

# HEALING HANDS



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## Traumatic Brain Injury: Emerging Tools for Assessment and Care

*Traumatic brain injury and attendant cognitive deficits are an ongoing problem for people experiencing homelessness. Much like the chicken and egg quandary, determining the relationship between brain injury and homelessness can be difficult. Trauma survivors may have suffered brain injury as children through abuse or accident, or during military service. Without adequate assessment, continued follow up, cognitive rehabilitation, and supportive living conditions, many spiral into poverty and homelessness. People living on the streets or in shelters are often victims of accidents and violence that may cause new brain injuries or exacerbate old ones. This issue discusses the growth of research on traumatic brain injury, tools for assessment, and strategies for care.*

Traumatic brain injury (TBI) is a hot topic. Over the last several years, the amount of research and clinical literature about TBI has increased exponentially. Gordon and associates point out that over the past 20 years research in TBI rehabilitation focused on the impairments, secondary conditions, natural course of recovery, and tools to measure post-TBI function. Work concentrating on the efficacy of interventions, however, was limited.<sup>1</sup>

Today, the issues of accurate assessment and rehabilitation modalities are emerging.<sup>1-13</sup> Driven in part by the natural evolution of knowledge about TBI, the current emphasis on research, assessment tools, and clinical care is also motivated by the Departments of Defense (DOD) and Veterans Affairs (DVA), which in 1992 created a program that became the Defense and Veterans Brain Injury Center (DVBIC).<sup>12,14</sup>

Over 20% of veterans returning from the conflicts in Iraq and Afghanistan who are afflicted with TBI have benefited from clinical practice guidelines released in 2006 and from the four DVBICs across the nation that provide specialized care.<sup>5,12</sup> The use and success of these guidelines and treatment centers are important to clinicians serving homeless people because many veterans of past conflicts have spiraled into poverty and homelessness when they were not able to find care for ongoing cognitive problems. Once on the streets, “homeless individuals bear a disproportionate risk for severe head injury [in part] because they are more likely to be victimized by assaults, have higher propensity for risk taking, and have higher prevalence of antisocial personality disorder.”<sup>15</sup>

Anecdotal reports in the popular press (e.g., *New York Times*, *Wall Street Journal*), appearing almost weekly, have focused public attention on injuries and ongoing impairments associated with TBI. This heightened public awareness and more intensive focus on rehabilitation have had some positive results: Emergency medicine is now able to treat accident and trauma victims who would have died soon after their injuries. Neurobiological research continues to explore and explain how the

neurological system can heal and regenerate, while neurorehabilitation clinicians devise strategies for successful cognitive and behavioral therapy. Nevertheless, this expanding body of TBI knowledge has stimulated as many questions as answers.<sup>10,12,13</sup>

**DEFINITION** The Centers for Disease Control and Prevention (CDC) defines TBI as a disruption in the normal function of the brain caused by a blow or jolt to the head or a penetrating head injury. Although blows and jolts to the head don't always result in TBI, brain injury can range in severity from mild — marked by a change in mental status — to severe, which may include an extended period of unconsciousness or amnesia after injury.<sup>16</sup>

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**TBI is a disruption in the normal function of the brain caused by a blow or jolt to the head or a penetrating head injury (CDC).**

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Unfortunately, as the Gordon team points out, TBI terminology does not clearly describe the impairment, its treatment, or outcomes. Thus, “two individuals may have severe TBIs with equivalent periods of loss of consciousness or posttraumatic amnesia, but the complexity of the brain can result in ... different patterns of impairment and secondary conditions, and therefore, their rehabilitation needs may be quite different.”<sup>11</sup> Moreover, the heterogeneous nature of both patients and their injuries makes defining parameters for research and clinical application problematic, whether in terms of inclusion of subjects, length of treatment, level of outcome analysis, or supports needed for treatment adherence.<sup>1</sup>

Surviving brain injury is often just the beginning of the journey. When TBI necessitates hospitalization for emergent and acute care, clinicians use a variety of sophisticated scanning technologies (CT, DTI, MEG, PET, SPECT, MRI), the Glasgow Coma Scale (GCS), the Craig Handicap Assessment and Reporting Technique (CHART), or the International Classification of Diseases (ICD-9) to assess the patient's

injuries and progress,<sup>7,17</sup> and recommend additional rehabilitation. Current research using magnetic resonance spectroscopy to predict cognitive functioning of severely brain injured children based on neurometabolic changes is promising,<sup>18</sup> although “these patients in the pediatric ICU generally do very poorly — blind, deaf, no response to the environment — and have an average life expectancy of 7 years (personal communication, John P. Phillips, MD, Medical Director of The MIND Institute, University of New Mexico Health Sciences Center).

Patients who appear to have made full recovery often go on to suffer new sequelae months or years later.<sup>1,17,19</sup> In addition, those who sustain a mild TBI often appear unscathed and may not know why or how to deal with subsequent cognitive impairments.<sup>1,5,17</sup>

Until recently, few tools have been available to help identify TBI in individuals who were not initially treated, such as homeless people who present with memory loss and/or substance use disorders, school children with behavioral problems, prisoners, or veterans returning from conflict.<sup>17</sup> Many homeless people have multiple comorbid conditions, which makes untangling the complex web of symptoms to find underlying causes particularly difficult. Lacking biomarkers for mild TBI, clinicians must rely on self-report associated with structured, in-depth interview, which remains the “gold standard” for assessing prior TBI.<sup>2,4,6,8,17</sup>

**EPIDEMIOLOGY** In the United States, 1.4 million civilians sustain a TBI each year, according to current CDC statistics. Over a million are treated and released from an emergency department, 235,000 are hospitalized, and 50,000 die. Children under 14 years of age account for 435,000 of these emergency department visits, 37,000 hospitalizations, and over 2,600 deaths.<sup>16</sup> These numbers don't include individuals who suffer TBI but receive no care. Unless there are obvious signs of trauma, TBI symptoms are often subtle and may not appear at the time of the injury.

Leading causes of TBI in the civilian population include assaults (30%), falls (28%), and motor vehicle-traffic accidents (20%).<sup>16</sup> While these causes may lead to TBI in military settings as well, the impact of improvised explosive devices (IEDs) and other blasts may often result in TBI without external injuries.<sup>5,11,12</sup>

**LONG-TERM OUTCOMES AND COSTS** The CDC estimates that 2% of Americans (about 5.3 million) require assistance with activities of daily living because of TBI. Ongoing functional changes can affect thinking and memory, sensation, language, and emotions. TBI can also cause epilepsy and increase the risk of Alzheimer's disease, Parkinson's disease, and other age-related brain disorders.<sup>16</sup> In 2000, the estimated direct and indirect costs of TBI, including medical costs and lost productivity, totaled \$60 billion.<sup>16</sup>

Surveillance data indicate that children and adolescents have far greater vulnerability to brain injury than adults. Pediatric injury can result in significant and interrelated deficits in academic, social, and emotional functioning that sets the stage for later cognitive problems.<sup>10,19,20</sup> Unfortunately, because children were thought to “bounce back” from brain injury without intervention, clinicians have often discharged them without insisting on follow-up screenings over the course of months and years after their injuries.<sup>10,19,21</sup> Follow-up referrals of children with suspected TBI are even less likely for those who are economically disadvantaged.<sup>20,21</sup>

Realizing that many veterans of past conflicts have found reintegration into their previous home environments and jobs impossible, the DOD and DVA TBI Task Force have launched a number of research and clinical initiatives to make sure that soldiers returning from Iraq and Afghanistan get the best care possible.<sup>14</sup> In addition to these federal initiatives, all military facilities and the DVA are working to educate veterans' families and the civilian community about TBI.<sup>11,12</sup>

## Assessment Tools for Mild Traumatic Brain Injury

As noted in the DBVIC clinical practice guidelines, TBI has emerged as a significant cause of morbidity for veterans of the Iraq and Afghanistan conflicts.<sup>5</sup> Soldiers with severe and penetrating TBI can be triaged and treated immediately; but those with mild TBI may go undiagnosed, particularly in the heat of battle. With the added pressure of multiple deployments and the increased presence of IEDs, soldiers are at continued risk for concussion and possible brain injury.<sup>5</sup>

As Gordon and associates note, the population of individuals with TBI is extremely heterogeneous, comprising children, older adults, homeless individuals, soldiers, and young adults.<sup>1</sup> This diversity, compounded by imprecise metrics describing TBI assessment,

treatment and outcomes, makes comparative research difficult. Clinicians working in a broad range of health care facilities are looking for TBI assessment tools that are precise enough to guide interventions and result in better outcomes for their clients.

**Jennifer Highley, NP**, a board-certified nurse practitioner in psychiatry who has worked extensively with chronically homeless individuals in New York City, says many of her clients have been without a domicile for more than a year: “These folks represent 10% of the homeless population in New York. They cycle through hospitals, emergency departments, shelters, detox-rehabilitation facilities, and jails, receiving services and housing at enormous societal cost, as well as considerable cost to themselves.”

### Signs and Symptoms of Mild Traumatic Brain Injury

- Deficits in executive functioning: poor concentration, lack of organization, easily distracted, difficulty making decisions, slowed thinking, unable to finish tasks
- Deficits in short- and long-term memory
- Headaches
- Confusion
- Delayed reaction time
- Dizziness, balance problems
- Fatigue, loss of energy, tires easily
- Impulsivity
- Inappropriate responses
- Difficulty falling or staying asleep
- Easily annoyed, irritability
- Post Traumatic Stress Disorder (PTSD)

Eighty-two percent of Highley's clients have a history of head injuries, and 70% score lower than the 10<sup>th</sup> percentile on the RBANS (see below) with serious deficits in executive functioning in one area.<sup>2</sup> She believes neuropsychological screening should be a routine component of medical care for homeless people. "At the end of the day, my clients want to be able to function in the world."

When clients report childhood abuse, Highley asks, "Where were you beaten?" She's found the answers jarring. Her clients have suffered both severe and mild TBI, often without benefit of health care. One man told of being repeatedly hit in the head with a bed slat when he was a teenager.

TBI is a national problem, she observes, encompassing veterans of previous wars, homeless people who were abused as children, adult victims of domestic violence, and survivors of trauma perpetrated on the street or in prison.

**REPEATABLE BATTERY FOR THE ASSESSMENT OF NEURO-PSYCHOLOGICAL STATUS (RBANS)** The NYC housing application requires a psychosocial assessment and psychiatric evaluation. To document her clients' cognitive status, Highley started out using the Mini Mental State Examination, but found it wasn't a fine enough measure to assess their neuro-psychological impairments. Following the advice of Wayne Gordon, PhD, Mount Sinai Medical Center (MSMC), she adopted the RBANS, which measures attention, language, visuospatial and constructional abilities, and immediate and delayed memory. (For more information, go to: <http://harcourtassessment.com/>.)

"This is a comprehensive and unbiased tool that does not require the client to be able to read, write, or do math, which is very important considering that many have had a truncated education," says Highley. RBANS can be administered by a nurse practitioner or social worker in about 30 minutes.<sup>3</sup> It also serves as a neuropsychological screening battery when lengthier standardized assessments are impractical (for example, if clients do not have the stamina for 5 to 6 hours of tests, or, as in New York state, when Medicaid will only pay for 1 hour of testing per day).<sup>2</sup> In addition, the NYC Social Security Administration office recognizes RBANS test results as evidence of SSI applicants' level of impairment.

**MONTREAL COGNITIVE ASSESSMENT (MoCA)** This cognitive screening tool was designed as a rapid test for use by a variety of health clinicians to detect mild cognitive impairment. **Monica Cotelingham, MD**, Director of Psychiatry for Health Care for the Homeless in Baltimore, asked a neuropsychologist colleague about assessment tools for TBI and was told that local clinicians were using the MoCA (available along with administration and scoring instructions and normative data at <http://www.mocatest.org>).

#### **OHIO STATE UNIVERSITY TBI IDENTIFICATION METHOD (OSU TBI-ID)**

Based on the CDC framework, this method employs self-report instruments to collect information about TBI in populations that have not received medical treatment.<sup>8</sup> It is designed to identify individuals at high-risk for TBI and its complications retrospectively.<sup>8</sup> A structured interview elicits self-reports of brain injury over an individual's lifetime by first establishing recall of all injuries that needed or received medical attention and concentrating on:

- Injuries caused by a blow to the head or high-velocity forces,
- Altered consciousness and treatment received, and
- The most severe head injuries (3 or fewer) related to extent of altered consciousness or medical attention.

This type of survey provides a multi-dimensional history of the client's injuries, including severity, initial and persistent symptoms, functional limitations, client age at the time of injury, and time elapsed since the most recent injury.

#### **MINI MENTAL STATE EXAMINATION (MMSE)**

Other clinicians use the MMSE (<http://www.hartfordign.org>) in conjunction with in-depth interview techniques. **Lisa Thompson, APRN, BC**, at the Colorado Coalition for the Homeless (CCH) in Denver, sees many clients with cognitive deficits in her mental health practice. "Determining the cause of cognitive impairment is a complicated process. Many clients have multiple co-occurring issues, which contribute to impairment, including:

- Traumatization resulting in PTSD
- Axis I – Psychiatric disorders
- Active substance use disorders

CCH's intake protocol includes questions about head injury: "Have you ever been hit in the

head or knocked unconscious? Do you notice problems with memory? Do you have trouble focusing or concentrating?" Assessment also includes the MMSE.

Thompson says, "I may use the MMSE with my clients on several different occasions to monitor for changes and varying scores over time. In the same way, I review other aspects of their psychiatric evaluation for new symptoms. Comprehensive assessment of cognitive deficits often requires a multi-disciplinary approach in which all team members give input – including case managers, outreach teams, and behavioral health professionals. Evidence-based mental health care supports this type of inter-disciplinary model of care; however, it requires adequate funding. I feel very fortunate to work at an agency that provides wraparound services."

After a thorough assessment has been performed, Thompson documents results in the consultative letter supporting the client's SSI application. "Assisting homeless clients with TBI to qualify for and obtain SSI/SSDI benefits is one of the most important things we can do for them," adds Thompson. "Benefits open up a wide range of client services including supportive housing opportunities, case management, and ongoing rehabilitation services."

**Tina Carlson, APRN, BC**, a Psychiatric Clinical Nurse Specialist with the Albuquerque Health Care for the Homeless program, says a significant portion of their clients have TBI which preceded their homelessness. "We use a battery of questions that ask if the client has ever hit or been hit in the head, fallen, or been in a car accident. Then we get more specific: Has he ever lost consciousness? How's his memory? Does he hear voices? Feel moody or irritable?" Carlson finds it noteworthy that "even if a client's life is already going downhill, there is a sharp turn for the worse during the year following head injury, particularly without treatment."

Carlson says she doesn't find the MMSE especially helpful because she is more interested in how a client functions: how he or she is groomed, reads, manages transportation, and uses compensatory skills to offset memory loss. In many parts of the country (including Albuquerque), neurological assessment is not available to people without health insurance; and even those with Medicaid may have limited access to neuropsychiatrists. Nevertheless,

because SSI/SSDI disability benefits (which include health insurance) increase the likelihood that clients will receive the services they need, Carlson carefully documents the severity of their cognitive deficits and the need for a neuropsychological evaluation in letters supporting SSI/SSDI applications. If Social Security deems a neurological assessment to be warranted, it may be requested as part of a Consultative Evaluation.

Training tools developed by the SSI/SSDI Outreach, Access and Recovery (SOAR) initiative and the National Health Care for the Homeless Council provide valuable information that clinicians and advocates can use to help clients prepare successful SSI/SSDI applications.<sup>22,23,24</sup>

#### Resources for Preparing Successful SSI/SSDI Applications

- *Expediting Access to SSA Disability Benefits: Promising Practices for People Who Are Homeless.*<sup>22</sup>
- *Stepping Stones To Recovery: A Case Manager's Manual for Assisting Adults who are Homeless, with Social Security Disability and Supplemental Security Income Applications*<sup>23</sup>
- *Documenting Disability: Simple Strategies for Medical Providers*<sup>24</sup>

Carlson's main goal is to get her clients a case manager or into the Goodwill Industries program and then get them housed. If they are using addictive substances, she works on matching them with a residential program that will take active users with brain injury. "I also give them meds," she adds: "Tegretol for mood swings and antipsychotics or anti-depressants, as appropriate."

One of the best supports for Albuquerque HCH clients with TBI is the Psychosocial Rehabilitation (PSR) program, which meets for 3 hours every morning and provides a structured program with nutritional food, a daily routine, and bus passes. PSR emphasizes activities and outings that reinforce social and home skills. "Wrap-around services are so important for folks who get housing but don't have family support," stresses Carlson. "Supportive services keep these individuals from getting lost and falling through the cracks."

Once a homeless person with TBI is housed, wraparound services are absolutely essential, agrees **Carol Waldmann, MD**, an internist with the Boston Health Care for the Homeless

Program (BHCHP). "We elicit a good oral history from clients who do not present with acute injuries and ask if they've ever been hit on the head or knocked out rather than had a 'head injury.' Childhood abuse, subsequent assaults, and accidents are just as important as recent head trauma because past head injury is a risk factor for future TBI. Then we go on to inquire about ongoing symptoms such as confusion, dizziness, memory problems, seizures, irritability, and anger issues," she says.

In Boston, homeless clients are fortunate to be able to access neuropsychiatric services through the HCH clinic, hospital partnerships, or the BHCHP respite program. "It's harder to get our clients to attend neurorehab services because their memory, motivation, and organizational problems interfere with their follow through," Waldmann adds. "It's really best to engage clients when they're still unsheltered and can be matched to a case manager who can support them throughout and help them negotiate the process. Those with TBI also have behavioral, impulse control, and anger issues."

"The encouraging thing about working with clients with TBI," says Waldmann, "is that it makes a big difference when they have information about their condition and can connect to a support team that helps them negotiate their life circumstances, one little step at a time. Health care is the glue that keeps these folks from falling through the cracks, helps them overcome barriers, and prevents agitation. Once anxiety takes hold, it snowballs and they are not able to stay in control."

#### BRAIN INJURY SCREENING

**QUESTIONNAIRE (BISQ)** Walker and associates recently published results of their work with clients in substance abuse treatment who had co-occurring traumatic brain injury with loss of consciousness (TBI-LOC). Because prior research had linked TBI with alcohol and drug use and found that people who drink had a 4 times greater risk of brain injury, these investigators hoped to sensitize clinicians to the prevalence and complexity of these often coexisting conditions.<sup>6</sup>

This study used the Substance Abuse and Mental Health Services Administration (SAMHSA) adaptation of the Addiction Severity index (ASI) in conjunction with the BISQ, which was developed by Wayne Gordon and colleagues at MSMC to address the issue of

unidentified (or hidden) TBI (<http://www.mssm.edu/tbicentral>).

Distinguishing clinical problems associated with TBI from those associated with other disorders proved difficult. The BISQ specifies 100 symptoms intended to validate a self-report tool for brain injury; 79 of those items are symptoms of anxiety, depression, or other affective or thought disorders.<sup>6</sup>

Results showed 32% of surveyed clients reported one or more episodes of TBI-LOC, and those with two or more TBI-LOCs were more likely to exhibit:

- Anxiety
- Depression
- Hallucinations
- Suicidal thoughts and attempts
- Trouble controlling violent behavior
- Trouble concentrating or remembering
- More months of substance use

Of interest, clients reporting TBI-LOC were more likely to use marijuana and tranquilizers than alcohol, "suggesting a pattern of seeking an emotionally dampening experience," and again pointing to the complexity of clinical treatment.<sup>6</sup> The authors found the link between TBI-LOC and anxiety and depression to be of particular clinical significance, warranting more research to better understand the relationships.

#### TRAUMATIC BRAIN INJURY QUESTIONNAIRE (TBIQ)

In an effort to demonstrate the reliability and validity of the TBIQ to assess TBI in incarcerated adults in the U.S., Diamond and colleagues compared it to other scales administered concurrently or in previous research:<sup>4</sup>

- Neurobehavioral Rating Scale
- Barratt Impulsiveness Scale
- Center for Epidemiologic Studies Depression Scale
- Psychology Services Inmate Questionnaire
- Neuropsychological Dysfunction Scale
- Bass-Perry Aggression Questionnaire
- Personality Assessment Inventory

Research assistants were trained to administer the TBIQ in interviews that ranged from 5 to 30 minutes, depending on the extent of the subject's history of head injury.

Originally developed for use with soldiers, Part I of the TBIQ was augmented as a 12-item yes or no tool that reflects civilian experience and

common incidents associated with head injury, including car accidents, falls, sports injuries, assaults, gunshots, child abuse, and domestic violence.<sup>4</sup> If there are affirmative responses to any of the questions, the interviewer probes more deeply to determine age at injury, presence of LOC or posttraumatic amnesia, duration of LOC or memory problems, location of injury, medical treatment and follow up. Subsequent injuries are also explored. Part II of the TBIQ includes 15 cognitive or physical symptoms often associated with head injury (e.g., headaches, dizziness, trouble remembering) and assesses their frequency and severity.

Overall, the TBIQ test-retest validity for lifetime history of head injury proved satisfactory in a sample of 225 federal offenders. With refinements, it is hoped that this tool can be administered by prison staff at intake and used to explore correlations between head injury and subsequent psychological and behavioral difficulties such as criminal acts or substance use.<sup>4</sup>

### BRIEF TRAUMATIC BRAIN INJURY

**SCREEN (BTBIS)** Clinicians in the DVbic programs are pursuing numerous treatment options for military personnel who have experienced brain injury. Schwab and colleagues felt that the first step toward effective treatment for TBI was to identify those who would benefit from care.<sup>11</sup> To that end, they developed and validated the BTBIS.

The purpose of the tool is to assess for probable TBI on the basis of self-report of incidents and symptoms associated with brain injury. The one-page pencil and paper questionnaire takes approximately 3 to 4 minutes to complete and asks about injuries during deployment as well as

immediate and delayed symptoms. It is hoped that the BTBIS can prove efficient as a triage tool to expedite access to appropriate care, including assessment, diagnosis, treatment, or education.<sup>11</sup>

Noting that an interview by a clinician together with direct client observation is currently the accepted standard for a diagnosis of mild TBI, the Schwab team was careful to compare results of the BTBIS with three other accepted tools previously used to assess for TBI: the Quarterly Survey, the Computerized TBI Questionnaire, and the Neurobehavioral Symptom Inventory.<sup>11</sup>

A follow-up interview of subjects who self-reported TBI by a Master's level psychologist or by trained and supervised staff members was attempted immediately after the initial evaluation or by telephone within two weeks of the self-report. These interviews elicited additional details that were consistent with the BTBIS.

The Schwab study showed good concurrent validity of the BTBIS. Although this assessment tool identified more self-reported TBIs than the criterion questionnaires, follow-up interviews supported the BTBIS findings. Even though this research focused on soldiers returning from active duty, the BTBIS could be used with other populations.<sup>11</sup>

### PUBLIC HEALTH IMPLICATIONS

A number of agencies at the city, county, state, and federal levels are eager to understand and address this enormous and growing public health challenge. A recent article in the *New England Journal of Medicine* by clinicians at the Walter Reed Army Institute of Research calls attention to the health care costs of mild TBI,

which they characterize as marked by brief loss of consciousness or altered mental status.<sup>13</sup>

The report notes that 25% of the 1.5 million U.S. military personnel deployed to Iraq and Afghanistan have suffered serious head and neck trauma. After examining a cohort of 2,525 infantry soldiers 3 to 4 months after their return from a one-year deployment, the Hoge team concluded that "mild TBI was significantly associated with psychiatric symptoms, notably PTSD."<sup>13</sup> They also suggest using the term "concussion" instead of "mild traumatic brain injury," an approach that varies from other research.

Concurrently, the U.S. Government Accountability Office (GAO) released a VA Health Care Report on Mild Traumatic Brain Injury Screening and Evaluation.<sup>25</sup> Because TBI has emerged as a leading injury from the current conflicts, the VA implemented a screening tool for mild TBI in April 2007. This is a modified version of the DVbic's tool mentioned previously and consists of questions that the VA must ask all service members from the Afghanistan and Iraq conflicts when they seek treatment at a VA facility.

These reports add to the growing arsenal of diagnostic tools that can be used to identify TBI in diverse populations. Indeed, health services that employ a variety of diagnostic and therapeutic modalities may prevent current veterans from experiencing community reentry problems witnessed after previous conflicts which frequently resulted in homelessness. These tools may also enable brain-injured persons who are already homeless to stabilize more rapidly and receive rehabilitation to the extent possible.

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A new HCH Case Report on TBI & Homelessness is available in the Clinical Resources section of the National Health Care for the Homeless Council's website at: <http://www.nhchc.org/casereports.html>

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