital charges included those incurred during the initial period of care that were related to intensive care unit/critical care unit care, surgery, laboratory, pharmacy, radiology, respiratory, therapy, and supplies, as well as routine charges. Hospital charges from the HDD system represent the charges that would be billed to someone without insurance; for this study, we included only those charges billed to a patient for an initial hospitalization associated with the treatment of a motorcycle crash–related TBI. These charges are not equivalent to actual costs. The average charge-to-cost ratio for North Carolina hospitals was approximately 3.2:1 in the period 2011–2012 [19]. However, we do not present costs here, because charge-to-cost ratios are an approximation and can vary considerably by hospital.

Counterfactual Inpatient Incidence and Hospital Charges

The counterfactual scenario of interest is the hypothetical condition in which North Carolina had no universal helmet law in 2011. In states where a universal helmet law has been repealed or weakened to a partial helmet law, there are generally 2 TBI-related effects: an increase in the number of motorcyclists with TBIs, and an increase in the average cost of care per motorcyclist with a TBI [12, 13]. Our analyses therefore estimated both an increase in the incidence of TBIs and an increase in average costs. We estimated these parameters using data from other states. Because there is uncertainty in utilizing data from other states as a substitute for the counterfactual North Carolina, we used 3 different populations to estimate the increases in TBI incidence and average cost of care: pre-repeal and post-repeal data from Florida [13]; pre-repeal and post-repeal data from Pennsylvania [12]; and results of universal helmet law repeal impacts from the Community Preventive Services Task Force [9] combined with data on hospital charges for South Carolina residents treated for motorcycle crash–related TBIs in North Carolina hospitals. We present a range of estimates based on these 3 populations.

Florida and Pennsylvania were selected because these states are approximately comparable to North Carolina in terms of factors that influence motorcyclist behaviors and exposures (eg length of riding season and road environment) and because well-conducted evaluation studies of universal helmet law repeal were available for these states. South Carolina residents treated in North Carolina hospitals were selected because they provided a comparison group treated in the same hospitals as North Carolina residents. Like the data on North Carolina residents, data on these patients were obtained from North Carolina’s HDD system.

In the Florida study, Ulmer and Northrup [13] examined acute care hospital-admitted motorcyclists with a principal diagnosis of head, brain, or skull injury before and after the January 2000 repeal of Florida’s universal helmet law. Comparing the 30 months pre-law to the 30 months post-law, they found cases increased from 602 to 1,097, for an increase of 82% [13]. Adjusted for inflation, the total cost of acute care for these injuries averaged $34,518 per case in the 30 months pre-law and $39,877 per case in the 30 months after the law change, for an increase of 16% [13].

In the Pennsylvania study, Mertz and Weiss [12] examined motorcycle-related hospitalizations with head injuries (having a TBI code listed as one of the first 5 ICD-9-CM diagnosis codes, with TBI defined based on the CDC definition). The authors examined hospitalizations 2 years before (2001–2002) and 2 years after (2004–2005) the September 2003 repeal of Pennsylvania’s universal helmet law. They found that motorcycle-related head injury hospitalizations increased 78% during this time [12], and the percentage increase in the mean charge per motorcycle-related head injury hospitalization was 32% [12]. Motorcyclists who were residents of South Carolina,
a state without a universal helmet law, who were treated in North Carolina hospitals provided a third estimate of expected average hospital charges in the counterfactual condition. For some areas of South Carolina, the nearest trauma hospital is located in North Carolina. We assumed that many of the South Carolina motorcyclists treated in North Carolina hospitals were involved in crashes in South Carolina near the border of the 2 states; we also assumed that the helmet use and distribution of TBI severity among these South Carolina residents were representative of all South Carolina residents admitted to hospitals with TBIs in 2011. The average charge for South Carolina inpatients with motorcycle-related TBIs was extracted from the North Carolina HDD system. The criteria used to define motorcycle-related TBIs for South Carolina patients were identical to those used for North Carolina patients. South Carolina patients had a mean charge per case of $104,814, compared to $83,428 for North Carolina residents, for an increase of 26%.

Because the North Carolina HDD system could not be used to estimate the expected increase in hospital admissions for North Carolina motorcyclists with TBIs under the counterfactual condition, we used an estimate from a recent systematic review from the Community Preventive Services Task Force [9]. This review estimated a 69% increase in nonfatal head injuries when a state changes from a universal helmet law to a partial helmet law or no helmet law [9].

**Calculations of Counterfactual Inpatient Admissions, Total Charges, and Charges by Payer Source**

To calculate the expected number of hospital admissions for North Carolina motorcyclists with TBIs under the counterfactual condition, we multiplied the actual number of motorcycle-related TBI admissions in North Carolina in 2011 by the expected incidence increase for each of the 3 substitute populations (FL, 82%; PA, 78%; SC, 69%).

To estimate the expected mean charge per motorcycle-related TBI admission for the counterfactual condition, we multiplied the actual average charge per motorcycle-related TBI admission by the expected average charge increase in each of the 3 substitute populations (FL, 16%; PA, 32%; SC, 26%). Finally, to estimate total hospital charges, the expected mean charge per admitted motorcyclist was multiplied by the expected number of admitted motorcyclists. Annual averted hospital charges were calculated as the difference between the actual charges in 2011 and the estimated charges obtained from each of the 3 substitute populations discussed above.

To estimate expected charges billed to each source of payment, we obtained data on expected sources of payment for hospitalized motorcyclists with TBIs from 2011 North Carolina HDD claims. Expected sources of payment were categorized as government or other public sources, such as Medicaid and Medicare (hereafter referred to as “taxpayer sources”); private insurance (eg, Blue Cross and Blue Shield of North Carolina) and other forms of payment; and self-payment. To estimate the total expected charges for each source of payment, the percentage of all charges billed to each source of payment was multiplied by the total expected charges.

**Results**

In 2011, there were 275 hospital admissions of North Carolina motorcyclists with TBIs (See Table 1). The mean hospital charge per case was approximately $83,400; the total charge for all cases was $22.9 million.

If North Carolina’s universal helmet law had been weakened or repealed in 2011 (counterfactual condition), the expected number of hospital admissions for North Carolina motorcyclists with TBIs would have increased to between 465 and 501 cases. This range is the actual number of motorcycle-related TBI admissions (n=275), multiplied by the expected incidence increase for each of the 3 substitute populations (FL, 82%; PA, 78%; SC, 69%).

Additionally, the expected mean charges per North Carolina motorcyclist with a TBI yielded total expected charges of $48.3 million to $53.9 million in the counterfactual condition, more than double the actual charges. Thus, by maintaining a universal helmet law in 2011, between $25.3 million and $31.0 million in hospital charges were averted (expected charges minus actual charges).

Charges to taxpayer sources for the treatment of North Carolina motorcyclists in the state’s hospitals were approximately $8.6 million in 2011, or 38% of total charges (See Table 1). Applying this proportion to total expected charges if North Carolina’s universal helmet law had been weakened or repealed in 2011 (counterfactual condition), we found that expected hospital charges to taxpayer sources would have increased to between $18.2 million and $20.3 million. Therefore, maintaining a universal helmet law averted between $9.5 million and $11.6 million in hospital charges to taxpayer sources. Averted charges for private sources were $12.6 million to $15.4 million, and averted charged for self-payment were $3.2 million to $3.9 million.

**Discussion**

Universal helmet laws increase helmet use, prevent injuries and deaths, and reduce costs [9, 20-25]. Similarly, weakening or repealing these laws has been shown to decrease helmet use, increase injuries and deaths, and increase costs [9, 11-14]. By maintaining North Carolina’s universal helmet law, there were between 190 and 226 fewer hospital admissions of North Carolina motorcyclists with TBIs in 2011 than if the state had not had a universal helmet law. Additionally,
we estimated that total hospital charges for admitted North Carolina motorcyclists with TBIs were approximately half what they would have been without a universal helmet law. Our estimates of averted charges by payer source indicated that approximately $9.5 million to $11.6 million in hospital charges to taxpayer-based payer sources were averted. However, the proportion of averted charges to taxpayer-based payer sources may be an underestimate. Lawrence and colleagues [26] noted that some motorcyclists designated as “self-pay” on billing records may have some proportion of their costs shifted to government sources if they become unable to pay all of their bills due to the costly nature of their injuries.

It is important to note that this study was focused on the initial period of care only. Initial care is typically only a small proportion of the care provided (and total costs incurred) during the treatment and recovery from TBI. The CDC reported that lifetime medical costs associated with nonfatal hospitalized TBIs averaged about $79,000 per patient in 2010 dollars, and lifetime work loss costs averaged an additional $179,000 per patient [16]. Additionally, Whiteneck and coauthors [27] found that about one-third of adults hospitalized with TBI from all causes still required help with daily activities 1 year after their discharge. Miller and colleagues [28] documented major employment impacts for motorcyclists with TBIs; specifically, employment levels dropped from just over 80% to 45% by 1 year post-injury, and unemployment tripled (11% to 32%). In addition to personal productivity losses, there are significant losses associated with caregiver burden and reduced quality of life [4, 26].

The results of this study confirm a previous study reporting that universal helmet laws produce economic benefits [29]. The previous study reported that states with universal helmet laws save, on average, nearly 4 times the costs per registered motorcycle compared to states without a universal law. Moreover, that study found that North Carolina led the nation in terms of both lives saved and costs saved by helmet use per registered motorcycle. Helmet use in North Carolina was estimated to save $163 million in medical and productivity costs per 100,000 registered motorcycles in 2010. For comparison, Southeastern states without universal helmet laws, such as South Carolina and Florida, were estimated to save $27 million and $38 million per 100,000 registered motorcycles, respectively [6, 29].

Some states that have weakened a universal helmet law to a partial helmet law have attempted to address the costly nature of motorcycle injuries by requiring that unhelmeted motorcyclists carry a minimal amount of insurance to cover the medical costs associated with a potential crash [10]. However, research has shown that these legislative provisions are typically insufficient to cover the increased costs

### Table 1

<table>
<thead>
<tr>
<th>Source or substitute population</th>
<th>Number of motorcyclists</th>
<th>Average hospital charge per TBI admission (2011 dollars)</th>
<th>Government and public sources</th>
<th>Private sources and other payments</th>
<th>Self-payment</th>
<th>Total charges (all sources)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal motorcycle helmet law in effect (actual)</td>
<td>North Carolina 2011</td>
<td>275</td>
<td>$83,428</td>
<td>$2,886,961</td>
<td>$22,942,711</td>
<td></td>
</tr>
<tr>
<td>No universal motorcycle helmet law (counterfactual)</td>
<td>Florida 2000b</td>
<td>501</td>
<td>$96,359</td>
<td>$6,075,347</td>
<td>$48,280,847</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pennsylvania 2003c</td>
<td>490</td>
<td>$110,125</td>
<td>$6,783,201</td>
<td>$53,906,168</td>
<td></td>
</tr>
<tr>
<td></td>
<td>South Carolina residents treated in North Carolina hospitals 2011†</td>
<td>465</td>
<td>$104,814</td>
<td>$6,129,639</td>
<td>$48,712,307</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pennsylvania 2003c</td>
<td>215</td>
<td>$26,697</td>
<td>$3,896,240</td>
<td>$30,963,457</td>
<td></td>
</tr>
<tr>
<td></td>
<td>South Carolina residents treated in North Carolina hospitals 2011†</td>
<td>190</td>
<td>$21,386</td>
<td>$3,242,678</td>
<td>$25,769,596</td>
<td></td>
</tr>
</tbody>
</table>

†Hospital inpatient charges for initial period of care, 2011 dollars, for North Carolina residents only.

‡Ulmer and Northrup [13] reported an 82% increase in incidence and a 16% increase in mean cost following the weakening of Florida’s motorcycle helmet law from a universal to a partial law.

§Mertz and Weiss [12] reported a 78% increase in incidence and a 32% increase in mean charges following the weakening of Pennsylvania’s motorcycle helmet law from a universal to a partial law.

∥South Carolina residents with motorcycle crash–related TBI treated in North Carolina hospitals in 2011 had mean charges that were 26% higher than North Carolina residents with motorcycle crash–related TBI. This estimate assumes a 69% increase in incidence based on pooled data from other states [9].
associated with motorcycle crash injuries, and many of the costs are paid by taxpayer-funded sources [13]. Florida weakened its motorcycle helmet law from a universal helmet law to a partial helmet law; the latter required helmet use only by riders under the age of 21 years and those with less than $10,000 of medical insurance. However, after the change in the law, less than a quarter of hospitalized motorcyclists with TBIs had medical costs that were less than $10,000; indeed, the mean cost per case was nearly $40,000 (in 1998 dollars) [13]. Additionally, only 63% of those admitted with head injuries were covered by private insurance; the remainder had their treatment classified as self-pay, or their care was billed to charitable or public sources [13].

This study has some limitations. First, we relied on E-codes to identify hospitalized motorcyclists with a TBI. While North Carolina hospitals have high use of E-codes, it is possible that some motorcyclists with TBIs were not correctly coded as such [30]. Therefore, our results could underestimate the true number of injured motorcyclists. Second, we presented a range of estimated injury incidences and mean charge increases, and each estimate was based on a slightly different injury definition. The Pennsylvania estimate used a similar definition to that used in our study by including motorcyclists with a TBI code as 1 of the first 5 ICD-9-CM diagnosis codes [12]. The Florida estimate included hospital-admitted motorcyclists with a principal diagnosis of a head, brain, or skull injury [13], which is identical to the definition used in our study. While our estimate based on South Carolina residents admitted to North Carolina hospitals used the same injury definition, we assumed that the distribution of TBI severity for these South Carolina residents was representative of what the TBI severity distribution for North Carolina residents would have been had the state lacked a universal helmet law. This may not be the case if more severe injuries are associated with an increased probability of transfer across state lines. Third, because we do not have information on North Carolina motorcyclists admitted to out-of-state hospitals, total charges associated with hospital admissions for North Carolina motorcyclists with TBIs are likely greater than what we have presented here. Fourth, some of the discharges included here result from transfers between hospitals or readmissions, but this is expected to be a small proportion of the overall number of total discharges. Finally, it is important to note that charges are not equivalent to actual costs.

Conclusion

North Carolina’s universal motorcycle helmet law provides key benefits in terms of reduced TBI hospital admissions of North Carolina motorcyclists and averted hospital charges. North Carolina hospitals had approximately 190 to 226 fewer admissions for North Carolina motorcyclists with TBIs in 2011 than would have been expected in the absence of a universal helmet law. Total charges for the initial, acute care of North Carolina motorcyclists hospitalized with TBIs were approximately half what they would have been without a universal helmet law. The state’s universal helmet law thus averted between $9.5 million and $11.6 million in hospital charges to taxpayer-based payer sources.

While this study focused on hospital charges associated with initial treatment, the total economic burden associated with motorcycle crash–related TBIs is far greater. The total cost of such injuries involves recurrent costs of therapy, loss of earnings capacity, and disability replacement costs. This study did not include data on these costs. NCMJ

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A Model of Care for the Uninsured Population in Southeastern North Carolina

Janelle A. Rhyne, Kae Rivers Livsey, Allie E. Becker

BACKGROUND Cape Fear HealthNet is a unique collaborative model that was established to address coordination of care for low-income, uninsured individuals in the Lower Cape Fear Region of North Carolina. This model involves a centralized referral network to direct uninsured clients to medical homes among safety-net providers, a system for specialty referrals, and a short-term episodic or urgent care clinic (HealthNet Clinic) to address immediate or urgent health needs.

METHODS We provide a descriptive analysis of patients seen in the episodic care clinic during the period August 2010 through July 2012.

RESULTS Our data suggests that, compared to county population estimates, the HealthNet Clinic patients were more likely to be people of color, and a higher percentage of clinic patients had chronic diseases or lifestyle determinants of chronic diseases, such as diabetes, obesity, or smoking. Almost half of clinic patients (43.7%) required some type of laboratory or diagnostic service; less than 10% of clinic patients were referred to a specialty provider. Findings from this study can inform community collaborative efforts and planning by other safety-net providers to help leverage limited resources and increase access to care among uninsured individuals in North Carolina.

LIMITATIONS Patient characteristics cannot be generalized to all uninsured individuals in the region, as there are other safety-net providers in the Lower Cape Fear region, and their clinical data were not included in this analysis.

CONCLUSIONS The Cape Fear HealthNet collaborative model is successful in directing patients, many of whom have significant chronic illness burdens, to a medical home in the community safety net.

The North Carolina Institute of Medicine estimates that the percentage of adults aged 19–64 years without health insurance in the counties that constitute the Lower Cape Fear region (Brunswick, Columbus, New Hanover, and Pender) ranges from 20% to 22.2% [1].

Research has shown that lack of health insurance leads to increased expenditures, poorer outcomes, and higher mortality [2-5]. Uninsured adults with chronic disease face the additional barrier of not being able to access care for monitoring of their chronic conditions.

Background

In 2008, Cape Fear HealthNet (CFHN), a 501(c)(3) non-profit organization, was established with initial funding from the Cape Fear Memorial Foundation, United Way of the Cape Fear Area, and The Duke Endowment. This collaborative network was created to address a lack of communication between safety-net providers in the Cape Fear region and to promote more appropriate utilization of health care services among uninsured individuals.

This paper describes this unique collaborative model and provides a snapshot of patients seen in the network’s episodic care clinic for the period August 2010 through July 2012. All data have been deidentified and were obtained from clinic charts following approval of the study by the Human Subjects Protections Institutional Review Board of the University of North Carolina Wilmington.

Methods

The goals of CFHN are to direct clients to medical homes, create a centralized system for eligibility and referrals, and provide affordable pharmacy options and case management for uninsured individuals with chronic diseases. The CFHN board of directors includes representatives with decision-making authority from other safety-net providers in the area—including the local hospital system and area health departments—as well as physicians, a pharmacist, and a psychologist. Additionally, the Dean of the College of Health and Human Services at the regional university in Wilmington also sits on the board of directors. CFHN partner agencies are listed in Appendix 1 (online version only). Initially, staffing for CFHN was limited to an executive director, 2 enrollment eligibility specialists (patient navigators), a registered nurse case manager, and an administrative assistant.

Prior to 2010, uninsured individuals in the Lower Cape Fear region had limited immediate access to medical care other than urgent care clinics and hospital emergency departments. As a result, many patients had unmet care needs, including patients who needed follow-up care after...
emergency department visits and/or hospitalizations, patients with nonurgent conditions who contacted the hospital nurse call line, and patients with ongoing medical needs who lacked a medical home, such as those with unmanaged chronic conditions (eg, hypertension and diabetes). Over time, it became increasingly difficult for patients to find care for immediate health problems within the existing safety-net clinics, as many providers were at capacity and were not accepting new patients or had long wait times for initial appointments, or they were located in rural areas with limited accessibility.

In response to identified gaps in care, CFHN in August 2010 started an episodic care clinic, the HealthNet Clinic, to provide short term assessment, diagnostic and medical treatment, and medication assistance for low-income, uninsured patients in the region. The HealthNet Clinic was designed to serve as an access point for patients with unmet medical needs and to refer them to a safety-net provider within the collaborative network that could serve as a medical home and provide ongoing primary care services. The HealthNet Clinic is not intended to provide ongoing care; eligible patients are limited to 2 visits.

The HealthNet Clinic originally opened at 2 co-located sites at partner agency facilities. The 2 partner clinic facilities provided the clinic space and some supplies. Grant money provided for additional supplies and for the salaries of a physician and a clinic coordinator. In May 2011, clinic operations were centralized to 1 location in a dedicated space on the Cape Fear Clinic (a free clinic) campus. The clinic is staffed by a full-time physician, volunteer physicians, a clinic coordinator, and volunteers.

Sources of Patient Referrals

Most patient referrals came from the local regional hospital (23%), the local county Departments of Social Services (21.27%), local health departments (20.19%), and other safety-net clinics in the area (18.02%). Other sources of patient referrals included family and friends (11.79%) and private medical providers (2.44%).

Eligibility and Enrollment Processes

In order to be eligible for services at CFHN (including referral to a medical home in the safety net), individuals must be uninsured, have an income at or below 200% of the federal poverty guidelines, and live in one of the counties served by the agency (Brunswick, Columbus, New Hanover, or Pender). When an individual calls to inquire about services, an algorithm triage sheet is used to determine whether the client is an appropriate candidate to be seen in the clinic (See Figure 1). The $20 administration fee was waived in hardship cases, or a lesser amount was accepted. The administrative fee nominally covers the administrative costs of running the clinic. More importantly, having patients contribute payment enhances the perceived value of the services provided to them and makes them a partner in their health care. During the 2-year study period, 25% (n=258) of patients were able to pay some amount of money, with amounts ranging from $1 to $40 for 1 visit; among patients who were able to pay, the average amount paid was approximately $7.

After being seen by the physician for an initial visit, each patient is asked to see a patient navigator. The role of the patient navigator is to determine the patient’s eligibility status to participate in CFHN; this evaluation is required for referral to other safety-net providers.

Patient Navigators

Patient navigators obtain and verify all pertinent data concerning the clients’ family composition, financial status, and employment status. Navigators recertify or review clients’ cases on a periodic basis (ie, every 6 months) in order to re-verify the clients’ eligibility for continued participation in the program. Patient navigators also provide referrals to a medical home and specialist services (with assistance from the HealthNet Clinic physician). In addition, patient navigators assist the patient with obtaining financial aid through local hospital charity care programs; help the patient access other services, including eye care and dental services, mental health services, food assistance, transportation, and prescription assistance programs; and connect the patient to other local human service agencies. Patient navigators are based at local health departments and social service agencies. In February 2012, an additional patient navigator position was created and co-located at the HealthNet Clinic to expedite the navigation process for patients seen in the clinic.

Patients who did not complete a visit with a patient navigator were not eligible for further services. Patients did not complete this visit for a number of reasons, including being unable or unwilling to share financial data, having an income above the eligibility threshold, relocation out of the area, or obtaining some form of health insurance. Referrals to other resources were provided for these individuals.

Case Management Services

HealthNet Clinic patients with chronic illnesses who are enrolled in CFHN are automatically referred to 1 of 3 case managers who provide telephonic case management and conduct home visits when necessary. The registered nurse case management component of the CFHN program is based on the success of the nationally recognized Community Care of North Carolina model.

The case managers, located at the CFHN administrative office or other partner locations, also utilize agency and community resources to assist clients with obtaining supplies and durable medical equipment. For example, diabetic supplies purchased by CFHN are supplied by the case managers to diabetic patients enrolled in the network. In one case, a patient with asthma had been to the emergency department more than 30 times in the preceding year. The case manager was able to supply the patient with a nebulizer machine and
provided teaching, which decreased the patient’s emergency department utilization to only 1–3 visits per year.

Results

The following sections present patient demographic characteristics, health conditions, and clinic utilization patterns in order to provide a snapshot of the patients seen at the clinic. Comparisons to county demographic profiles are provided when applicable.

Clients Seen Through the Clinic and Enrolled in CFHN

Of the unduplicated clients seen in the clinic over the course of the 2-year study period, 62% (n=638) of the clinic patients (n=1,030) were enrolled in CFHN (See Figure 2). In comparison, CFHN saw 4,439 people who did not visit the HealthNet Clinic. Only 27.30% of this group met the criteria and completed the process for enrollment into CFHN. Therefore HealthNet Clinic patients were more than twice as likely to be enrolled in the network as individuals who accessed CFHN through other avenues. As a result of co-location of the patient navigator at the clinic site, the percentage of patients (based on monthly unduplicated clinic visits and number of unduplicated clients enrolled) who were seen in the clinic and enrolled in CFHN rose from an average of 56.8% prior to co-location of the patient navigator (for the period August 2010 through January 2012) to 70.1% (for the period February 2012 through July 2012).

A total of 1,030 patients were seen at the clinic during the study period. Approximately 40% (n=433) of these patients were seen more than once while awaiting eligibility determination and referral to a medical home through a partner agency. Second appointments were sometimes scheduled to discuss laboratory or diagnostic test results and to follow up on immediate health care needs.
### Patient Demographic Characteristics

The mean age of patients seen in the clinic was 44.5 years (range, 19–75 years). Of the patients seen in the clinic for whom ethnicity data were captured (n=989), 50.8% (n=523) were white, 28.3% (n=291) were African American, 11.8% (n=122) were Latino, and approximately 9% were other ethnicities or ethnicity was unknown. Compared to population estimates for the 4-county catchment area, clinic patients were more likely to be people of color. Table 1 provides a breakdown of patient demographic information in comparison to county demographic data estimates [6].

Only 30.9% (n=318) of patients seen in the clinic during the study period reported being employed. Of the clients seen in the clinic, 6.5% (n=67) reported being homeless; most reported living on their own or sharing housing with friends or family. Data on specific income ranges for clinic patients were not available; however, the average income of patients in the entire CFHN system was approximately 53% of federal poverty guidelines, on average. Despite meeting Medicaid income eligibility requirements, most of these patients did not meet the categorical requirements for Medicaid. In fact, under current state eligibility requirements, only 2.1% (n=22) of clients seen in the clinic were determined to be eligible for and were subsequently enrolled in Medicaid.

### Chronic Health Conditions Among Clinic Patients

Most of the patients seen in the clinic had chronic medical conditions, such as hypertension (43.3%; n=446) or diabetes (14.5%; n=149), and most of these conditions were poorly managed. More than half (64.9%; n=95) of patients with diabetes also had hypertension. The percentage of clinic patients with diabetes (14.5%) was higher than population estimates for the state (10%) and higher than population estimates for each of the counties served by the clinic, which range from 10% for Brunswick County to 12% for Pender and Columbus counties [7].

Among patients with diagnosed diabetes mellitus, the mean hemoglobin A1c level was 9.0 (range, 5.4–16.1). Patient blood pressures (at the time of the initial visit) ranged from 80/54 mmHg to 240/140 mmHg. Using the National Heart, Lung, and Blood Institute guidelines, 18.8% of the patients seen in the clinic were overweight (body mass index [BMI] of 25.0–29.9) and 35.1% were obese (BMI above 30.0). For clients for whom BMI was captured (n=726), the mean BMI was 30.1 (range, 16.5–66.4). Weights of patients seen in the clinic ranged from 88 lbs to more than 414 lbs. Four patients weighed more than 400 pounds and were too heavy to be weighed by the clinic scales; their weights were estimated. As with diabetes, the percentage of clinic patients who were obese was higher than county population demographic estimates [7].

Almost 1 in 5 (18.3%; n=189) patients had a mental health diagnosis. This figure is consistent with estimates of mental illness among the general population [8]. The percentage of clinic patients with mental illness who smoked (49%) was higher than either national estimates of people with mental illness who smoke cigarettes (36%) or estimates of smoking among adults without mental illness (21%) [8].

Prevalence
rates of smoking among clinic patients were also higher than county estimates for the general population, according to data from County Health Ranking & Roadmaps [7].

**Other Health Conditions**

Other chronic health conditions seen among clinic patients included hypercholesterolemia (14.9%; n=153), arthritis or chronic pain (9.8%; n=101) and headaches (3.8%; n=39). Hypothyroidism was present in 4.3% (n=44) of patients, with 89% of these patients being female. A small percentage (4.8%; n=49) of clinic patients were diagnosed with asthma, and 2.1% (n=22) had chronic obstructive pulmonary disease. A small percentage of clinic patients had a diagnosed seizure disorder (2.1%; n=22), hepatitis C virus infection (2.5%; n=26), or anemia (2.4%; n=25).

**Monthly Clinic Utilization Patterns**

During the study period, monthly visits ranged from 12 total completed visits in August 2010 to 90 visits in March 2011. The number of patients seen per month was influenced by seasonal trends, school holidays, and staffing. Initially, the clinic was only open for 16 hours per week, but it expanded to being open 36 hours per week. Utilization of clinic services dipped following relocation of the clinic to a central site but has since risen as awareness of the clinic among providers and consumers has grown (See Figure 3). The rate of no-shows averaged about 13.44% over the course of the study period, although the clinic experienced a spike in no-shows at the end of the study period. No-show rates ranged from 0% during the first month of operation (August 2010) to as high as 23.68% in June 2012. While the clinic’s provider could have seen more patients on any given day, the clinic’s capacity was limited by other staffing levels, especially related to administrative needs.

**Patient Referrals From the Clinic**

Patients who completed the patient navigation visit (n=638) were referred to primary care providers in partner agencies or to other private practice providers who volunteered for CFHN. When eligible, clients were referred to the Veterans Affairs clinic. See Figure 2 for referrals to primary care providers. New Hanover Regional Medical Center (NHRMC) agreed to perform any laboratory testing and diagnostic studies free of charge for patients seen through

![Figure 3: Monthly Clinic Utilization Patterns](figure 3)
the HealthNet Clinic who also met their requirements for charity care. Almost half of patients (43.7%) required some type of laboratory or diagnostic service.

All specialty referrals were coordinated through a central referral coordinator who rotates referrals equitably among participating providers. Less than 10% (9.1%; n=115) of clinic patients received a referral to a specialty provider; otolaryngology was the most frequent specialty referral, followed by orthopedic and general surgery, cardiology, and gastroenterology (See Table 2).

### Table 2. Type of Specialty Referrals Among HealthNet Clinic Patients

<table>
<thead>
<tr>
<th>Types of Specialty Referrals Provided</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Otolaryngology</td>
<td>19 (16.52%)</td>
</tr>
<tr>
<td>Cardiology</td>
<td>11 (9.57%)</td>
</tr>
<tr>
<td>Gastroenterology</td>
<td>7 (6.09%)</td>
</tr>
<tr>
<td>Dermatology</td>
<td>2 (1.74%)</td>
</tr>
<tr>
<td>Endocrinology</td>
<td>1 (0.87%)</td>
</tr>
</tbody>
</table>

**Hospital and Emergency Department Referrals**

Of the patients seen in the clinic over the 2-year period, only 3 (0.3%) patients were admitted directly to the hospital for life-threatening conditions, and only 4 (0.4%) patients were sent directly to the emergency department for urgent attention. As with referrals to specialists, there was consistent dialogue and sharing of information between the HealthNet Clinic physician, hospitalists, emergency department physicians, and hospital case managers when patients were referred either to the emergency department or to the HealthNet Clinic.

**Limitations**

There are limitations to the current study. The sample size is relatively small, and data may be biased towards people with chronic medical conditions, since uninsured healthy persons may be less likely to request an appointment. Patient characteristics cannot be generalized to all uninsured individuals in the region, as there are other safety-net providers in these 4 counties, and their clinical data were not included in this analysis. The clinic sees a higher percentage of people of color than the general population, which is not surprising given that lack of insurance tends to be more common in this group [9]. Latinos may also be over-represented when compared to the overall population of the county. The over-representation of Latinos is consistent with findings from a previous study conducted in North Carolina [10] that examined the use of safety-net providers in the western region of the state. Furthermore, this study does not provide any indications of how the clinic, registered nurse case management, and CFHN impact long-term patient health outcomes. Finally, we cannot prove any association between use of these services and utilization patterns at urgent care clinics or emergency departments in the area.

**Discussion**

In this paper, we seek to describe the impetus, design, and operational model of the CFHN collaborative and the HealthNet Clinic. This collaborative has enhanced coordination of the delivery of care to uninsured individuals in the Lower Cape Fear region. CFHN provides several valuable services to uninsured patients with chronic conditions: it serves as an entry point to get these individuals into the referral network and place them in a medical home within the local safety net; it provides an option (other than the emergency department) to address the needs of uninsured individuals with chronic diseases; it provides registered nurse case managers who can assist with teaching, medication adherence, and other patient needs; and it provides affordable pharmacy options. We surmise that the ease of accessing urgent care through the clinic closely aligns with the behaviors of individuals who may only seek care on an as-needed basis.

We found that the number of eligible patients increased as the number of patient encounters in the clinic increased, but we also believe it is extremely beneficial to have enrollment services provided through a patient navigator who is co-located at the clinic. Nevertheless, many patients fail to bring the paperwork required for the patient navigation visit, and some patients do not meet eligibility requirements.

Our data support that HealthNet Clinic patients have a higher percentage of chronic diseases and lifestyle determinants of chronic diseases, such as obesity and smoking, than county population estimates. Although we did not estimate the cost of care, our findings are similar to that of another study that concluded that uninsured adults in Buncombe County are likely to have somewhat more costly health problems compared to adults without disabilities who are currently enrolled in Medicaid [10].

**Conclusion**

This collaborative model is successful in directing patients to a medical home in the community safety net. Close collaboration with hospital systems and other community health care providers is paramount to help promote coordination of care, especially as resources for the safety net remain limited. It is worth noting that many of these patients would have been eligible for Medicaid coverage if North Carolina had expanded Medicaid under the Patient Protection and Affordable Care Act of 2010, as this would have eased categorical requirements for Medicaid eligibility.

The HealthNet Clinic model continues to evolve. The CFHN structure has changed to meet the evolving needs of the health care system under the Affordable Care Act and funder requests to further align services. In July 2013, the HealthNet Clinic merged with the Cape Fear Clinic and relocated to the Cape Fear Clinic Medical Building. The rationale behind the merger, which was fully supported by both agencies’ boards of directors, is that this would minimize...
expenses and streamline the clinics' administrative burden. Cape Fear Clinic now only accepts HealthNet Clinic patients as new primary care patients. CFHN now employs an Affordable Care Act patient navigator, 3 enrollment eligibility specialists (previously called patient navigators), an executive director, an administrative assistant, and a temporary worker. The registered nurse case managers are now employed by Community Care of the Lower Cape Fear.

Having this kind of clinic in place in the safety-net community can help increase access to care on an episodic basis. However, broader community prevention efforts are also needed to help modify social determinants that may negatively influence health among low-income, uninsured individuals. Our hope is that the findings from this study can inform community collaborative efforts and planning by other safety-net providers to help leverage limited resources and increase access to care among uninsured individuals in North Carolina.  

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References  
POLICY FORUM

Another Silent Epidemic

Introduction

Could yet another silent epidemic be going unnoticed in our midst? This epidemic has an annual death toll rival to influenza, but it has no vaccine, no immunization to protect the vulnerable. This epidemic is traumatic brain injury.

You could argue that the media is full of stories about concussions among athletes—amateurs and professionals alike. You could argue that the terrible price of concussive injuries sustained by soldiers in Iraq, Afghanistan, and elsewhere creeps into the headlines. We certainly read personal testimonials of injury and recovery in the pages of newspapers and magazines. Still, we miss the epidemic.

Like with influenza, it is young and old individuals who are most likely to sustain a traumatic brain injury. The most common mechanism of injury is simply a fall.

This issue of the NCMJ exposes the silent epidemic of traumatic brain injury. There are articles about sports and the military, among others. We deplore the circumstances of injury in war and decry the dangers of sport, and we are grateful that good work is being done to prevent such injuries. We are “packaging” our troops, teams, riders, and drivers in armor, padding, helmets, and air bags.

We do not yet “package” our children and senior citizens. Infant and child car seats in vehicles are seldom supplemented by childproof furniture in homes, but even the best-supervised child can wander and fall without warning. We are also often too late to remove the throw rugs and replace the sharp-cornered furnishings that make seniors’ homes so risky. In addition to nodding our heads to prevention and raising our voices in support of protection, we have expected and gotten improvements in rapid response and treatment of the injured. If we cannot prevent these injuries, we can at least mitigate the damage they cause.

Most forgotten, though, are the challenges faced by brain injured individuals and their loved ones. Traumatic brain injury presents protean obstacles to recovery and the resumption of activities of daily living. The epidemic of injury grabs the headlines, but the prevention and consequence of these injuries still demand attention. NCMJ

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This issue brief provides an overview of the “state of the state” for traumatic brain injury (TBI) issues and challenges in North Carolina. A previous issue of the North Carolina Medical Journal discussed this topic approximately 14 years ago, and this issue brief showcases changes and advances since that time. Collectively, articles in the current issue highlight the current epidemiology of TBI; the rapidly advancing and critical topic of concussions; special populations where TBI is seen more frequently, such as elderly individuals and veterans; advances in TBI-related treatments; and the all-important family perspective on TBI. Additionally, this issue brief discusses key developments and advances in the state related to a statewide needs assessment; legislative and policy actions, including a new sports concussion awareness act and a significantly revised definition of TBI as it relates to special education classification; and ongoing exploration of evidence-based community services that have the potential to improve our system of care for adults with TBI. Finally, ongoing challenges are detailed with the intention of pushing the state to become one of the nation’s leaders in TBI services.

Traumatic brain injury (TBI) affects 1.7 million individuals in the United States per year, with many concussions and other types of mild TBI likely going unreported. The rate of emergency department visits for TBI is highest in young children, followed by teenagers and then young adults [1, 2]. In North Carolina for the year 2012, there were an estimated 76,708 TBIs, with 1,871 fatalities. There were about 6,249 hospitalizations, and about 68,588 people were treated and released from emergency departments [3], with both statistics suggesting the concomitant need for TBI-related services in the community due to associated, and perhaps chronic, morbidity. TBI is thus a major public health concern, a potentially long-term and costly event for individuals and families, and a topic worthy of ongoing educational update.

Approximately 14 years ago, the North Carolina Medical Journal devoted an issue to TBI [4]. Articles were devoted to epidemiology, abusive head trauma, TBI training of school personnel, several treatment approaches for community reintegration and primary care, a hospital-based model of coordinated care, falls among elderly individuals, sports-related brain trauma, the economics of TBI in the state, and an overview of the state’s status with respect to TBI. As such, these articles represented the state of TBI services in North Carolina in 2001. Interestingly, while there have been significant advances in the broad area of TBI since 2001, including changes in North Carolina, many of these issues continue to be relevant in our current climate and are addressed via the articles in the current issue. To complement these articles, a number of additional advances and changes in the state since 2001 are worth mentioning.

Statewide Needs Assessment

As part of the 2001 issue of the NCMJ, there was mention of the need to conduct a statewide needs assessment. In 2007, the North Carolina Division of Mental Health, Developmental Disabilities, and Substance Abuse Services (MH/DD/SAS) orchestrated a preliminary needs assessment to begin to more fully understand the needs of the state’s TBI constituency. The results of this needs assessment were published in March 2008. For this preliminary needs assessment, existing TBI databases (eg, from the Division of Vocational Rehabilitation Services and the Department of Public Instruction) were examined, and surveys were developed and distributed to TBI survivors, family and friends, and providers. Across all sources, a multitude of needs were expressed, and some common themes emerged. These themes reflected the need for increased financial support, community-based services, housing, transportation, professional and agency-based knowledge of the available community services, and education of professionals working with individuals who have sustained a TBI. Findings also illustrated a need for better prevalence data, particularly for returning veterans, and a need to better understand the challenges faced by families following a TBI. While many of these challenges continue to be present in the state, there clearly have been improvements in these areas, as will be shown by the articles in the current issue.
Legislative Actions and Public Policies

Since 2001, there have been significant advances in the state related to public policy. While continued challenges remain (eg, sustainable funding for TBI services), a number of changes have propelled North Carolina into a position among the national leaders on a number of fronts. First, the North Carolina General Assembly passed the Gfeller-Waller Concussion Awareness Act in June of 2011. This act, similar in scope to many of the other concussion laws passed in other states, includes concussion management guidelines for student-athletes in North Carolina public middle schools and high schools, return-to-play guidelines, and concussion education for coaches and other school personnel. Described in detail in the sidebar by Bloom [5], this law represents a significant advance not only in concussion management of student-athletes but also in the implementation of education and prevention strategies.

Second, a major change occurred in the TBI definition used by the North Carolina Department of Public Instruction, Exceptional Children Division, as reflected in the policies governing services for children with disabilities [6]. This revised definition emanated from a collaboration between the Department of Public Instruction and the Children and Youth Committee of the North Carolina Brain Injury Advisory Council, with a comprehensive review of state definitions across all 50 states. While maintaining the basic tenets of the federal definition of TBI, there are key components of the revised North Carolina definition that differ from the federal definition. The current state definition, enacted in October 2013, reflects the idea of acquired brain injury, and it is one of the few definitions in the country that includes birth-related brain injuries in this special education classification:

Traumatic brain injury means an acquired injury to the brain caused by an external physical force or by an internal occurrence resulting in total or partial functional disability and/or psychosocial impairment that adversely affects a child’s educational performance. Causes may include but are not limited to, open or closed head injuries, cerebrovascular accidents (eg, stroke, aneurysm), infections, kidney or heart failure, electric shock, anoxia, tumors, metabolic disorders, toxic substances, or medical or surgical treatments. The brain injury can occur in a single event or can result from a series of events (eg, multiple concussions). Traumatic brain injury also can occur with or without a loss of consciousness at the time of injury. Traumatic brain injury may result in impairments in one or more areas such as cognition; language; memory; attention; reasoning; abstract thinking; judgment; problem-solving; sensory, perceptual, and motor abilities; psychosocial behavior; physical functions; information processing; and speech. Traumatic brain injury does not apply to brain injuries that are congenital or degenerative, but can include brain injuries induced by birth trauma.

The revised definition increases the range of neurological conditions that can fall under the TBI classification. It resulted in increased consistency of definition across state agencies, and it likely requires providers to have more background knowledge in neurological conditions and associated factors.

Third, there have been longstanding efforts to develop a state trust fund and/or a Medicaid waiver to support intensive services for TBI survivors and their families. Persons suffering from a severe TBI require an array of short- and long-term treatments, rehabilitation, and home and community supports. Many states have developed specific programs and infrastructure to address the needs of these individuals and their families. To date, about 40 states provide intensive TBI services that are funded by Medicaid waivers, trust funds, or a combination of these 2 sources. North Carolina does not have either funding mechanism, and this has created many hardships for TBI survivors and families across the state.

The North Carolina Brain Injury Advisory Council presented a report to the legislature during the 2014 North Carolina legislative session that examined the benefits of establishing a Medicaid waiver for constituents who have sustained a TBI. Legislation in response to this report directed the Joint Legislative Oversight Committee on Health and Human Services to establish a subcommittee on TBI to study the problem and make recommendations.

The following recommendations were approved in December 2014 with the intent that they will be considered in the 2015 legislative session. First, a Medicaid home- and community-based waiver is the preferred approach to provide state-funded services to individuals with TBI. Second, the Department of Health and Human Services (DHHS) needs to provide more support for the efforts of local management entities/managed care organizations (LME/MCOs) as they attempt to identify veterans who are eligible for federally funded TBI services and to coordinate with the US Department of Veterans Affairs. Third, there is a need for valid and reliable data on the incidence rate of TBI in North Carolina and on the need for subsequent acute, rehabilitative, or long-term services. Fourth, DHHS should ensure that LME/MCOs screen, identify, and collect data on individuals in need of TBI treatment and services.

Finally, from a policy perspective, the state 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, as described in the article by Farmer [7]. This structured environment helps integrate the individual back into the community and, ultimately, fosters a support network crucial for positive behavioral health. This model of care also provides respite for caregivers.

Additionally, the state was awarded a Health Resources and Services Administration (HRSA) Traumatic Brain Injury State Implementation Partnership Grant to focus on information and referral, training, screening, and resource facilitation. The TBI program will contract with the Brain Injury...
Association of North Carolina to provide an initial access point for TBI survivors and their caregivers. This concept is further enhanced by the use of a resource facilitator to help clients and caregivers navigate the system. The state will work with the LME/MCOs to increase screening to identify individuals with TBIs and connect them to appropriate behavioral health treatment. All of these aspects foster the development of a medical home for those with TBI.

**Prevention Activities**

In the 2001 issue of the NCMJ, an article by Hooper and Callahan [4] described a number of prevention-related activities in the state (eg, The Injury Prevention Research Center TBI Prevention Handbook). Since that time, prevention activities have gained increased attention at the national level [8, 9] as well as in North Carolina. Over the past 14 years, there has been an increasing number of TBI prevention strategies employed by the state, with many of these activities being coordinated by the MH/DD/SAS TBI Program, the Brain Injury Association of North Carolina, the North Carolina Brain Injury Advisory Council, and the Matthew Gfeller Sport-Related Traumatic Brain Injury Research Center at the University of North Carolina at Chapel Hill. With the increase of evidence-based guidelines for managing all forms of TBI, including concussions (eg, the Centers for Disease Control and Prevention’s Heads Up Program), the state has become much more active with respect to the dissemination of TBI-related materials. A major change that puts the state in a leading position nationally is the state’s hiring of a full-time TBI manager to develop, coordinate, and administer statewide prevention and intervention initiatives across the lifespan.

**The Current Issue**

In addition to the updates and advances mentioned above, the current issue of the NCMJ comprises an array of articles dedicated to key issues and advances in TBI, with a major focus being placed on issues relevant to the state of North Carolina. Each of these articles provides insight into a significant advancement with respect to TBI across the lifespan: epidemiology, concussions, special populations, treatments, and family perspectives.

Any issue devoted to TBI would be remiss without an up-to-date appraisal of the epidemiology of this condition. Although these types of data surface across many of the articles in this issue, the Running the Numbers column by Austin and colleagues showcases the most recent numbers with respect to TBI in North Carolina [10].

As noted above, one of the major advances in the field of TBI over the past decade has been the increased public awareness and associated scientific inquiries related to mild brain injuries or concussions. This issue contains several articles that address facets of this condition. Conder and Conder provide a comprehensive overview of concussion in the sports setting, and they describe how various factors contribute to the manifestation of this form of mild brain injury [11]. Additionally, 3 associated sidebars describe selected issues pertinent to concussion in sports. The sidebar by Bloom provides an overview of North Carolina’s sports concussion law, the Gfeller-Waller Concussion Awareness Act, which is an important piece of legislation that has changed how concussions are recognized and managed for student-athletes at the middle school and high school levels, particularly with respect to return-to-play practices [5]. Two additional sidebars address key aspects of managing concussions. The sidebar by Newlin and Hooper provides a complement to the Gfeller-Waller Act’s return-to-play procedures by describing the return-to-learn protocol for use with all students who have sustained a concussion across the K-12 grade span [12]. A second article, by Gusiewicz, provides empirical findings with respect to concussion prevention [13].

Another area of interest that has emerged over the past decade has been a focus on special populations. The article by Filer and Harris in the current issue is devoted to the occurrence of falls among elderly individuals and how such events are a leading cause of TBIs within this population [14]. Similarly, with the involvement of our country in multiple wars over the past decade, there has been much attention devoted to our returning veterans, many of whom have sustained concussions and other types of brain injuries. The commentary by Hooker and Moore is focused on this special population and showcases the multiple complex needs of injured veterans when they return from the battlefield [15].

The topic of treatment is a major aspect of this issue, and 3 commentaries are devoted to this area of interest. The commentary by Niemeier and colleagues provides an overview of evidence-based treatments and practices [16], while the commentary by Nelson and coauthors describes advances in prehospital care for individuals who have sustained a TBI, with an inside look at practices in North Carolina [17]. A third commentary, by Santopietro and colleagues, addresses behavioral health, which is an often-overlooked aspect of treatment for individuals following a TBI. This third article addresses the current status of such treatment in the state and suggests that policy provisions could facilitate access to behavioral health care for individuals who have sustained a TBI [18]. In regards to treatment, there have also been some advances made with respect to evidence-based community practices, and the Spotlight on the Safety Net column describes one such effort: the clubhouse model [7].

This issue contains one final sidebar that confronts a major issue that crosses over different populations, different ages, and all treatment approaches: families. The family perspective and the active involvement of family members from the moment of injury through the recovery process should never be overlooked. This sidebar by Herbert provides a powerful description of the family perspective, illustrating the challenges and frustrations of navigating a complex and
Similarly, concussions have witnessed an explosion of inter-
to align with an acquired brain injury conceptualization.

On a positive note, there have been efforts to survey the
needs of North Carolina constituents with respect to TBI
services in the state, and screening and prevention efforts
appear to be more coordinated than they were in 2001. One
of the largest accomplishments has come through the North
Carolina Department of Public Instruction, Exceptional
Children Division, with the changing of their definition
appear to be more coordinated than they were in 2001. One
of the largest accomplishments has come through the North
Carolina Department of Public Instruction, Exceptional
Children Division, with the changing of their definition
align with an acquired brain injury conceptualization.
Similarly, concussions have witnessed an explosion of inter-
est at the national level, in large part due to attention arising
from the recognition of concussions in professional athletes
and veterans. This attention has led to all 50 states develop-
ning and passing sports concussion laws. As evidenced
by the commentaries and sidebars in this issue, there have
been significant advances not only in how to manage con-
cussions, but also in our understanding of how to prevent
them from occurring. Finally, while the state has not deve-
oped a TBI surveillance system, our counting of various TBIs
has advanced; thus, our understanding of the epidemiology
of TBI in the state has improved significantly over the past
14 years. These are the types of data that will continue to
advance targeted initiatives in the state.

On the state’s list of things to do, North Carolina remains
challenged with many of the same issues that were present
14 years ago. For example, despite the preliminary needs
assessment conducted in 2007, it took another 7 years for
the state to complete a more thorough needs assessment,
and these results have not yet been analyzed with respect
to setting contemporary goals and objectives for TBI endeav-
or in the state. Further, North Carolina continues to remain
fragmented with respect to how individuals with TBI are
served across the lifespan, and associated community-

At present, North Carolina remains 1 of only 10 states that
have not enacted some form of financial assistance for this
population. As a final item on the state’s “to do” list, initial
efforts to address screening have begun, but how screening
strategies will be implemented across our various state sys-
tems remains unknown. These TBI-related issues, amidst a
number of others, remain ongoing challenges for the state
to tackle in the next decade.

Conclusions: State of the State
The articles contained within this issue provide keen
insights into not only the advances that have occurred in
the state of North Carolina over the past 14 years but also
the many ongoing challenges faced by TBI survivors, their
families, the communities in which they reside, and their
provider networks.

On the state’s list of things to do, North Carolina remains
challenged with many of the same issues that were present
14 years ago. For example, despite the preliminary needs
assessment conducted in 2007, it took another 7 years for
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to setting contemporary goals and objectives for TBI endeav-
or in the state. Further, North Carolina continues to remain
fragmented with respect to how individuals with TBI are
served across the lifespan, and associated community-

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Concussions are an inherent part of collision sports such as football and soccer. As a subset of traumatic brain injury, concussions are neurometabolic events that cause transient neurologic dysfunction. Following a concussion, some athletes require longer neurologic recovery than others. Education and intervention aimed at prevention and management can minimize the long-term sequelae of sports-related concussions.

The Centers for Disease Control and Prevention (CDC) estimates that 45 million children and adolescents aged 5–19 years participate in organized or recreational sports [1]. While sports promote positive physical, intellectual, and social development [2], sports participation also poses risk of injury, including orthopedic injury and traumatic brain injury (TBI). An estimated 5–10% of children and adolescents sustain a sports-related concussion with an associated emergency department presentation, and a large but less quantifiable number are injured but do not present to the emergency department [3]. Out of 50,000 deaths per year nationwide from TBI of any etiology, an estimated 900 deaths per year result from sports and recreational activities [4]. In 2013, there were 8 sports-related concussion fatalities from football nationally, all at the high school level [5]. Such statistics raise acute concern about the health and safety of elementary school, high school, and collegiate athletes who receive a sports-related concussion, as such injuries can impair academic and cognitive development [6].

Definition of Sport-Related Concussion

Sports-related concussions have been classified as a subtype of mild TBI. Concussions occur from an external force or blow to the head or body that causes an alteration in neurologic functioning, with impairment in concentration, working memory, and executive functioning [7, 8]. Additional problems that can occur include headaches, insomnia, emotional lability, dizziness, and fatigue (See Table 1).

The prototypical recovery pattern following a single, uncomplicated sports-related concussion is full or near complete symptom resolution in the first 1–2 weeks following injury, although some symptoms may persist for several weeks. Animal research on concussions by Giza and Hovda [9] posits that there is a neurometabolic cascade, with a mismatch in glucose metabolism and regional cerebral blood flow, which creates an energy crisis at the cellular level. In the majority of these animal studies, the neurometabolic crisis restores to homeostasis in about 7 days, without irreversible damage at the cellular level [9]. However, emerging data from experimental studies of concussed athletes suggest that the animal neurometabolic model may be insufficient to model sports-related concussion neuropathology in humans. Traditional neuroimaging techniques such as computed tomography (CT) or magnetic resonance imaging (MRI) fail to reveal signs of a typical, uncomplicated sports-related concussion, but newer neuroimaging measures used in research (diffusion tensor imaging, functional MRI, magnetic resonance spectroscopy, quantitative electroencephalography, and event-related potentials) show abnormal brain activity and anomalies for weeks or months following a sports-related concussion [10-12]. The 2014 report on sport-related concussions in youth from the Institute of Medicine of the National Academies [13] concluded that, while the clinical significance of these abnormalities was unclear, these newer techniques provide compelling tools that can be used to image cerebral disruption that may be responsible for prolonged post-concussive symptoms in certain athletes, or they may suggest a longer period of post-injury physiological vulnerability than is currently appreciated.

Risk Factors for Prolonged Recovery

One of the strongest predictors of prolonged recovery is a history of previous concussions, especially 3 or more. Other identified risk factors for a complicated, prolonged recov-

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**TABLE 1.** Signs and Symptoms of Concussion

<table>
<thead>
<tr>
<th>Category</th>
<th>Signs and Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>Headache, balance problems, dizziness, visual problems, fatigue, sensitivity to light and noise.</td>
</tr>
<tr>
<td>Cognitive</td>
<td>Difficulty concentrating, difficulty remembering, feeling mentally “foggy,” feeling slowed down, answers questions slowly.</td>
</tr>
<tr>
<td>Emotional</td>
<td>Irritability, sadness, more emotional, nervousness, lability.</td>
</tr>
<tr>
<td>Sleep</td>
<td>Drowsiness, sleeping more than usual, sleeping less than usual, difficulty falling asleep, difficulty staying asleep.</td>
</tr>
</tbody>
</table>

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Address correspondence to Dr. Robert L. Conder, Carolina Neuropsychological Service, 1540 Sunday Dr, Ste 200, Raleigh, NC 27607 (bconder10@gmail.com).
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Factors Associated With Increased Concussion Risk

Age and Sport

Age accounts for a significant variance in the incidence of concussions, as does the particular sport or athletic activity being performed. Boys and girls aged 10–14 years have the highest rates of emergency department visits associated with sports-related TBI [4]. Among the 10–14 year age group, the sport and recreational activities producing the most concussions include bicycling, football, and playground activities. For the 15–19 year age group, participation in formal school sports shifts the etiology of concussions from recreational activities to organized sports. Football and soccer have the highest concussion rates, and collision/contact sports such as hockey, lacrosse, and basketball generally have higher concussion rates than non-contact sports such as track and volleyball. For the 4–9 year age group, playground and bicycling accidents are the leading activities associated with concussion risk. Evolving research suggests that the length of recovery varies based on age. In organized sports, 90% of collegiate athletes return to baseline cognitive functioning within 2 weeks. High school athletes take longer to recover, with only 50% recovering in 7–10 days, and 90% returning to baseline within 4 weeks. For the youngest athletes, many sports or recreational activities are informal and are not...
cussion. The act also mandates that the athlete is restrict-
ed from returning to play until evaluation and clearance by
an appropriate medical provider. A fundamental and wide-
ly accepted tenet in the management of sports-related concussions is that an athlete not be returned to “harm’s way” (ie, participation in sports or activities with risk of head trauma) until the concussion has been deemed en-
tirely resolved by an appropriate medical provider. In or-
der to confidently make this assertion, an athlete must be
asymptomatic at rest and under conditions of physical and
cognitive stress. The North Carolina High School Athletic
Association has worked with the Matthew Gfeller Center
to create a return-to-play form that facilitates appropriate
progression and safe return to play [4].

The Gfeller-Waller Act also mandates that each school have a written EAP. An EAP is a venue-specific plan that
provides simple and clear instructions for the manage-
ment of any onsite medical emergency. The Gfeller-Waller
Act calls for an EAP to be posted conspicuously; distrib-
uted to all appropriate school personnel; and reviewed or
rehearsed by all licensed athletic trainers, first responders,
coaches, school nurses, personnel, and volunteers for ex-
tracurricular activities. Sample EAPs can be found online
[5].

It is important to note that the Gfeller-Waller Act ap-
plies only to public high schools and middle schools. How-
ever, it has also been adopted officially and unofficially by
several youth sports programs, as well as by independent
school associations, as their de facto concussion manage-
ment framework. As of 2014, all 50 states and the District
of Columbia had enacted similar legislation [6].

Evaluation, management, and general understanding of sports-related concussions is a dynamic and rapidly
expanding area of medical research and remains of keen
interest to the general public. With the rapid evolution of
our understanding of this subset of brain injury, it is rea-
sonable to expect that further provisions (legislative or
otherwise) will be forthcoming in the future, thus adding
to the foundation laid by the Gfeller-Waller Act. NCMJ

organized for reporting injuries, so both incidence and recovery data for this group are based upon estimates.
However, there is growing consensus that younger children with sports-related concussions may experience greater
deficits and may need a longer time to recover [14]. Thus
there appears to be an inverse relationship between age/
level of sport participation and symptom resolution time;
specifically, professional athletes recover the quickest,
followed by collegiate athletes, high school athletes, pre-
adolescents, and children. The consensus among multiple
studies is that conservative management of concussions is
recommended for athletes of high school age or younger
[7, 8]. Conservative management for younger athletes
would include longer removal from play, an extended period
of asymptomatic rest and restricted physical exertion, and
reduced cognitive and academic demands, with careful
monitoring by parents, teachers, and coaches.

Sex

Football is the greatest concussion generator for males, and
soccer is the greatest concussion generator for females.
Notably, females are at higher risk for sustaining concus-
sions across all ages and sports. For sports with the same
rules for each sex, females have almost twice the incidence
of sports-related concussions [15]. Hypothesized reasons for
this higher risk include physiologic differences such as
reduced skull thickness, smaller neck muscles, and hor-
monal influences. Additionally, some studies suggest that

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females may be more willing to report symptoms than males [15]. However, the most prevalent concussion symptoms are similar across both sexes. Approximately 97% of females and 95% of males report headaches post-concussion. Dizziness and vestibular dysfunction are endorsed by about 77% of both sexes. Concentration difficulties are reported by 51% of males and by 47% of females. Regarding more prolonged sports-related concussion symptoms, headaches and concentration difficulties are more persistent in female athletes [16].

**Consequences of Sports-Related Concussions**

Consequences of sports-related concussions can be divided into short-term or long-term consequences, or they can be categorized by whether their effects compromise neurocognitive, emotional, physical, or academic functioning. The aforementioned data highlight factors associated with prolonged recovery following a sports-related concussion, which is often referred to as post-concussive syndrome (PCS). Various diagnostic systems quantify the length of symptom duration and the degree of resulting impairment required to meet diagnostic criteria for PCS.

Long-term post-concussive sequelae are termed refractory PCS, and are seen in 10-20% of concussed athletes between the years of kindergarten through 12th grade. These student-athletes require more comprehensive evaluation by a multidisciplinary team of physicians, neuropsychologists, and vestibular therapists with training and experience in the assessment and treatment of concussions. Neuropsychological assessment and biopsychosocial evaluation can help to make the differential diagnosis, identify factors that are prolonging symptoms, and target appropriate interventions to maximize recovery. Premorbid and comorbid neurologic risk factors can increase the potential for refractory symptoms following a sports-related concussion [17].

Typical physical consequences of a sports-related concussion include headache, dizziness, fatigue, and sleep disturbance. When prolonged, these symptoms can have a secondary impact on attention, memory, and learning efficiency, and there can be tertiary effects on academic progress or job performance. Neurocognitive sports-related concussion symptoms can directly impact learning. Behavioral and emotional dysregulation are also common post-concussion consequences, with emotional flooding and reduced impulse control or frustration tolerance. When these are not recognized as post-concussion symptoms, they can engender negative responses from parents, teachers, or peers. Finally, restrictions on return to play (RTP) can have a negative impact on an athlete’s sense of identity, peer group inclusion, and perceived control. Positively, most athletes exhibit resiliency and return to baseline.

**Minimizing the Risks of Sports-Related Concussions and Subsequent Injury**

While prevention of sports-related concussions is the ultimate objective, this goal is currently unattainable. Concussions are a naturally occurring event in collision sports such as football and hockey. Therefore, current prevention efforts are aimed at minimizing the incidence and severity of sports-related concussions.

**Education**

In any prevention effort, education is primary. Education about concussions should be directed toward all persons involved in sports, since early detection and proper management improve outcomes. North Carolina’s Gfeller-Waller Concussion Awareness Act mandates education about sports-related concussions for players, parents, coaches, and others involved in middle and high school sports in our state, and it specifies steps that must be taken before an athlete with a suspected concussion can return to practice or play. [Editor’s note: The Gfeller-Waller Act is discussed further in the sidebar by Bloom on pages 90-91.] Positively, the Gfeller-Waller Act has been voluntarily adopted by many of the private school sports associations in North Carolina. Free educational materials on sports-related concussions can be accessed from the Matthew Gfeller Sport-Related Traumatic Brain Injury Research Center at the University of North Carolina at Chapel Hill (http://tbicenter.unc.edu) and from the CDC (http://www.cdc.gov/concussion/HeadsUp/ youth.html).

**Safe Play Guidelines**

Prevention of sports-related concussions has benefitted from recent efforts to promulgate safe play guidelines. Many of these efforts use materials that have been widely distributed through the Heads Up: Concussion in Youth Sports tool kit developed by the CDC. Organizations including USA Football and Pop Warner have also established rules.
Sport-Related Concussions: Paranoia or Legitimate Concern?

Kevin Guskiewicz

Sport is very popular in today’s society, and millions of athletes participate in a variety of youth, high school, collegiate, professional, and recreational sports. For younger participants, the sport experience provides an environment that can help them grow and develop physically, mentally, emotionally, and socially. With public health concerns such as increasing incidences of obesity, cardiovascular disease, and diabetes, it is important to encourage youth to find physical activities that are enjoyable and that can be retained lifelong for the maintenance of a healthy lifestyle. However, recent media reports about the dangers of concussions in sport have led many parents to withdraw their children from contact sports such as football, hockey, lacrosse, and soccer. The concern for safety is understandable, yet the pendulum has perhaps swung too far in the direction of paranoia [1].

Caution is certainly warranted, given published studies suggesting that there is an increased risk of subsequent concussion after an athlete has sustained prior concussions [2], as well as increased risks of mild cognitive impairment [3] and depression [4] among retired professional football players who sustained 3 or more concussions. Other reports suggest that playing contact sports increases the risk of neurodegenerative diseases such as chronic traumatic encephalopathy (CTE) [5], but education and counseling about these conditions are paramount, as there is still much controversy about risk factors—especially for CTE. Currently there is no methodology for identifying individuals who are at high risk of developing CTE, in part because the case-only descriptions of CTE symptomatology are confounded by the retrospective nature of the data collection and by selection factors.

Given that no prospective studies have connected repetitive head trauma to CTE, more work is needed to understand if a cause-and-effect relationship exists.

Although media reports would suggest that there has been an increase in concussions occurring on playing fields across the United States in recent years, this is not the case. While incidence rates for reported concussions may be slightly higher over the past 5 years, this can be attributed to increased awareness, more concussions being identified and diagnosed in emergency departments, and better data collection methods [6]. Concussion legislation began sweeping the nation in 2009, leading to 50 states now requiring concussion education that emphasizes the importance of reporting symptoms, prevents same-day return to play following a suspected concussion, and mandates clearance by a trained clinician. The emphasis placed on the proper management of concussions has resulted in the hiring of more certified athletic trainers at the secondary school level and more consistent use of validated concussion assessment tools for the detection and management of concussions.

Given that there are currently no proven interventions to prevent concussions, a renewed focus on concussion prevention is warranted. Despite attempts by manufacturers to create a concussion-proof helmet, the dynamic properties of the involved neurological tissues and the biomechanics of head impacts make this impossible. While helmets may reduce the forces applied to the brain and skull to prevent catastrophic head injuries such as skull fractures, brain contusions, and brain hemorrhages, they do not reduce the forces necessary to prevent concussions. Therefore, it is important for all coaches, parents, and techniques to minimize injury risk, and USA Football recently adopted new rules for practice and play for high school. Adherence to these rules and techniques of fair/safe play by coaches and players is essential to reduce the incidence of sports-related concussions.

Equipment

Given the recent emphasis on the risk of concussion in sports, equipment and devices advertised to prevent or minimize sports-related concussions are increasingly being marketed. However, scientific study of these products and equipment may not validate their efficacy. Currently, there are no football helmets or other equipment proven to prevent concussions. Rather, high-tech helmets are designed to prevent catastrophic brain injuries such as skull fractures. Nonetheless, newer helmets may help reduce the impact to the player’s brain. Also, there is no conclusive evidence to date that mouth guards or equipment modifications prevent concussions. In fact, aftermarket modifications may make the equipment less safe and can invalidate certification from the National Operating Committee on Standards for Athletic Equipment.

Strength and Conditioning

Good aerobic conditioning before a concussion may minimize recovery time. Additionally, good muscular strength, especially of the neck muscles, has been postulated to reduce concussions, especially when the player is aware that a hit may occur (eg, not a blindsided hit). Finally, subthreshold aerobic exercise is an intervention for PCS.

Removal, Rest, and Graduated Re-entry

It is essential that a player suspected of having a sports-related concussion be removed from the game and evaluated.
ents, and athletes to understand that there is currently no athletic equipment that fully prevents concussive injuries.

Turning the attention toward prevention, we might consider that recent technological advances have allowed for accelerometers to be placed in sports helmets in order to directly assess the force and magnitude of head collisions in real time. A review of the clinical usefulness of helmet accelerometers by Guskiewicz and Mihalik [7] reported that concussions may occur at lower magnitudes than was originally thought, and athletes with a high number of head impacts over the course of a season may never have a diagnosed concussion. While helmet accelerometer data are not yet useful for diagnosis of concussions, the data may have utility as a behavior modification tool (ie, illustrating to athletes and coaches the location and characteristics of head impacts during tackling, blocking, and other contact encounters), which could promote techniques that reduce the frequency and magnitude of head impacts. New types of technology, including helmet accelerometers, hold great promise for improving the safety of athletes of all ages.

Coaches are a crucial part of the concussion prevention initiative, as they can teach and enforce proper technique. This is especially important in collision sports, where tackling and body checking are taught from an early age. Skill development is optimized through an interaction of the player, the environment, and the specific skill or technique being taught [8]. Heads Up Football, sponsored by USA Football, is an online program aimed at educating coaches about proper tackling fundamentals and reducing the amount of head contact [9]. These interventions, including behavior modification using accelerometer technologies, have shown great promise but must be carefully studied to better understand their utility.

In the meantime, there is little debate that educating players, parents, and coaches about concussions—and emphasizing the importance of minimizing head contact during sport participation—will improve player safety and reduce the risk of concussions. NCMJ

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When athletes are asymptomatic at both rest and exertion, they may begin a graded exercise challenge following the Graduated RTP Protocol. As they return to learn (RTL), many student-athletes will also require temporary modifications and accommodations that allow for graduated cognitive exertion. Currently, the North Carolina Department of Public Instruction does not have formal post-concussion return-to-school guidelines, but such a policy is being drafted. The need for RTL supports following a sports-related concussion has been endorsed by the American Academy of Pediatrics [18] and the American Medical Society for Sports Medicine [19]. While RTL plans will need to be individually tailored, policy guidelines offer a template for how students can return to school before they have completely recovered from a sports-related concussion. Educational plans appropriate for students with short-term consequences of a sports-
related concussion or persistent PCS can prevent academic decline and the stress this places on student-athletes and their families.

Conclusion

Given the scope of the problem and the potential for adverse consequences following sports-related concussions, there is clear need for systematized statewide efforts aimed at concussion education, management, and prevention. Factors associated with the risk of sports-related concussions include age, sport, sex, and prior concussion. Premorbid neurologic risk factors, comorbid disorders, and younger age have been identified as factors contributing to prolonged recovery. Prevention strategies include education, equipment, strength and conditioning, and safe play guidelines. Early identification, early intervention, implementation of physical and cognitive rest, and graduated RTP and RTL protocols are critical in maximizing recovery following a sports-related concussion.


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References

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,
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 [21].

**Attention, Memory, and Problem Solving**

**Attention.** 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
educates individuals with TBI, their families, and caregivers, BIANC works with clients and caregivers to provide training across the state. Through the support of its regional information and referral services, as well as TBI-specific Brain Injury Association of North Carolina (BIANC) for the division contracts and closely collaborates with the of the Department of Health and Human Services (DHHS). Disabilities, and Substance Abuse Services (MH/DD/SAS) of the state TBI program is this population—from acute medical services to rehabilita-
tion 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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References


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 [1]. 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 [2].

DVBIC defines a TBI as “a blow or jolt to the head that disrupts the normal function of the brain” [3]. 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” [4].

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 [5]. 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” [6].

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 [7]. 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” [4].

Treat 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 [8]. 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 [6]. 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 [9]. A list of these drugs and their potential side effects can be found in testimony to a Joint Committee of Congress [10].

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 [11].

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” [12].

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” [13]. 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 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 [12], leaving this question unanswered for the DoD and the VA. However, recent scientific studies published in the Journal of Neurotrauma [14] and by the Sackler School of Medicine of Tel Aviv University [15] report that TBI subjects with post-

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

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>Patient • Impaired function as family member, employee, employer, and citizen.</td>
</tr>
<tr>
<td></td>
<td>• Loss of caregiver, divorce, unemployment, homelessness.</td>
</tr>
<tr>
<td></td>
<td>• Hopelessness, despair, suicide.</td>
</tr>
<tr>
<td>Cognitive</td>
<td>Federal and state government • Lifetime and Social Security compensation benefits; each individual’s benefits are estimated at $3.2 million.*</td>
</tr>
<tr>
<td></td>
<td>• Necessary local community services to support patient status.</td>
</tr>
<tr>
<td>Emotional</td>
<td></td>
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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.

### TABLE 2.
Community Reintegration Challenges for Veterans With Traumatic Brain Injury (TBI) or Post-Traumatic Stress Disorder (PTSD)

- Lack of or incomplete medical records transition from active duty to retired/discharged.
- TBI diagnosis complexity.
- TBI/PTSD treated as mental illness not physical brain injury.
- TBI/PTSD treatment protocols provide only partial resolution of functional impairments.
- Many drug protocols for mild TBI/PTSD have additional side effects.
- Many counseling protocols for mild TBI/PTSD are designed to teach patients how to live with symptoms.
- Large numbers of TBI/PTSD wounded receive “Chapter Out,” resulting in lost VA benefits.
- Some TBI/PTSD wounded are incarcerated, resulting in lost VA benefits.

Note. SSA, Social Security Administration; VA, Veterans Affairs.

“Chapter Out” refers to Chapter 11 of military regulations, which allows a commander to discharge a service member under less than honorable conditions for certain types of behavior. This type of discharge typically results in the loss of all VA disability and medical benefits, as well as the loss of unemployment compensation.
conclusion 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.

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 [16]. 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. NCMJ

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References


| TABLE 3.  |
|-----------------|------------|-----------------|-----------------|------------|---------|--------------|
| **Resources for North Carolina Veterans With Traumatic Brain Injury or Post-Traumatic Stress Disorder** |
| **Veterans Administration** | **DVBIC** | **North Carolina Veteran Affairs** | **North Carolina LME/MCO** | **Military bases** | **BIANC** | **Social Security Administration** |
| Diagnosis and treatment | X | | | | | |
| Provider referral service | | X | | | X |
| Veteran/family information | X | X | | | X |
| Veteran/family support groups | | | | | |
| Provider training and education | | | X | X | | |
| Financial benefits | | | | | X |

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.

5.3 million people living with brain injury want what everyone wants: a good job, a nice home, someone to love, and fun in their lives.

Learn more. #NotAloneinBrainInjury
The scientific traumatic brain injury (TBI) literature chronicles 50 years of epidemiologic data, neurobehavioral and cognitive symptoms, diagnostic tools for measuring outcomes, and treatments for persons with TBI. In this article, we review the state of our knowledge about TBI causes and symptom complexities, evidence-based treatments, and ongoing treatment needs.

Each year, 235,000 Americans are hospitalized for non-fatal traumatic brain injuries (TBIs), 1.1 million people are treated in emergency departments, and 50,000 people die [1]. TBI survivors share a list of common goals: attaining preinjury levels of productivity, enjoying a social and support network, and experiencing improved quality of life [2]. Their journey has received much attention in the scientific TBI literature over the past 50 years. The first 30 of those years were largely devoted to studying the epidemiology of TBI; the complexity of neurobehavioral and cognitive symptoms and their impact on family and community; and the variability in pace, degree, and rate of recovery [3-7]. In addition, tools for accurately diagnosing TBI, for measuring variables that contribute to the heterogeneity of the population, and for assessing treatment outcomes were (and still are) a prominent focus of research [8, 9].

This foundational work was essential for understanding the heterogeneity and complexity of TBI. Since the late 1980s, however, trials of treatment interventions have increasingly been a focus of investigation [10-12]. Federal agencies such as the National Institute on Disability and Rehabilitation Research [13] and the National Institutes of Health [14], through the Eunice Kennedy Shriver National Institute of Child Health and Human Development, began to support investigations into efficacious treatments for persons with TBI. Private businesses, the National Football League [15], and the US government are also continuing to support TBI research priorities and external funding initiatives through programs such as the Brain Initiative [16].

There is still a significant need to conduct research focused on improving the effectiveness of treatments for persons with TBI. However, evidence from the last 15 years has helped clinicians have some confidence in their ability to meet the challenges involved in working with persons with TBI [10-12, 17, 18]. In the area of prevention, research amassed since 1998 has led to a greater understanding of the diverse aspects of TBI [12]. We have identified children and older adults as at-risk groups for falls resulting in head trauma [12]. Due to increased vehicular crash-related TBIs, we have implemented preventive measures regarding drunk driving, seat belt use, and helmet use [12]. To date, multiple social-behavioral, targeted therapeutic rehabilitation, and medication intervention trials have been conducted with both civilian and military TBI populations [10-12, 17-21].

Major systematic and selective reviews of trials now exist [10-12, 17-21]. Reviewers present trials classified according to the quality of evidence as recommended by the American Academy of Neurology [22]; they also provide recommendations for clinical application or use of methodologies based on these levels of evidence [10, 11]. In a general sense, the literature tells us that early and comprehensive inpatient rehabilitation improves both function at discharge from acute care and subsequent community integration [23]. We know that caregiver support and skills training of caregivers have a direct and positive effect on the person with TBI [24]. The literature also shows that injury-related information, work or other productive activity, and a social network result in the best perceived quality of life after TBI [2].

The following is a selective list of some of the most promising evidence-based treatments for TBI, by specific post-TBI symptom domain.

**Depression and Anxiety Following TBI**

Perhaps as a result of the deficits in problem solving and coping resources that are common after TBI, up to 53.1% of people with TBI develop clinical depression [25]. There are also accompanying post-TBI problems with anxiety, sleep disturbance, agitation, anger outbursts, and impulsivity [25, 26]. Potential helpers or caregivers, whose support is critical for people with TBI, are stressed and sometimes pull away in the face of these injury-related challenges [6]. Specific medications (such as sertraline [27]), physical...
exercise [28], and cognitive behavioral therapy [29-31] are high on the list of evidence-based practices for improving mood and coping after TBI. In addition, there is evidence that online and telephone delivery of counseling and psychotherapy are effective [32, 33]. Cognitive behavioral therapy, which includes a range of methods geared toward changing disruptive and maladaptive thinking habits, is consistently shown to help reduce anxiety, improve restorative sleep, and improve self-management and behavioral self-regulation [11, 12, 29-31]. Gold standard methods used by the military to treat co-occurring TBI and post-traumatic stress disorder are prolonged exposure and cognitive reprocessing [19, 21]. Prolonged exposure provides therapist-supported, repeated situational and imagined exposure to aspects of the trauma incident [34]. Cognitive processing therapy is a manualized cognitive behavioral therapy that includes education about emotional and thought responses to trauma, cognitive restructuring, and writing of trauma narratives [35]. These 2 methods are currently being tested in a large, multisite comparative effectiveness trial [21].

Cognitive Deficits

Multiple evidence-based cognitive rehabilitation intervention protocols are now available to clinicians for improving the declines in memory, attention, and executive function that are typical after TBI [10-12]. Examples of cognitive rehabilitation methods for improving memory include training and supported practice of a range of compensatory strategies that can be helpful when used together to address specific problems [11]. Both low-tech (paper) and high-tech methods (computers, cell phones) have been shown to be effective for improving memory [36]. Pagers, personal data assistants, computers, smart phones, and accompanying applications are all highly effective memory prostheses for the person with TBI, and these devices can be individually tailored to his or her needs [37]. While the steps to use these devices must be carefully trained and practiced, a memory log with a calendar, schedule, and important telephone numbers or e-mail addresses can be an effective, low-tech, low-cost intervention [36].

Attention

There are a variety of interventions for improving visual and general attention [36]. Improving attention is important given its role in memory on a day-to-day basis [36, 38, 39]. Evidence-based methods for increasing attention include the Lighthouse Strategy, which is a 3-session mental imagery and cognitive rehabilitation strategy for improving hemispatial inattention and neglect [38]. Neglect of left or right visual fields is a notoriously poor prognostic sign after brain injury [38]. Higher-functioning individuals with mild TBI can significantly improve their concentration for work and independent living skills through trained use of metacognitive self-instruction strategies [40].

Problem Solving

Several methods, some provided in a standardized manualized format, have been shown to improve problem solving [24, 41, 42]. Protocol components include training, practice, and rehearsal of situational analysis; generation of multiple options; emotional control; decision-making strategies; and evaluation of outcomes [24, 41, 42]. Many clinicians have successfully employed group therapy models during implementation [24, 41, 42]. Caregiver training in problem solving, which can be implemented in person or online, has also shown promise for improving caregiver confidence and competence and for reducing caregiver anxiety [24, 32].

Pharmacological Approaches to Behavioral and Medical Complications of TBI

While evidence has disproved the utility of intravenous steroids or long-term seizure prophylaxis after TBI, hypothermia treatments are being investigated for potential morbidity benefits [12, 26, 43]. In addition, various medications can be effective for addressing certain aspects of TBI. Dopamine, serotonin, and acetylcholine augmentation (with agents such as amantadine, methylphenidate, sertraline, and donepezil) have improved post-TBI hypoarousal and inattention [43]. Amantadine has been shown to accelerate the pace of functional recovery during active treatment in patients with post-traumatic disorders of consciousness [44]. Data on methylphenidate shows improvement in attention and memory impairments; similarly, cholinesterase inhibitors have shown improvement in memory impairments, but with worsening of behavioral issues [45].

Post-TBI complications—including deep venous thrombosis, heterotopic ossification, spasticity, dysautonomia, hydrocephalus, depression, and post-traumatic stress disorder—are readily identified [12, 26, 43]. Pituitary dysfunction, specifically of the anterior pituitary, exists in 25–40% of moderate and severe TBI survivors due to incompletely understood mechanisms [46]. In severe injuries, signs and symptoms of sympathetic storming can include hypertension, tachycardia, tachypnea, pupillary dilatation, diaphoresis, hyperthermia, posturing, and dystonia [47]. Data supports the use of intrathecal baclofen for spasticity and beta-blockers for central storming [26]. In addition to using evidence-based cognitive behavioral therapy approaches [31], agitation and delirium are successfully managed with new generation antipsychotics such as quetiapine fumarate and antiseizure medications like valproate and carbamazepine [43]. Trazodone for sleep onset and modafinil for reducing daytime sleepiness are effective for addressing sleep-wake cycle issues [43]. However, there is no specific medication that addresses all post-TBI challenges [12].

Ongoing Needs and Future Promise

While the aforementioned range of evidence-based therapies is encouraging, there is still much work to do. Given the
Return-to-School Protocols Following a Concussion
Elizabeth Newlin, Stephen R. Hooper

Concussion is emerging as a major public health concern, with incidence rates on the rise due to advances in recognition and general public awareness [1]. Despite this concern, we lack clear evidence as to how a concussion affects school functioning or how students should be managed in the school setting following a concussion. In this regard, return-to-school protocols generally remain non-existent or, at best, their delivery and execution are inconsistent [2, 3].

The problems typically seen following a concussion (e.g., headache, physical and cognitive fatigue, double vision, light sensitivity, loss of attention, slower processing speed) can all negatively impact a student’s functioning in school. To facilitate full reintegration into the social and academic aspects of the school setting, proactive management of the student’s symptoms should be considered on an individual basis [4-6]. While concussion management guidelines have been offered in the sports arena via professional organizations (e.g., the American Medical Society for Sports Medicine) and legislative actions (e.g., the Gfeller-Waller Concussion Awareness Act), similar guidelines and policies are only beginning to emerge for the return-to-school component of concussion management [7, 8].

Policies and Procedures
Gioia and colleagues have proposed 5 key components of a return-to-school policy: the formation of an interdisciplinary team with documented expertise in brain injuries, including concussion; professional development of all school-based personnel; screening/identification, assessment, and developmental surveillance; accommodations and interventions; and medical-school communication (unpublished data, 2015). While no state has addressed all of these proposed components in a comprehensive policy, several states have begun to advance strategies, policies, and procedures to address the needs of students who have sustained a concussion. For example, the BrainSTEPS Program in Pennsylvania has trained a large number of interdisciplinary teams to address the return-to-learn aspects of concussion [9]; in Oregon, a comprehensive training program is available for all school personnel [10]; and in North Carolina, an online curriculum is available for school personnel, with a particular focus on school psychologists [11].

In North Carolina, the Wake County Public School System has begun developing and implementing policies and procedures to facilitate the return-to-learn needs of students with concussions. These procedures protect the student during their recovery phase, are generally not costly or time consuming, and span the core policy requirements proposed by Gioia and colleagues. Examples of these procedures include the following:

For athletic injuries that fall under the scope of the Gfeller-Waller Concussion Awareness Act, there is a mandatory e-mail alert to a designated school professional from the coach or athletic trainer of the student who was pulled from play for a suspected head injury. For other students, any first responder health care provider can provide this alert. This alert allows the designated school professional to be in communication with parents regarding potential educational accommodations related to a concussion diagnosis, and it alerts teachers to observe the student for educational issues associated with a concussion. Teacher education is also an important aspect of the return-to-school process so that all school-based professionals are knowledgeable about concussions.

An interdisciplinary team then collaborates with the parents, school staff, health care professionals, and the student in providing accommodations as the student transitions back to school. A collaborative team approach with all stakeholders provides for the best management of the student’s post-concussion education [12].

heterogeneity of this patient population, researchers need to identify which treatments work best for which patients. Use of telephone- and Internet-based therapies is bringing needed evidence-based therapies to more consumers with TBI. However, there is ongoing need for reducing other barriers to treatment, such as cost, and for improving access for even more consumers, especially for rural populations and veterans.

The study of diagnostic biomarkers of TBI, while still in its infancy, has potential for improving the accuracy of TBI diagnosis and more timely provision of treatment services to affected individuals [48-50]. Several proteins synthesized in astroglial cells or neurons—such as the BB isozyme of creatine kinase, glial fibrillary acidic protein, myelin basic protein, neuron-specific enolase, and S100B—are being investigated as diagnostic and prognostic biomarkers for patients with moderate to severe TBI [48-50]. In addition, positive findings of studies of hormonal neuroprotection, which is thought to have been demonstrated in animal research, have been inconsistent in human research [51]. Current studies on measures of injury severity suggest that the duration of post-traumatic amnesia may be the most meaningful predictor of a patient’s functional level at discharge [52].

All these newer areas of research are improving our understanding of the effects of sex and other variables on
The education plan may indicate the need for accommodations like a partial-day schedule, postponing testing until the student is symptom-free, pacing homework or assignments to allow for cognitive rest, rest during the school day, providing pain medication for headaches, and/or limiting noise or light distractions [1]. The education plan is developed with the counselor, educator, parent, and student in collaboration with written recommendations from the physician and the interdisciplinary team. For students who have persistent symptoms, a referral for special education evaluation can be discussed with the family, the medical provider, and the interdisciplinary team. Similarly, the student’s medical plan is developed in collaboration with the parent, student, physician, and school nurse. This plan provides support for physical complaints such as headaches, light sensitivity, and/or noise sensitivity.

The student’s educational and medical plans are evaluated at least every 2 weeks, or whenever a doctor’s note is presented. In most cases, symptoms resolve in 1–3 weeks. In cases where symptoms or problems persist past 6 months, or in cases where the extent of the injury warrants further evaluation, the student may be referred for additional assessment.

Conclusion

In North Carolina, there has been some movement by individual school systems toward developing policies and procedures to address the return-to-school needs of students who have sustained a concussion. Actively linking these policies and procedures to ongoing state initiatives—such as the mandated training for school psychologists working with students following a brain injury, diabetes and asthma management in the school setting, and the Gfeller-Waller Concussion Awareness Act—should facilitate more coordinated management and, hopefully, better outcomes for all students following a concussion. NCMJ

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outcomes. We are continuing to study post-TBI psychosocial and vocational outcomes and the variables that predict more positive trajectories of recovery, including pre-injury substance use disorders, caregiver burden and stress, and factors that affect quality of life. Despite the significant work ahead, TBI clinicians and researchers are highly motivated and aspire to establish clinical pathways that will lead toward greater improvements in post-injury functional and neurobehavioral outcomes for individuals with TBI. NCMJ

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Research, treatment, and support speeds recovery for the 2.5 million Americans who survive traumatic brain injuries each year.

Find help.
#NotAloneinBrainInjury
This commentary discusses traumatic brain injury (TBI) related to falls among elderly individuals, as well as common TBI sequelae and their treatment. It also discusses the current understanding of TBI-related dementia and chronic traumatic encephalopathy.

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 [1]. 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 [1]. 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 [2]. 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 microhemorrhages 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 [3]. 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...
A Caregiver’s Perspective on Traumatic Brain Injury

Linda Herbert

My son, Jon, sustained a traumatic brain injury in June 2002 as a result of a car accident. He was 19 years old and had just completed his freshman year of college. Prior to his accident, Jon lived at home with my husband and me in northern Indiana; his older brother, Jason, was living away from home. Jon’s accident changed his life forever and had a tremendous impact on our family.

Jon was in a coma for almost 4 months. His injuries were substantial. He spent almost a full year as an in-patient—first in the hospital and then in rehabilitation programs in Chicago, IL, and Gallatin, TN. Jon’s accident occurred in June, and I was able to spend the first several months by his side. As a teacher, I returned to my job when school began in August. I then took every Friday off from school, for the entire school year, so that I could drive 8 hours to be with Jon over long weekends when he was in Tennessee. My husband spent as much time as he could with Jon, while also juggling work and tedious tasks such as dealing with insurance and applying for Social Security and disability for Jon. All of this could have been much worse if we did not have excellent insurance. The worst part for us was not knowing how far Jon would progress, how long he would stay at each facility, and what we would face as a family once Jon was discharged.

During this time, my husband and I made the decision to move from Indiana to North Carolina to be in a warmer climate and closer to family. I quit teaching, Jon was discharged, and we planned for him to live at home with us. Jon had made much progress with his recovery, but he continued to have major cognitive and memory deficits, as well as severe behavioral outbursts that we were not equipped to handle. He thus entered inpatient rehabilitation programs again, this time in Charlotte, NC, and then in Wauchula, FL. As much as I wanted to have my son at home with us, I realized that I was not equipped to be a full-time caregiver and to deal with Jon’s deficits. My husband agreed, and we were fortunate to find a group home that cares for 3 men with TBI within 2 hours of where we live. Jon has lived there since 2004, and he is receiving excellent care.

Jon’s traumatic brain injury affected my family greatly. It put much stress on the relationship between my husband and me. It was difficult going through each stage of Jon’s recovery not knowing what we would face, and we had difficulty finding the resources we needed. I was able to focus on Jon’s recovery and accept the “new” Jon, but my husband had difficulty accepting that Jon would never be the young man he once had been. This was one of the reasons why my husband and I separated several years after Jon’s accident. I also felt tremendous guilt when I realized that I could not handle being a full-time caregiver for Jon. I have come to peace with this now, as Jon is relatively happy in his home. We speak daily and I see him often. Jon’s father died of a heart attack in 2012. Jon’s older brother, Jason, became a firefighter, in part because firefighters were the first responders to find and treat Jon after his accident, and Jason aspired to help others as they had helped Jon.

As a family, what we faced was difficult, but many families face even more obstacles. As I said before, Jon had excellent health insurance, which allowed him to receive extensive inpatient therapy. We did not have to worry about personal finances, and since Jon’s accident occurred before the age of 21 years, he was eligible to receive government assistance. Further, we did not have younger children to care for while going through this turmoil, and I was fortunate that my job allowed me to take time off to be with Jon throughout the school year.

Having a family member sustain a traumatic brain injury is life changing, not only for the individual but for the entire family. Every injury and recovery is different, and every family has a different story to tell.

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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 24.3% [4].

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 non-hemorrhagic axonal injury, respectively [5]. 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 [6].

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 [7]. 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 cranectomy, 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 [8, 9]. The impact of these changes on patient outcomes is unknown, and more research is needed to better guide these practices and policies.

### 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 [10].

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

| TABLE 1. Changing Trends in Inpatient Rehabilitation for Older Adults With Traumatic Brain Injury |
|---------------------------------|-------------------|-------------------|
| Mean age, in years (SD)         | 66.8 (9.2)        | 66.6 (9.0)        |
| Rehabilitation length of stay, in days | 56.0             | 18.8             |
| Admission FIM                   | 52.2              | 53.6              |
| Discharge FIM                   | 90.6              | 87.8              |
| Percent of patients discharged to community | 82%              | 81%              |

Notes. FIM, Functional Independence Measure; SD, standard deviation.

*Data are from Cifu et al [8].

*Data are from Frankel et al [9].
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 [11].

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 [12]. 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 [12].

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 [13]. 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 [14]. 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 results in more than 140,000 visits to North Carolina emergency departments annually. North Carolina first implemented a systematically organized approach to brain injury management in 1967, and the state's emergency medical services community continues to optimize patient care by incorporating evolving knowledge into protocols and procedures.

Traumatic brain injury (TBI) comprises a spectrum of disease resulting in mild to severe brain dysfunction caused by blunt or penetrating head trauma [1]. The main causes of TBI are falls (35.2%), motor vehicle crashes (17.3%), blunt impacts (16.5%), and assault (10%). During the period 2010–2011, there were 140,234 visits to North Carolina emergency departments for head injuries; the most frequent visits occurred among males, very young children, and very old individuals [2].

The evolution of TBI management is rich with both advancements and aborting therapies that caused harm; much of this knowledge has slowly influenced prehospital care in various ways. The oldest known surgical document on trauma is the ancient Egyptian scroll referred to as the Edwin Smith Papyrus (circa 1650–1550 BC). This text describes 48 trauma cases, including head injuries, and classifies them based on presentation [3]. Treatment of head injuries existed even before recorded history in the form of a surgical decompression technique called trepanation, in which a hole was drilled into the skull. Archeological evidence demonstrates that many patients survived this early form of surgery [4].

In 1965, 52 million accidental or general injuries were recorded nationwide. Of these, 107,000 people died, more than 10 million people were temporarily disabled, and 400,000 people were permanently impaired [5]. In 1966, the National Academy of Sciences published Accidental Death and Disability: The Neglected Disease of Modern Society. This paper noted that trauma is the leading cause of death in the first half of an individual's lifespan, and it highlighted the significant burden traumatic injuries place on American society. This burden of disease resulted in an annual cost to society of over $18 billion. In addition, the National Academy of Sciences paper described a magnitude of deficiencies, including inadequate layperson training, poor communication systems, and a lack of trauma care systems. This document also called attention to the lack of properly trained and equipped ground and aeromedical emergency medical services (EMS) units [5].

Following publication of Accidental Death and Disability, Congress enacted the National Traffic and Motor Vehicle Safety Act of 1966, thus creating the National Highway Traffic Safety Administration. This legislation also directed each state to develop regional EMS systems. North Carolina responded in 1967 by legislating the Ambulance Services Act. This placed the regulatory responsibilities of EMS under the North Carolina Department of Health and Human Services (DHHS). It provided DHHS with authority to adopt required equipment standards, inspect ambulances, and establish qualifications for ambulance attendants [6].

In 1973, North Carolina established the Office of Emergency Medical Services and provided funding to improve training, transportation, emergency departments, and communication systems. In 1993, legislation was enacted to develop a statewide trauma system. In 2001, further legislation was passed to align North Carolina with the National Highway Traffic Safety Administration’s EMS Agenda for the Future [6].

As described, significant progress has been made since 1967 with respect to improving EMS and trauma systems in North Carolina. How has this impacted TBI care? Standardization of EMS systems, training for prehospital personnel, improved emergency department capabilities, and a statewide trauma care system all provide a framework for improved TBI care. In addition, several key therapies for TBI had been introduced by 1978, including prehospital resuscitation, prehospital aggressive respiratory and circulatory support, hospital intracranial monitoring and control, and computed tomography (CT) scanning [7].

Prehospital strategies for trauma patients with head injuries include cervical and spinal immobilization; fluid resuscitation to prevent hypotension, which may lead to decreased...
cerebral perfusion pressure; and aggressive oxygenation and ventilation. Unfortunately, hyperventilation—which was advocated as a strategy to decrease intracranial pressure following herniation—became used more generally when herniation was not present. Hyperventilation and hyper-oxygenation can cause increased secondary brain injury via decreased cerebral perfusion pressure and apoptosis from free radical formation. This well-known phenomenon has been observed in both adult and pediatric patients in cardiopulmonary resuscitation research over the past few decades [8, 9].

In 1995, the Brain Trauma Foundation and the American Association of Neurological Surgeons jointly published a set of guidelines for the treatment of TBI. The guidelines promote aggressive resuscitation, rapid transport to a trauma center, CT scanning, prompt hematoma surgery, and intracranial pressure monitoring and control [7]. Unfortunately, recent work has demonstrated poor compliance with evidence-based guidelines for TBI. In 2014, a study of Level 1 trauma centers found an overall compliance rate with the guidelines of 73%, with wide variation among the 11 trauma centers [10].

Historically, this variation can also be seen in the EMS system in North Carolina. Since the introduction of paramedical personnel for field treatment, numerous authorities with different agendas have provided education to prehospital personnel over different periods. There is also considerable variability in the leadership of local EMS systems. North Carolina general statutes require that a physician medical director provide oversight of the entire EMS system, but many physicians are not trained in emergency medicine or in the care of TBI patients. In the past, each EMS agency was also responsible for the formation of treatment protocols and procedures. The protocols were locally specific, not standardized, and may not have included a protocol on TBI.

Unfortunately, many of the practices carried out in the field in the 1970s and 1980s did not always contribute positively to patient outcomes. With the introduction of pulse oximetry, many prehospital providers erroneously believed that all patients with head injuries required 100% oxygen saturation at all times, possibly increasing the use of hyperventilation. As the use of the Glasgow Coma Scale (GCS) became more prevalent in the field, a standard was developed that directed paramedics to intubate patients with GCS scores less than 8. Many patients do require endotracheal intubation in the field, but evidence continues to demonstrate increased morbidity and mortality of head-injury patients who are intubated in the field [11]. Patients with isolated head injuries who are intubated in the field have a 23% higher mortality rate than patients intubated in the emergency department [12], possibly due in part to lack of experience of prehospital providers.

Concussion is also managed in the prehospital environment; such injuries are defined as a transient brain impairment following blunt trauma with dysfunction ranging from mild dizziness to amnesia, vomiting, and/or severe headache, with or without loss of consciousness. In 2011, the North Carolina General Assembly passed the Gfeller-Waller Concussion Awareness Act in response to the deaths of 2 high school football players in 2008. Matthew Gfeller was a sophomore who suffered a helmet-to-helmet injury that resulted in an intracranial hemorrhage. Four weeks later, Jaquan Waller died from a “second-impact syndrome” [13].

The Gfeller-Waller Act mandates a concussion training program for public schools. The program must include several components: written information detailing signs and symptoms of a concussion; a description of the physiology and potential short- and long-term effects of concussions; and a medical return-to-play protocol for post-concussion participation in athletic activities. The act also requires each school to develop a venue-specific emergency action plan for serious injury or illness [14]. The Gfeller-Waller Act has increased awareness and has likely improved care of concussions in scholastic sports in North Carolina, but no study to date has evaluated its impact on prehospital personnel.

Since the early 2000s, the North Carolina College of Emergency Physicians (NCCEP) has become heavily involved in standards for medical care in EMS systems. An EMS committee within the NCCEP is comprised of board-certified emergency physicians with expertise in EMS. They work to develop protocols, procedures, and policies that are standardized for all EMS agencies across the state; these include protocols for both pediatric and adult patients that are specific to multiple trauma and TBI. Standardized statewide protocols were first introduced in 2005, with subsequent updates in 2009, 2012, and 2014. Once finalized and approved by the NCCEP Board of Directors, the document becomes codified into North Carolina general statute.

Recent Advances

Prehospital TBI care has greatly improved over the past several decades. This care has emphasized rapid, safe extrication of the trauma victim; stabilization of the spine; aggressive resuscitation to prevent hypotension; airway management; and rapid, safe transport to an appropriate receiving facility. Key features of current pediatric and adult head injury protocols aim to decrease secondary brain insult. In 2009, the North Carolina Office of Emergency Medical Services also established triage and destination protocols to aid in the decision-making process of many time-dependent conditions, including trauma.

This is presented as an algorithm with 5 arms (see Figure 1). The first arm of this algorithm directs the patient who presents with an unmanaged airway or profound shock to the nearest hospital for stabilizing measures. The second and third arms assess for abnormal vital signs and critical injuries for hospital triage. The fourth arm accounts for special or associated problems like pregnancy or anticoagulation. The fifth arm takes into account the mechanism of injury. This aids the prehospital provider in deciding upon
Advances in TBI care continue to evolve in North Carolina, with strategies culminating in a standardized approach to care for TBI patients. In 2005, rapid sequence intubation was established in North Carolina. Agencies employing this procedure are required to use end-tidal capnography to monitor the airway, assure endotracheal intubation, and prevent a missed esophageal tube placement. Advanced life support (ALS) personnel are able to monitor oxygen saturation through the use of pulse oximetry and ventilation status via waveform capnography. End-tidal capnography is also paramount in preventing hyperventilation of TBI patients. ALS providers can now measure expired carbon dioxide levels and change the ventilation depth and rate accordingly, with a goal of keeping the carbon dioxide level at 35–45 mmHg. Patients who demonstrate a unilateral, large, and unreactive pupil; decorticate or decerebrate posturing; bradycardia; and/or abrupt decline in mental status are candidates for hyperventilation, but only to the extent of maintaining end-tidal carbon dioxide levels of 30–35 mmHg. Furthermore, capnography can also function as an early warning system to aid in the identification of nonintubated patients who are hyperventilating, thus allowing the health care provider to initiate airway or ventilation interventions before hypoxia occurs.

Moving forward, injury prevention needs to play a greater role. Unfortunately, most EMS agencies lack adequate funding for day-to-day operations, especially in rural areas, and they have little or no funding for prevention strategies. Local governments must be willing to adequately fund their EMS systems to improve care in their communities and to prevent injuries through education.

A recent grant from the National Institutes of Health was
awarded with the goal of enrolling 25,000 TBI patients in Arizona over the next 9 years. The specific aim of this study is to determine if statewide implementation of the international adult and pediatric EMS TBI guidelines will significantly reduce morbidity and mortality in patients with moderate or severe TBI [15]. Hopefully this large trial will provide definitive evidence for the treatment of TBI patients in the prehospital environment.

While prehospital management of severe TBI remains challenging due to a lack of randomized controlled trials, expert consensus recommends that adequate airway management (with prevention of hypoxia, hypocapnia, or hypercapnia), prevention of hypotension, and control of hemorrhage are critical to improving survival from severe TBI [16]. As knowledge continues to evolve, the EMS community in North Carolina will continue to optimize patient care by incorporating new information into future protocols and procedures. NCMJ

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Traumatic brain injury (TBI) is often referred to as a “silent epidemic” because, although it is a major cause of death and disability, many of the signs, symptoms, and sequelae of TBI—such as memory loss or changes in language and emotion—are not easily recognized [1]. TBIs vary in severity, from mild injuries that require minimal medical attention to severe injuries that may cause lifelong disability or death [2]. Both nationally and in North Carolina, TBI is a contributing factor to more than 30% of all injury deaths [1, 3]. Having population-based data regarding fatal and nonfatal TBIs among North Carolina residents is important both for understanding the overall burden of these injuries in the state and for identifying potential risk factors.

Methods
This analysis used data from 3 statewide data sources to examine TBI-related deaths, hospitalizations, and emergency department (ED) admissions among North Carolina residents in 2012. Death certificate data for 2012 were obtained from the North Carolina State Center for Health Statistics (SCHS). We only included events in which the primary cause of death was identified as an injury and the primary or underlying cause(s) of death was identified as TBI-related using the International Classification of Diseases, 10th Revision (ICD-10) codes [4]. Hospital discharge data for every hospital discharge of a North Carolina resident in 2012 were also obtained from the SCHS. TBI-related hospital discharges were identified using the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) external cause of injury codes [4]. ED admissions for 2012 were obtained from the North Carolina Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT). NC DETECT receives data on a daily basis from hospital-affiliated EDs statewide. As of 2014, there were 123 North Carolina hospital-affiliated EDs that submitted data on a daily basis to NC DETECT, as well as 4 Veterans Affairs medical center-affiliated EDs. TBI-related ED admissions were identified using ICD-9-CM external cause of injury codes [4].

Specific causes of TBI-related deaths, hospitalizations, and ED visits were identified using ICD-10 and ICD-9-CM codes. Counts and rates of TBI-related deaths, hospitalizations, and ED visits per 100,000 North Carolina residents were calculated by age, sex, and cause. Rates by sex and cause were age-adjusted.

Results
Burden of TBI in North Carolina
The overall burden of TBI among North Carolina residents in 2012 is presented in an “injury iceberg” diagram (see Figure 1). This figure illustrates the fact that deaths represent only the tip of the iceberg.
with regard to the burden of TBI in North Carolina. In 2012, for every 1 TBI-related death, there were more than 3 TBI-related hospitalizations and 36 TBI-related ED visits among North Carolinians. These data do not reflect the number of individuals who sought outpatient care or did not seek medical attention in the event of a TBI, which is likely much higher than the number of TBI-related ED visits. Unfortunately, surveillance data are not available for these events.

**Leading Causes of TBI-related Deaths, Hospitalizations, and ED Admissions**

Overall, TBI-related deaths, hospitalizations, and ED admissions in 2012 were more common among males than females. In 2012, the leading causes of fatal and nonfatal TBIs in North Carolina were firearms, motor vehicle traffic crashes, and unintentional falls; among these causes, there were differing trends by age and sex.

The leading cause of TBI-related death among North Carolina residents in 2012 was firearms, with a rate of 7.0 deaths per 100,000 residents. Approximately 70% of these firearm-related TBI deaths were self-inflicted, and an additional 20% were homicides. Firearm-related TBI deaths disproportionately affected older males. Across all age groups, males were more likely than females to die as a result of a firearm-related TBI (see Figure 2). In addition, the highest rate of firearm-related TBI death was among males aged 85 years and older (36.2 deaths per 100,000 population) followed by males aged 75–84 years (23.8 deaths per 100,000 population).

The leading cause of TBI-related hospitalizations among North Carolina residents in 2012 was unintentional falls, with a rate of 24.8 hospitalizations per 100,000 residents. Across all age groups, males were more likely than females to be hospitalized for an unintentional fall-related TBI (see Figure 3). In addition, unintentional fall-related hospitalizations were more common among the youngest and the oldest age groups for both males and females. The highest rate of unintentional fall-related TBI hospitalizations was among adults aged 75 years and older; the second-highest rate was among children less than 1 year old.

The leading causes of TBI-related ED admissions among North Carolina residents in 2012 included unintentional falls (316.8 ED admissions per 100,000 population) and motor vehicle traffic crashes (109.0 ED admissions per 100,000 population). The age trends for unintentional fall-related TBI ED admissions were similar to those of unintentional fall-related TBI hospitalizations; however, rates were generally higher among females than males (data not shown). Motor vehicle traffic-related ED admissions were more common among females aged 5–24 years compared to males of the same age (see Figure 4). Across all remaining age groups, males were more likely than females to be admitted to an ED for a motor vehicle traffic-related TBI. The highest rate of motor vehicle traffic-related TBI ED admissions was among females.
aged 15–24 years (258.7 ED visits per 100,000 population), followed by males aged 15–24 years (252.8 ED visits per 100,000 population).

**Conclusion**

TBI is a major contributor to injury deaths, hospitalizations, and ED admissions among North Carolina residents. An examination of rates of fatal and nonfatal TBIs among North Carolina residents revealed differing trends by age, sex, and cause. Older adult males had particularly high rates of firearm-related TBI deaths, while unintentional fall-related TBI hospitalizations were common among older adults as well as young children. In addition, teenagers and young adults, who possibly represent less experienced drivers, had the highest rates of motor vehicle traffic-related TBI ED admissions. TBIs are preventable, and prevention efforts will need to be tailored to specific populations, outcomes, and causes. For example, efforts to prevent unintentional fall-related TBI hospitalizations might target older adults and young children and
might include strategies for home modifications and/or evidence-based exercise programs. Efforts to prevent motor vehicle traffic-related TBI ED admissions might target young drivers and could include graduated driver's license components, education on the importance of seat belt use, and increased awareness of the dangers of driving while impaired [5]. Continuing to understand the burden of TBI among North Carolina residents through the use of population-based surveillance and data sources will help to inform and enhance these prevention efforts. NCMJ

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Acknowledgments

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Potential conflicts of interest. All authors have no relevant conflicts of interest.

References


Spotlight on the Safety Net

A Community Collaboration

Traumatic Brain Injury Clubhouses in North Carolina

Traumatic brain injury (TBI) is a major and growing public health problem in North Carolina. Individuals who have experienced a moderate to severe TBI require a continuum of care involving acute hospitalization and post-acute rehabilitation; the latter should include community reintegration that, ideally, allows them to return home and to function as a productive member of the community. Specialized clubhouse/day programs are one model of community reintegration that has demonstrated some success.

A brain injury clubhouse is a community center for people living with the effects of TBI. The clubhouse is based on a model that has been recognized for more than 70 years. In 1948, Fountain House was founded on the premise that clubhouse members could work productively and have socially satisfying lives in spite of mental illness [1]. Over the years, the clubhouse model has been adapted to accommodate other disability groups, including people with brain injuries. A clubhouse offers a safe environment where people are treated with dignity and respect. Table 1 provides online resources related to TBI clubhouses.

A clubhouse focuses on abilities rather than disabilities, and it capitalizes on these abilities for the combined good of all members. Each member of the clubhouse is recognized for his or her contribution, no matter how big or small that contribution is. There are no “patients” in the clubhouse. Members work together to support each other in their pursuit of personal goals. In the process, people develop the skills and self-esteem needed to regain control of meaningful and productive lives. The clubhouse encourages community re-entry, the rebuilding of social relationships, and the development of skills required for productive activity. The clubhouse model is divided into 4 main areas: work-ordered day (which consists of units such as kitchen and business), employment, education, and evening/weekend activities.

Table 1.
Online Resources About Traumatic Brain Injury and Clubhouses

<table>
<thead>
<tr>
<th>Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clubhouse International: <a href="http://iccd.org/">http://iccd.org/</a></td>
</tr>
<tr>
<td>International Brain Injury Clubhouse Alliance: <a href="http://braininjuryclubhouses.net/">http://braininjuryclubhouses.net/</a></td>
</tr>
<tr>
<td>Brain Injury Association of America: <a href="http://www.biausa.org">http://www.biausa.org</a></td>
</tr>
<tr>
<td>Brain Injury Association of North Carolina: <a href="http://www.bianc.net">http://www.bianc.net</a></td>
</tr>
</tbody>
</table>

The brain injury community had adopted the clubhouse model over the past 15 years, and a group of clubhouse providers founded the International Brain Injury Clubhouse Alliance (IBICA) in 2004. The foundational concepts of these programs have been built with TBI-specific modifications to accommodate persons with brain injury. This provided a strong foundation from which to build a new, modified program for TBI clubhouses in North Carolina.

In 2009, the North Carolina Division of Mental Health, Developmental Disabilities, and Substance Abuse Services (MH/DD/SAS) received a grant from the federal Health Resources and Services Administration that included funding to provide technical assistance for the development of 2 clubhouse programs designed to serve people with TBI. MH/DD/SAS contracted with the Brain Injury Association of North Carolina (BIANC) to develop these 2 clubhouses using best practice guidelines.

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0029-2559/2015/76216
BIANC provides information and referral services for people with brain injuries, their families, and professionals. Inquiries for support have indicated a dire lack of services for this population for many years. One particular concern is the lack of day programs that allow people to lead active, productive lives. Psychosocial rehabilitation clubhouses are available throughout the state for individuals with mental illness and other disabilities. However, in 2009 there was only 1 clubhouse program in North Carolina that served people with brain injuries: Hinds’ Feet Farm in Huntersville.

BIANC developed relationships with 2 provider agencies—Hinds’ Feet Farm in Asheville and Community Workforce Solutions in Raleigh—to provide the direct services for the TBI clubhouses. BIANC and the 2 providers visited several TBI clubhouses in Virginia, drop-in centers in South Carolina, and a well-established clubhouse in Atlanta to observe and learn from existing successful programs. Community Workforce Solutions developed Gateway Clubhouse in Raleigh based on this research and over 40 years of working with persons with disabilities. Hinds’ Feet Farm had previously developed a TBI day program in another area of the state, and they modeled their second clubhouse on their existing site.

In designing Gateway Clubhouse, Community Workforce Solutions made the decision to join the IBICA and to adhere to those defined guidelines. The Hinds’ Feet Farm Clubhouse chose to follow another model of brain injury clubhouse design. Hinds’ Feet Farm shares far more similarities than differences with the 33 standards of the IBICA, but Hinds’ Feet Farm replicates the Stepping Stones Day Program, a program of the Krempels Center in Portsmouth, NH [2]. Stepping Stones, founded in 2000, is based on the concept of creating a place that is welcoming, with a predominate focus on holistic health and wellness, versus the clubhouse’s primary focus of work-ordered days and employability. MH/DD/SAS believes that providers can choose the clubhouse model that best suits their population based on their business model, as long as consumer satisfaction is maintained. Once a clubhouse is opened, providers must justify the program with documentation in order to receive continued funding from the state.

Both TBI clubhouses have been successful in establishing programs that have greatly benefited people with brain injuries and their families. Quarterly assessment reports indicate that the members of both clubhouses have found that they provide positive, life changing programs. The benefit of the clubhouse program is best reflected in this statement from a new member: “I just recently began coming to Gateway, and everyone is so accepting. Everyone understands that accidents happen and we are all unique.”

There is a well-documented need to develop more TBI clubhouse programs in North Carolina. BIANC, the North Carolina Brain Injury Advisory Council, and other brain injury advocacy groups are working together to expand the availability of these valuable programs across the state. NCMJ


Acknowledgments
Potential conflicts of interest. S.F. is an employee of the Brain Injury Association of North Carolina.

References
To the Editor—In 2015, the North Carolina General Assembly will again have the opportunity to consider Medicaid reform and expansion. Lawmakers have framed this issue as a choice between a managed care organization (MCO) approach and an accountable care organization (ACO) approach. The physician leaders of Triad HealthCare Network (THN) have well-formed opinions based on our experience as an ACO in the Medicare Shared Savings Program (MSSP). Not surprisingly, THN’s physicians tout the superiority of the ACO approach and believe a better frame would be: What steps would give the ACO approach the best chance for success?

Certain local factors—such as physician engagement, leadership, and governance—are critical to the success of an ACO. Physician engagement requires a cultural shift. The business culture of medicine favors practice independence over physician unity around common goals at the community level. THN created a physician-led governance structure as an important, early step in bridging that gap. Physician governance must strike good balances between health system–employed physicians and independent physicians and between generalists and specialists. Trust is vital and will not emerge unless each physician feels that his or her perspective is considered.

Health care reform cannot happen without physicians, health systems, and health plans uniting around common goals. THN created a physician-led governance structure as an important, early step in bridging that gap. Physician governance must strike good balances between health system–employed physicians and independent physicians and between generalists and specialists. Trust is vital and will not emerge unless each physician feels that his or her perspective is considered.

Health care reform cannot happen without physicians, health systems, and health plans uniting around common goals—such as quality, cost, and patient satisfaction—and creating aligned incentives to achieve those goals. In our community, Cone Health led reform efforts by initiating overtures to Triad-area physicians and by funding THN’s start-up costs. Once this collaboration solidified, we sought relationships with payers, as through our MSSP participation.

The same alignment can occur in North Carolina with Medicaid reform. The biggest challenge will be to create a mutually acceptable balance between risks and rewards. The legislative goals are 2-fold: fiscal restraint and budget certainty. Lawmakers want to transfer the risk for Medicaid budget overruns to ACOs. While ACOs need time to develop the capacity to assume risk, they must take ownership of costs. ACO proponents should articulate our goals with equal clarity. We want rules and regulations that provide a fair balance of risks versus rewards.

THN’s experience with the MSSP provides a good example for both aligned incentives and balanced risk versus reward. Cone Health and THN accepted the risk of our $7.4 million start-up costs with no promise of a return. After reviewing the MSSP’s requirements, we felt that the quality targets were generally reasonable and that THN and the Centers for Medicare & Medicaid Services had common goals. For the period ending December 2013, we saved approximately $21 million, despite starting from baseline per-capita spending that was 15% below the national average. Half of those savings went to THN and will fund our continued efforts to bring better health care value to our communities. We will want a similar opportunity for successful alignment in the Medicaid program.

Medicaid expansion will test our ability to collaborate. I feel that North Carolina’s elected leaders have adopted the mantra of “no Medicaid expansion without Medicaid reform.” THN physicians, Cone Health, and our communities have directly felt the negative financial impact of that decision. More importantly, our physicians have witnessed the angst of poor families who lack health insurance coverage. As a partner in Medicaid reform—and recognizing how Medicaid expansion affects our balance of risk versus reward—THN leadership has its own mantra: No Medicaid reform without Medicaid expansion.

I have reason for cautious optimism. We are all diligent people of good faith aligned around common goals. Together, we can achieve Medicaid reform and expansion in 2015.

William A. Hensel, MD member, Triad HealthCare Network Operating Committee, Greensboro, North Carolina; director, Cone Health Family Medicine Residency Program, Greensboro, North Carolina; professor, Department of Family Medicine, University of North Carolina School of Medicine, Chapel Hill, North Carolina.

Acknowledgment
Potential conflicts of interest. W.A.H. is a member of Triad HealthCare Network, an accountable care organization. He is paid for his participation on Triad HealthCare Network’s Operating Committee.
To the Editor—The house pictured on the cover of the January 2015 issue of the NCMJ has a legacy in North Carolina medicine. It is the Caldwell home in Cataloochee, North Carolina. Cataloochee Valley was settled in 1814, with the first family being the Caldwells. The house was constructed in 1903–1906 by my great-great-uncle, Hiram Caldwell. His nephew Eston, my grandfather, spent much of his youth in this home after the death of his parents. Eston’s son, my father, was E.R. Caldwell Jr. He was the first in the family to go to college, finishing at Wake Forest College and Bowman Gray School of Medicine. He practiced in Statesville and served for many years on the North Carolina Board of Nursing. He had five children. Three sons are physicians, educated at Wake Forest and Bowman Gray: E.R. Caldwell III is a pediatrician practicing in Winchester, Virginia; Stephen Caldwell is a hepatologist at the University of Virginia in Charlottesville; and I am a rheumatologist at Duke University Medical Center. Two daughters, Susan Madison and Lynn Vessells, became nurses; they completed training at North Carolina Baptist Hospital and the University of North Carolina at Greensboro, respectively. Perhaps this history was predestined. My great-grandfather’s given name was Doctor.

The Caldwell home is now maintained by the National Park Service as part of Great Smoky Mountains National Park. The stream in the foreground is Caldwell Fork. Descendants of the original settlers return there every August for a reunion.

David S. Caldwell, MD, FACP, FACR associate director, Rheumatology Fellowship Training Program, Duke University Medical Center, Durham, North Carolina.

Acknowledgment

Potential conflicts of interest. D.S.C. has no relevant conflicts of interest.
**Access to Care and Preventive Health**

North Carolina’s future growth and prosperity depends on our ability to foster the health and well-being of our children. Health during childhood impacts not only children’s daily life, but also their future health, educational outcomes, employment, and economic status. Having access to affordable health care is critical to ensuring the health and well-being of children and families in North Carolina.

North Carolina has reason to celebrate as more children today have access to health insurance, providing them the opportunity to receive needed medical care. In 2013, the percentage of uninsured children in North Carolina declined to 6.2%. One of the most effective strategies to cover children is to have affordable health insurance options available to their parents. North Carolina policymakers should consider the effect of changes to the Medicaid program and the private insurance market on both children and parents.

Although having health care coverage is necessary for gaining access to affordable health care services, having health insurance does not guarantee that a child will receive preventive primary care services. Preventive care is critical to ensuring children’s health needs are met. Well-child visits provide opportunities for immunizations, developmental and health screenings, early detection of emerging concerns, and a chance to offer parents health education and advice for their children. Preventive dental care visits allow for professional cleanings, treatment of tooth decay, and the application of sealants or other necessary care. Although preventive visits are covered under private and public insurance, data from Medicaid and Health Choice show that many children do not receive the recommended levels of preventive care. North Carolina measures well compared to other states for rates of preventive medical and dental visits, but there is still room for substantial progress. As more children in North Carolina have access to affordable care, it is critical to continue efforts to ensure that families utilize their preventive care benefits.

### Grade Health Indicator

<table>
<thead>
<tr>
<th>Current Year</th>
<th>Benchmark Year</th>
<th>Percent Change</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insurance Coverage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of all children (ages 0-17) uninsured†</td>
<td>6.2%</td>
<td>8.1%</td>
<td>-23.5%</td>
</tr>
<tr>
<td>Percent of children below 200% of poverty uninsured†</td>
<td>8.2%</td>
<td>11.7%</td>
<td>-29.9%</td>
</tr>
<tr>
<td>Number of children covered by public health insurance (Medicaid or Health Choice) (in December)</td>
<td>1,172,855</td>
<td>1,020,317</td>
<td>15.0%</td>
</tr>
<tr>
<td>Percent of Medicaid-enrolled children receiving periodic well-child screening assessments†</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **School Health** | | | |
| School nurse ratio | | | |

| **Breastfeeding** | | | |
| Percent of infants ever breastfed | 77.2 | * | * | * |
| Percent of infants breastfed at least six months | 48.3 | * | * | * |

| **Immunization Rates** | | | |
| Percent of children with appropriate immunizations: | | | |
| Ages 19-35 months† | 76.6% | – | – | – |
| At school entry† | 97.2% | 96.5% | 0.7% | No Change |

| **Environmental Health** | | | |
| Asthma: | | | |
| Percent of children ever diagnosed | 17.5% | – | – | – |
| Hospital discharges per 100,000 children (ages 0-14) | 148.9 | 171.7 | -13.3% | Better |

| **Dental Health** | | | |
| Percent of children: | | | |
| With untreated tooth decay (kindergarten) | 13.0% | 17.0% | -23.5% | Better |
| With one or more sealants (grade 5) | 45.0% | 44.0% | 2.3% | No Change |
| Receiving fluoridated water | 87.5% | 85.6% | 2.2% | No Change |
| Percent of Medicaid children enrolled for at least 6 months who use dental services: | | | |
| Ages 1-5 | 67.0% | 55.0% | 21.8% | Better |
| Ages 6-14 | 71.0% | 62.0% | 14.5% | Better |
| Ages 15-20 | 52.0% | 48.0% | 8.3% | Better |
Children's health and well-being are impacted by their family's income, educational achievement, race, ethnicity, and other environmental factors. Children living in families with low incomes are restricted in their opportunities for health through reduced access to healthy and safe living conditions, healthy food, exercise, and good schools. Growing up in a family living in poverty or near poverty negatively impacts a child's health throughout his or her life. Education and health outcomes are also tightly intertwined; success in school and the number of years of schooling impact health across the lifespan. Policies to reduce poverty and improve educational outcomes also positively impact child health.

During adolescence, new health behaviors emerge and many health habits that affect life outcomes are established. Unfortunately, data show that many North Carolina youth engage in behaviors that compromise their health. North Carolina had made tremendous gains in reducing cigarette use among youth over the past twenty-five years, however, emerging tobacco products, including e-cigarettes, hookahs, and flavored cigars, are quickly erasing those gains. More than one in five high school students reported current use of an emerging tobacco product in 2013. Use of other illegal substances also remains quite high. North Carolina's past success in implementing a multifaceted, evidence-based approach to reduce youth smoking, including implementing educational, clinical, regulatory, economic and social strategies, provides examples of policies that could be implemented to reduce youth substance use in other areas.

### Health Risk Behaviors

<table>
<thead>
<tr>
<th>Grade</th>
<th>Health Indicator</th>
<th>Current Year</th>
<th>Benchmark Year</th>
<th>Percent Change</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Percent of high school students graduating on time with their peers*</td>
<td>82.5%</td>
<td>71.8%</td>
<td>14.9%</td>
<td>Better</td>
</tr>
<tr>
<td>D</td>
<td>The percent of children in poverty</td>
<td>2013</td>
<td>2009</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Under age 5</td>
<td>28.0%</td>
<td>26.7%</td>
<td>4.9%</td>
<td>No Change</td>
</tr>
<tr>
<td></td>
<td>Under age 18</td>
<td>25.2%</td>
<td>22.5%</td>
<td>12.0%</td>
<td>Worse</td>
</tr>
<tr>
<td>B</td>
<td>Number of pregnancies per 1,000 girls (ages 15-17):</td>
<td>2013</td>
<td>2009</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>16.6</td>
<td>30.1</td>
<td>-44.9%</td>
<td>Better</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Percent of Children:</td>
<td>2012</td>
<td>2008</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meeting the recommended guidelines of 60 minutes or more of exercise 6 or 7 days a week</td>
<td>36.7%</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Ages 2-9</td>
<td>36.7%</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Ages 10-17</td>
<td>26.7%</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Meeting the recommended guidelines of less than two hours of screen time every day*</td>
<td>43.2%</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Ages 2-9</td>
<td>43.2%</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Ages 10-17</td>
<td>13.8%</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Ages 10-17 who are overweight or obese1</td>
<td>36.3%</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>D</td>
<td>Tobacco Use</td>
<td>2013</td>
<td>2009</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Percent of students (grades 9-12) who used the following in the past 30 days:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cigarettes</td>
<td>13.5%</td>
<td>16.7%</td>
<td>-19.2%</td>
<td>Better</td>
</tr>
<tr>
<td></td>
<td>Smokeless tobacco</td>
<td>8.3%</td>
<td>8.5%</td>
<td>-2.4%</td>
<td>No Change</td>
</tr>
<tr>
<td></td>
<td>Emerging Tobacco Product4</td>
<td>22.4%</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Mental Health, Alcohol and Substance Abuse</td>
<td>2013</td>
<td>2011</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Percent of Middle School students who have ever tried to kill themselves</td>
<td>10.5%</td>
<td>9.5%</td>
<td>10.5%</td>
<td>Worse</td>
</tr>
<tr>
<td></td>
<td>Percent of High School students who required medical treatment during the past 12 months due to a suicide attempt by injury, poisoning, or overdose</td>
<td>5.3%</td>
<td>5.0%</td>
<td>6.0%</td>
<td>Worse</td>
</tr>
<tr>
<td>D</td>
<td>Percent of students (grades 9-12) who used the following:</td>
<td>2013</td>
<td>2009</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marijuana (past 30 days)</td>
<td>23.2%</td>
<td>19.8%</td>
<td>17.2%</td>
<td>Worse</td>
</tr>
<tr>
<td></td>
<td>Alcohol (including beer) (past 30 days)</td>
<td>32.2%</td>
<td>35.0%</td>
<td>-8.0%</td>
<td>Better</td>
</tr>
<tr>
<td></td>
<td>Cocaine (lifetime)</td>
<td>4.9%</td>
<td>5.5%</td>
<td>-10.9%</td>
<td>Better</td>
</tr>
<tr>
<td></td>
<td>Prescription drugs without a doctor’s prescription (lifetime)</td>
<td>17.2%</td>
<td>20.5%</td>
<td>-16.1%</td>
<td>Better</td>
</tr>
</tbody>
</table>

www.ncchild.org  |  www.nciom.org
Children thrive when they are healthy and supported by safe, stable, and nurturing relationships and environments. Child maltreatment is a significant public health problem that negatively impacts North Carolina’s future. Child maltreatment impacts health across an individual’s lifespan and is associated with a broad range of health problems including substance abuse, intimate partner violence, teenage pregnancy, anxiety, depression, suicide, diabetes, heart disease, sexually transmitted diseases, smoking and obesity. Significant adversity during childhood, such as child maltreatment, can cause toxic stress which can disrupt a child’s brain development. In the absence of protective factors, such as nurturing relationships with caregivers, these disruptions produce changes in the brain that can lead to difficulty learning and lifelong impairments in both physical and mental health. Child maltreatment is a problem that can be prevented, if communities take steps to promote positive development of children and families and prevent family violence. Research has shown that safe, stable, nurturing relationships and environments are fundamental to healthy child development, reduce the occurrence of child maltreatment, and can help protect children against the negative effects of child maltreatment and other adversity.

While North Carolina has taken many steps to prevent maltreatment and promote healthy families, more could be done to promote children’s positive development. Children spend the vast majority of their time at home, in early care and education settings, and in school. North Carolina’s child care star rating system has helped to increase the quality and safety of early care and education environments. Incorporating measures of learning environments that support children’s social and emotional development, language skills, and health could further raise the quality of child care settings. Schools, like early care and education settings, should be free of violence. The implementation of Positive Behavior Intervention and Support, an evidence-based program which all schools in North Carolina use, to support student performance and reduce behavior problems can help ensure safer schools. Eliminating corporal punishment in schools is another step towards ensuring North Carolina schools provide safe and supportive learning environments. North Carolina should continue to take steps to ensure that all children are able to grow up with the safe, stable, and nurturing relationships and environments they need to thrive.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Health Indicator</th>
<th>Current Year</th>
<th>Benchmark Year</th>
<th>Percent Change</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth Outcomes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>Number of infant deaths per 1,000 live births</td>
<td>7.0</td>
<td>7.9</td>
<td>-11.4%</td>
<td>Better</td>
</tr>
<tr>
<td></td>
<td>Percent of infants born weighing less than 5 lbs., 8 ozs (2,500 grams)</td>
<td>8.8</td>
<td>9.1</td>
<td>-3.3%</td>
<td>No Change</td>
</tr>
<tr>
<td></td>
<td>Percent of preterm births (before 37 weeks of pregnancy)</td>
<td>11.4</td>
<td>13.2</td>
<td>-13.6%</td>
<td>Better</td>
</tr>
<tr>
<td>Maternal Risk Factors</td>
<td></td>
<td>2013</td>
<td>2009</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Percent of babies born to women who smoke</td>
<td>10.7</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Percentage of births to mothers receiving late or no prenatal care</td>
<td>6.6</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Child Fatality</td>
<td></td>
<td>2013</td>
<td>2009</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of deaths (ages 0-17) per 100,000</td>
<td>56.5</td>
<td>65.4</td>
<td>-13.6%</td>
<td>Better</td>
</tr>
<tr>
<td></td>
<td>Number of deaths:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Motor Vehicle-related</td>
<td>87</td>
<td>114</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Drowning</td>
<td>23</td>
<td>28</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Fire/Burn</td>
<td>8</td>
<td>8</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Bicycle</td>
<td>0</td>
<td>1</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Suicide</td>
<td>34</td>
<td>35</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Homicide</td>
<td>41</td>
<td>36</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Firearm</td>
<td>42</td>
<td>46</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Poisoning (ages 10-17)</td>
<td>7</td>
<td>15</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>All Other Injury Deaths</td>
<td>49</td>
<td>33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child Abuse and Neglect</td>
<td></td>
<td>2013</td>
<td>2009</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of children:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Children investigated for child abuse or neglect</td>
<td>129,842</td>
<td>126,187</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Substantiated as victims of abuse or neglect</td>
<td>10,255</td>
<td>11,301</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Recommended services</td>
<td>20,052</td>
<td>23,479</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Confirmed child deaths due to abuse</td>
<td>19</td>
<td>16</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
Twenty years ago, NC Child and the North Carolina Institute of Medicine partnered to produce and disseminate the first North Carolina Child Health Report Card. The goal was to compile the latest data on leading indicators of child health and safety into an easy-to-understand document that highlights trends, enhances discussions about child well-being in North Carolina, and informs public policy decisions about investment to support a North Carolina in which every child can live a healthy, productive life.

By many measures, North Carolina's 2.2 million children are safer and healthier than they were a generation ago. A child born today is half as likely to die before his or her first birthday as a child born in the 1990s. Health insurance coverage has reached a historic high, providing more children access to the care they need to achieve and maintain good health. Teens are less likely to engage in behaviors that endanger their lives and their future health: after peaking in 1990, teen pregnancy rates have fallen to just one-third of previous levels; 86 percent of high school students report they do not smoke; and the percentage of students graduating on time from high school continues to climb.

“What gets measured gets done, what gets measured and fed back gets done well, what gets rewarded gets repeated.” —John E. Jones

This long-term progress in child well-being is not accidental, it is the direct result of intentional commitments by policymakers, advocates, practitioners, and local communities to strengthen critical services and implement policies that bolster child well-being. The data are clear: public policy decisions can profoundly affect children's chances of growing up healthy, safe, and educated. Enhanced safety measures like seatbelts and helmet regulations, expanded access to health insurance through NC Health Choice, and targeted prenatal care for women at risk of poor birth outcomes offer concrete evidence of the significant returns on investment generated for children and our state by data-informed public policy solutions.

Even as we celebrate the hard-earned improvements of the past two decades, we acknowledge this year's report contains disturbing trends that foreshadow future threats to children's development and their ability to lead healthy, productive lives. The percent of children living in poverty, a bellwether for current and future health, remains above the U.S. average at one in every four children (25 percent). More than one-third of adolescents and teens report being overweight or obese (36 percent), and sobering gaps in health outcomes by race and ethnicity persist across indicators.

At the time of the first report card, research linking the complex influence of social and demographic factors (income, education, and environments) with child health was still emerging. Today, a substantial body of evidence shows the communities and homes where children live, learn, and grow have a profound effect on lifelong health. Children thrive in safe, stable, and nurturing relationships and environments. Children born into poverty are more likely to experience developmental and other health problems, to accumulate health risks as they age, and to live in poverty as adults. Education and health outcomes are tightly intertwined, with success in school and the number of years of schooling impacting health throughout one's life. These links between health and other factors have expanded our understanding of how investments in health, education and family well-being are intertwined. Wise investments in children and families can lead to better health, future savings, and increased productivity.

Tackling the next generation of child health and safety challenges will require both a continued commitment to investing in safe, stable families and communities, as well as new strategies to address emerging threats to children's health and well-being. There's reason to be encouraged; North Carolina has a history of making investments to improve the health and well-being of children. Today we have a strong body of evidence on the types of programs and policies that are effective, which can be used to inform decision making. As decision-makers evaluate policies and practices to improve child health and well-being, the North Carolina Child Health Report Card will remain a resource to help inform key policy debates.
Data Sources 2014 Child Health Report Card

Access to Care and Preventive Health


Health Risk Behaviors


Death and Injury


Data Notes 2014 Child Health Report Card

1. Immunization is measured for children 19-35 months of age using the 4:3:3:1:3:3:1 measure. 4:3:1 plus full series Haemophilus influenzae type b (Hib-FS) vaccine, ≥3 doses of hepatitis B (HepB) vaccine, and ≥1 dose of varicella (Var) vaccine.
2. Screen time includes TV, videos, or DVDs OR playing video games, computer games or using the Internet.
3. Overweight is defined as a body mass index equal to or greater than the 85th percentile using federal guidelines; obese is defined as a body mass index equal to or greater than the 95th percentile.
4. Emerging tobacco products include electronic cigarettes, clove cigars, dissolvable tobacco products, flavored cigarettes or little cigars, hookahs or waterpipes, roll-your-own cigarettes, and snus.
5. Findings represent exclusive counts of reports investigated in a state fiscal year. The number substantiated includes those substantiated of abuse, neglect, or abuse and neglect.
6. Data for indicators followed by a + sign are fiscal or school year data ending in the year given. For example, immunization rates at school entry labeled 2010 are for the 2009-2010 school year.

Grades and Trends

Grades are assigned by a panel of health experts to bring attention to the current status of North Carolina children in salient indicators of health and safety. Grades are a subjective measure of how well children in North Carolina are faring in a particular area, and are not meant to judge the performance of the state agency or agencies providing the data or the service. Please note that several agencies have made a great deal of progress in recent years, which may not be reflected in these grades.

Data trends are described as “Better,” “Worse,” or “No Change.” Indicators with trends described as “Better” or “Worse” experienced a change of more than 5% during the period. A percentage change of 5% or less is described as “No Change.” Percent change and trends have not been given for population count data involving small numbers of cases. Due to data limitations, only the indicators for alcohol and drug use have been tested for statistical significance. Grades and trends are based on North Carolina’s performance year-to-year and what level of child health and safety North Carolina should aspire to, regardless of how we compare nationally.

Laila A. Bell from NC Child and Berkeley Yorkery and Adam Zolotor, MD from the North Carolina Institute of Medicine led the development of this publication, with valuable input from colleagues, child health experts, and many staff members of the North Carolina Department of Health and Human Services.

This project was supported by the Annie E. Casey Foundation’s KIDS COUNT project, and Blue Cross and Blue Shield of North Carolina Foundation. NC Child and the North Carolina Institute of Medicine thank them for their support but acknowledge that the findings and conclusions do not necessarily reflect the opinions of financial supporters.

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North Carolina’s future growth and prosperity depends on our ability to foster the health and well-being of our children. Child maltreatment is a significant public health problem that negatively impacts North Carolina’s future. Child maltreatment impacts health across an individual’s lifespan and is associated with a broad range of problems including substance abuse, intimate partner violence, teenage pregnancy, anxiety, depression, suicide, diabetes, heart disease, sexually transmitted diseases, smoking, and obesity.¹

In North Carolina, during 2013–2014, over 128,000 children were referred to local department of social services agencies for suspected abuse or neglect. Of these, over 36,000 children were recommended to receive additional services.² In 2012, 28 children in North Carolina died as a result of abuse or neglect by a parent or caregiver.³ Significant adversity during childhood, such as child maltreatment, can cause toxic stress which can disrupt a child’s brain development and other organ and metabolic systems. In the absence of protective factors, such as nurturing relationships with caregivers, these disruptions produce changes in the body and brain that can lead to difficulty learning and lifelong impairments in both physical and mental health. Additionally, child maltreatment has a significant financial impact on our medical and social services systems, with annual nationwide costs of child maltreatment estimated at approximately $80 billion, and $200,000 in total lifetime costs per victim.⁴

Child maltreatment is a problem that can be prevented if communities take steps to promote positive development of children and families and prevent family violence. Research has shown that safe, stable, nurturing relationships and environments are fundamental to healthy child development, and that they reduce the occurrence of child maltreatment and can help protect children against the negative effects of child maltreatment and other adversity.⁵ To address the problem of child maltreatment, the Centers for Disease Control and Prevention (CDC) developed the Essentials for Childhood Framework, through which communities committed to preventing child maltreatment can help children thrive and develop safe, stable, and nurturing relationships and environments. The framework’s foundation is that young children grow and develop through experiences and relationships with parents and other caregivers, and when children and their caregivers experience safe, stable, and nurturing relationships and environments they are able to mitigate the effects of potential stressors that could lead to child maltreatment.⁶

In 2013, North Carolina was one of five states to receive funding to implement the Essentials for Childhood Framework. As part of this work, the North Carolina Institute of Medicine (NCIOM), in collaboration with the North Carolina Department of Health and Human Services (DHHS) Division of Public Health (DPH), convened a statewide Task Force on Essentials for Childhood. The Task Force on Essentials for Childhood was tasked with studying and developing a collaborative, evidence-based, systems-oriented, public health-grounded strategic plan to reduce child maltreatment and secure family well-being in North Carolina. Using the CDC’s Essentials for Childhood Framework, the Task Force developed a collective, evidence-based state plan for reducing child maltreatment and securing child and family well-being for our state. Additionally, the Task Force examined progress on recommendations issued by the 2005 NCIOM Task Force on Child Abuse Prevention,⁷ and prioritized the services, programs, and policies needed to build on this progress.

The Task Force on Essentials for Childhood was chaired by Kenneth A. Dodge, PhD, founding director of the Duke Center for Child and Family Policy, and Katherine V. Pope, vice chair and program and policy committee co-chair of the Board of Directors for PCANC. The Task Force was comprised of 48 members, including representatives from DHHS, the Department of Public Safety’s Juvenile Justice section, the North Carolina General Assembly, health care providers, community-based service organizations, universities, and youth and parent organizations. The Task Force met 10 times between January and December 2014.
The CDC’s Essentials for Childhood lays out four goals that communities should strive to meet in order to promote safe, stable, nurturing relationships and environments between children and their caregivers. The Task Force on Essentials for Childhood used these goals as the organizing structure of their work and this report:

- **Goal 1: Raise awareness and commitment to promote safe, stable, nurturing relationships and environments and prevent child maltreatment**
- **Goal 2: Use data to inform actions**
- **Goal 3: Create the context for healthy children and families through norms change and programs**
- **Goal 4: Create the context for healthy children and families through policies**

The Task Force reviewed each of the steps within the four goals and made recommendations to support the implementation of each step. Taken together, the recommendations of the Task Force, if implemented, will ensure North Carolina has a comprehensive, coordinated system to support child and family well-being.

**GOAL 1: Raise Awareness and Commitment to Promote Safe, Stable, Nurturing Relationships and Environments and Prevent Child Maltreatment**

The Task Force on Essentials for Childhood envisions a statewide, collective effort for supporting North Carolina’s children and families. This effort should build upon the success and promise of the many people currently working to ensure that North Carolina’s children and families are healthy and productive. Current efforts to increase awareness and understanding of children’s development provide the building blocks for expanded focus around the effects of trauma and adverse childhood experiences. Additionally, there is a need for coordinated leadership at the state level to build support for investing in North Carolina’s children and families and to identify appropriate policy solutions.

**Recommendation 3.1: Establish Coordinated State Leadership Efforts to Address Essentials for Childhood Through a Collective Impact Framework (PRIORITY RECOMMENDATION)**

The North Carolina Department of Health and Human Services Division of Public Health (DPH), and Prevent Child Abuse North Carolina should establish membership and convene a Leadership Action Team, which will plan for and oversee investment in childhood and family programs to promote safe, stable, and nurturing relationships and environments and prevent child maltreatment.

**Recommendation 3.2: Support the Establishment and Continuation of Trauma-Informed Practices and Communities (PRIORITY RECOMMENDATION)**

The Leadership Action Team should establish a working group to examine research on brain development; the impact of trauma on development and behavior over the lifespan; and ways in which other states and communities have established trauma-informed practices in communities, schools, and among health care providers.

**GOAL 2: Use Data to Inform Actions**

Data plays a critical role in achieving the goals of the Task Force on Essentials for Childhood both by raising awareness of child maltreatment and for measuring progress—or lack thereof—towards providing safe, stable, and nurturing relationships and environments for children and ensuring economic opportunity and security for North Carolina’s families. Traditionally child maltreatment has been measured solely by data collected by Child Protective Services. Taking a public health approach to child maltreatment prevention requires a much broader view of child maltreatment. To get to this broader frame, data beyond the traditional measures of child maltreatment are needed. In order to better assess the well-being of children and families, more data is needed on their social-emotional, behavioral, and mental health, as well as on the community and societal contexts in which families live. Analyzing data from multiple sources will provide a clearer picture of child well-being and the systems that serve children, families, our communities, and our state.

**Recommendation 4.1: Establish a Child Data Working Group of the Leadership Action Team to Identify and Support Data Collection and Collaboration**

The Leadership Action Team should establish a child data working group tasked with reviewing existing child data systems, exploring options for integrating existing data systems, monitoring child maltreatment surveillance system efforts currently being piloted, and identifying critical data that is not currently collected. Additionally, the child data working group should identify indicators to be included in the Leadership Action Team’s annual Essentials for Childhood report.

**Recommendation 4.2: Gather Data on Social Norms around Children and Parenting**

The child data working group of the Leadership Action Team should explore and identify the most appropriate mechanism and funding source by which to measure public opinion and social norms around parenting, children, and families, and report back to the Leadership Action Team.

**Recommendation 4.3: Create an Online Data System for an Expanded Kindergarten Health Assessment**

The North Carolina Department of Public Instruction,
Department of Health and Human Services, North Carolina Pediatric Society, North Carolina Academy of Child Psychiatrists, North Carolina Academy of Family Physicians, and additional partners should develop an online data system for the Kindergarten Health Assessment that could be shared between health providers and schools and integrated into the Child Profile generated by the Kindergarten Entry Assessment. As part of this effort, the Kindergarten Health Assessment should be expanded to include prompts for addressing specific concerns, including developmental and behavioral concerns and health-related concerns.

GOAL 3: Create the Context for Healthy Children and Families through Norms Change and Programs

To provide support for families and children and prevent child maltreatment, the Task Force on Essentials for Childhood supports the promotion of the collective belief that we all share responsibility for children’s well-being. Individual members of a community have a role in developing neighborhoods, activities, and programs where people gather, interact, and get to know each other. Relationships formed through neighborhood associations, faith communities, and other community organizations can link families and provide support. Communities can promote positive norms around early childhood development, family support, and effective parenting behavior. As part of this work, communities and policymakers can support the implementation of evidence-based programs that have been tested and proven effective and focus on effective parenting and behavior management skills for parents and caregivers.

Recommendation 5.1: Promote Positive Community Norms Around Child Development and Parenting (PRIORITY RECOMMENDATION) The North Carolina Early Childhood Foundation should continue and expand their work on changing social norms through the First 2,000 Days campaign.

Recommendation 5.2: Foster Community Support for Healthy Children and Families The North Carolina Department of Health and Human Services, Department of Public Instruction, Prevent Child Abuse North Carolina, and North Carolina Partnership for Children should work towards incorporating the Strengthening Families Framework in state and local child maltreatment prevention efforts.

Recommendation 5.3: Support Implementation of Evidence-Based Programs to Prevent Child Maltreatment and Promote Safe, Stable, and Nurturing Relationships and Environments (PRIORITY RECOMMENDATION) The Leadership Action Team should convene a state Essentials for Childhood Evidence-Based Programs working group to coordinate and align infrastructure across evidence-based programs serving children and develop sustainable funding strategies.

Recommendation 5.4: Assess Potential Funding Strategies to Ensure Adequate Investment in Evidence-Based Programs to Prevent Child Maltreatment The Leadership Action Team should study existing alternative funding strategies for evidence-based program investment, examining the experience of South Carolina and other states.

Recommendation 5.5: Explore Incentivizing Outcomes Resulting from Evidence-Based Treatment Programs The North Carolina Division of Medical Assistance, in collaboration with Community Care of North Carolina, the Division of Mental Health, Developmental Disabilities, and Substance Abuse Services, and the Division of Public Health should identify opportunities to incentivize payment for outcomes resulting from evidence-based treatment programs, especially as quality of care is incentivized under reform of Medicaid in North Carolina.

Recommendation 5.6: Increase Funding for Evidence-Based and Evidence-Informed Programs Implemented by the Smart Start Network (PRIORITY RECOMMENDATION) The North Carolina General Assembly should increase appropriations by 5% per year to the Smart Start network targeted to support the implementation of evidence-based programs.

GOAL 4: Create the Context for Healthy Children and Families through Policies

Public policies have strong influences on our communities and environment. National, state, and local policies create the context in which children and families function. As part of their work, the Task Force examined state and agency-level policies and how they may influence and promote safe, stable, and nurturing relationships and environments for North Carolina’s children. The Task Force identified several areas in which policy approaches can enhance child development and educational success; reduce risk factors for child maltreatment and adverse childhood experiences; and improve families’ economic security and job opportunities.

Recommendation 6.1: Ensure that Child Care Centers Provide a High Quality, Nurturing Environment (PRIORITY RECOMMENDATION) The Division of Child Development and Early Education (DCDEE), in partnership with the Child Care Commission and the Department of Public Instruction Office of Early Learning, should continue to re-evaluate its quality star rating system and reimbursement system to identify high quality child care programs based on updated evidence and best practices. DCDEE, in partnership with others, should continue work to grow
a high quality and well-trained early care and education work force. The North Carolina General Assembly should enhance child care subsidies by ensuring a larger portion of eligible families receive subsidy payments.

**Recommendation 6.2: Enhance Care and Reimbursement Standards to Promote Children and Families’ Mental Health (PRIORITY RECOMMENDATION)** Community Care of North Carolina, and others, should establish guidelines for primary care clinicians for expanded screening of families with children for psychosocial risk factors and family protective factors. The Division of Mental Health, Developmental Disabilities and Substance Abuse Services, the Division of Medical Assistance, and others should support current work to increase integrated behavioral health care under Medicaid reform.


**Recommendation 6.4: Enhance Career Training and Education Opportunities to Promote Economic Security for Families** The North Carolina Community College System and other education partners should provide additional support for workforce development and skill building programs that increase families’ economic security and students’ preparation for the workforce.

**References**


**Acknowledgements:** The work of the Task Force would not have been possible without the hard work of the dedicated people who volunteered their time to serve on the Task Force and Steering Committee and the invaluable feedback and input of the rural community members who participated in meetings across the state.

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A copy of the full report, including the complete recommendations, is available on the North Carolina Institute of Medicine website, http://www.nciom.org.
North Carolina Institute of Medicine. In partnership with the Division of Public Health within the North Carolina Department of Health and Human Services Funded by the Centers for Disease Control and Prevention
Help Seniors Live Better, Longer: Prevent Brain Injury

If you are one of the millions of people in this country who provides care for an older adult — a parent, grandparent, other family member, or a close friend — you should learn about ways to prevent, recognize, and respond to traumatic brain injury or TBI. A TBI is caused by a bump or blow to the head that affects how the brain works. Falls are the leading cause of TBI.

To learn the signs and symptoms of TBI, visit www.cdc.gov/BrainInjuryInSeniors
It’s personal to you.

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