Traumatic Brain Injury and Suicide: State of the Science and Implications for Assessment and Treatment

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Disclosure

This presentation is based on work supported, in part, by the Department of Veterans Affairs, but does not necessarily represent the views of the Department of Veterans Affairs or the United States Government.
“I think it took awhile before I realized and then when I started thinking about things and realizing that I was going to be like this for the rest of my life, it gives me a really down feeling and it makes me think like—why should I be around like this for the rest of my life?”

- VA Patient/TBI Survivor
6,085 US Service members have Died OEF/OIF (2001-2014)
6,644 Men and 157 Women

Roster of OEF/OIF/OND Veterans through November 30, 2013

1,759,433 OEF/OIF/OND Veterans have become eligible for VA health care since FY 2002

1,035,718 (~59%) Former Active Duty

723,715 (~41%) Reserve and National Guard

http://apps.washingtonpost.com/national/fallen/
COMBAT EXPERIENCES

Images from DOD: www.defense.gov
Service Total Suicides By Year

- Army
- Navy
- Air Force
- Marine Corps

• Traumatic Brain Injury - A bolt or jolt to the head or a penetrating head injury that disrupts the function of the brain. Not all blows or jolts to the head result in a TBI. The severity of such an injury may range from “mild” (a brief change in mental status or consciousness) to “severe” (an extended period of unconsciousness or amnesia) after the injury.

• A TBI can result in short- or long-term problems with independent function.
Bimodal Distribution and Highest Risk Age

Ages: 15 - 24

Ages: 65 - 75

Elderly adults – higher mortality rates
TBI and Gender

• Traumatic brain injury is more than twice as likely in males than in females
Alcohol/Drugs and TBI Acquisition

The greatest risk factors for traumatic brain injury:

Alcohol/drug use

An alcohol/drug disorder
Studies suggest that between 1/3 to slightly over 1/2 of persons with TBI are intoxicated at the time of injury and/or show a pre-injury history of alcohol abuse
Risk Factors for Sustaining a TBI also Risk Factors for Suicidal Behavior

- Alcohol/drugs
- Familial discord
- Low SES
- Unemployment
- Low educational status
- Psychiatric symptoms
- Antisocial/Aggressive behavior
- Previous TBI
# Injury Severity

<table>
<thead>
<tr>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altered or LOC&lt;30 minutes with normal CT and/or MRI</td>
<td>LOC&lt;6 hours with abnormal CT and/or MRI</td>
<td>LOC&gt;6 hours with abnormal CT and/or MRI</td>
</tr>
<tr>
<td>GCS 13-15</td>
<td>GCS 9-12</td>
<td>GCS&lt;9</td>
</tr>
<tr>
<td>PTA&lt;24 hours</td>
<td>PTA&lt;7 days</td>
<td>PTA&gt;7 days</td>
</tr>
</tbody>
</table>
Mild TBI Definition – American Congress of Rehabilitation Medicine

“Traumatically induced disruption of brain function that results in loss of consciousness of less than 30 minutes’ duration or in an alteration of consciousness manifested by an incomplete memory of the event or being dazed and confused.”
Mild TBI
Short- and Long-Term Effects
Common Mild TBI Symptoms

NOT to be confused with the injury itself

TBI is a historical event
Common Mild TBI/Postconcussive Symptoms

- Headache
- Poor concentration
- Memory difficulty
- Irritability
- Fatigue
- Depression
- Anxiety
- Dizziness
- Light sensitivity
- Sound sensitivity

Immediately post-injury 80% to 100% describe one or more symptoms

Most individuals return to baseline functioning within a year

Ferguson et al. 1999, Carroll et al. 2004; Levin et al. 1987
7% to 33% have persistent symptoms

Belanger et al., 2005
Screening Results: n=3,973

<table>
<thead>
<tr>
<th>Injury Status</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injured with TBI</td>
<td>907 (22.8)</td>
</tr>
<tr>
<td>Injured without TBI</td>
<td>385 (9.7)</td>
</tr>
<tr>
<td>Not injured</td>
<td>2,681 (67.5)</td>
</tr>
<tr>
<td><strong>Total Screened</strong></td>
<td>3,973 (100)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Injury Characteristics for Soldiers with TBI‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dazed or confused only</td>
</tr>
<tr>
<td>Had LOC* or could not remember the injury</td>
</tr>
<tr>
<td><strong>Total with TBI</strong></td>
</tr>
</tbody>
</table>

‡ TBI is defined by an alteration in consciousness, such as being dazed or confused, not remembering the injury event, and/or losing consciousness in the context of an injury
* LOC=loss of consciousness

Terrio et al., 2009
Ft. Carson:
Post-Deployment Data (n = 907)

Currently Symptomatic: Onset of Symptoms (n = 844)

Twelve months after injury, 31% of patients reported a psychiatric disorder, and 22% developed a psychiatric disorder that they had never experienced before. The most common new psychiatric disorders were depression (9%), generalized anxiety disorder (9%), posttraumatic stress disorder (6%), and agoraphobia (6%).
Rates of Major Depressive Disorder and Clinical Outcomes Following Traumatic Brain Injury

Charles H. Rosenblatt, MD
Josie E. Parker, MD, MPH
Nancy B. Trescot, MD
Peter E. Kudla, MD
Jane Burton, RN
Sofia S. Hildreth, MD

TBI (traumatic brain injury) is a major cause of disability in the United States and a significant injury among wounded soldiers. The acute medical treatments of TBI typically focus on physical and cognitive management. Post-concussive symptoms represent significant causes of disability. Major depressive disorder (MDD) may be the most common and disabling psychiatric condition in individuals with TBI. Poorer cognitive functioning, compromised memory, and greater functional disability predict poorer recovery. Higher rates of suicide attempts, and greater healthcare costs are thought to be associated with MDD after TBI.

Despite considerable research, the rates, predictors, and outcomes of MDD after TBI remain uncertain. Depression prevalence rates have ranged from 16% to 78%. Small sample size, selection, socioeconomic factors, and the use of measures without diagnostic validity and reliability are some factors that have limited studies of rates and correlates of TBI-related MDD. More definitive studies could increase efforts to improve recognition and treatment of this important secondary condition. Therefore, we sought to describe the rate of MDD during the first year after TBI, multivariate predictors of MDD, MDD-related comorbidities, and the trajectory of MDD in a year's quality of life outcomes to a large prospective study of consecutive patients hospitalized for complicated mild to severe TBI.

METHODS

This study was the multicenter phase of a clinical trial investigating the efficacy of escitalopram for MDD following TBI. The trial was designed to evaluate the efficacy of escitalopram for the treatment of major depression in TBI. The study consisted of a 12-week treatment phase, followed by a 12-week tapering phase. The primary outcome measures were the Hamilton Depression Rating Scale (HDRS) and the Montgomery-Asberg Depression Rating Scale (MADRS) at weeks 1 and 12.

Participants

Five hundred fifty-nine consecutively hospitalized adults with complicated mild to severe TBI.
During the first year after TBI, 297 of 559 patients (53.1%) met criteria for MDD at least once. The point prevalence of MDD was highest the first month after TBI.

Figure Legend:
Postinjury rate is the proportion of cases ascertained with major depressive disorder for the first time after traumatic brain injury at each assessment. The values underestimate the true rates because not all participants were assessed at each time. Error bars indicate 95% confidence intervals.
**Risk Factors vs. Warning Signs**

**Risk factor** is a characteristic at the biological, psychological, family, community, or cultural level that precedes and is associated with a higher likelihood of problem outcomes.

<table>
<thead>
<tr>
<th>Additional Warning Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Threatening to hurt or kill self</td>
</tr>
<tr>
<td>- Looking for ways to kill self</td>
</tr>
<tr>
<td>- Seeking access to pills, weapons, or other means</td>
</tr>
<tr>
<td>- Talking or writing about death, dying, or suicide</td>
</tr>
</tbody>
</table>

**ASK THE QUESTIONS**

1. Are you feeling hopeless about the present/future?
   - If yes, ask...

2. Have you had thoughts about taking your life?
   - If yes, ask...

3. When did you have these thoughts, and do you have a plan to take your life?

4. Have you ever had a suicide attempt?

**RESPONDING TO SUICIDE RISK**

- Ensure the patient's immediate safety and determine the most appropriate treatment setting.
- Refer for mental health treatment or ensure that a follow-up appointment is made.
- Inform and involve someone close to the patient.
- Limit access to means of suicide.
- Increase contact and make a commitment to help the patient through the crisis.

Provide the number of an ER/urgent care center to the patient and significant others.

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Protective Factor

- **Protective factor**: a characteristic associated with a lower likelihood of problem outcomes or that reduces the negative impact of a risk factor on problem outcomes.

https://www.youtube.com/watch?v=f03H_7bJUFA#t=11

Make The Connection
Shared experiences and support for Veterans
http://maketheconnection.net/
Participants: Sample of 13 Veterans with a history of TBI, and a history of clinically significant suicidal ideation or behavior.

Method: In-person interviews were conducted and data were analyzed using a hermeneutic approach.
Cognitive Impairment and Suicide

• “I knew what I wanted to say although I'd get into a thought about half-way though and it would just dissolve into my brain. I wouldn't know where it was, what it was and five minutes later I couldn't even remember that I had a thought. And that added to a lot of frustration going on....and you know because of the condition a couple of days later you can't even remember that you were frustrated.”

• “I get to the point where I fight with my memory and other things...and it’s not worth it.”
Emotional and Psychiatric Disturbances and Suicide

• I got depressed about a lot of things and figured my wife could use a $400,000 tax-free life insurance plan a lot better than....I went jogging one morning, and was feeling this bad, and I said "well, it's going to be easy for me to slip and fall in front of this next truck that goes by..."
Loss of Sense of Self and Suicide

• Veterans spoke about a shift in their self-concepts post-injury, which was frequently associated with a sense of loss
  – "...when you have a brain trauma...it's kind of like two different people that split...it’s kind of like a split personality. You have the person that’s still walking around but then you have the other person who’s the brain trauma."
Military TBI and Suicide
• 85 died by suicide
• Engaged in suicidal behavior long post-injury
• Prior to death
  – 59% communicated the desire to die
  – 25% had a history of post-injury suicidal behavior

• Risk Factors
  – 75% signs of depression
  – 30% severe depression
  – 19% “most probably in a psychotic state” at time of death
  – Pre-injury history of psychiatric and psychosocial difficulties and alcohol misuse
37% (14%) of 3,700 Veterans who sustained TBI died by suicide

Risk Factors
- Familial Distress
- Disability and subsequent inability to work
- Financial difficulties
Suicidal Ideation and Behaviours after Traumatic Brain Injury: A Systematic Review

Nazanin H. Bahrami,1,2 Graham K. Simpson,3,4 Lisa A. Brenner,1,2 Adam S. Hoffberg,1 and Alexandra L. Schneider1

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2 University of Colorado, School of Medicine, Aurora, Colorado, USA
3 Liverpool Brain Injury Rehabilitation Unit, Liverpool Hospital, Sydney, Australia
4 Rehabilitation Studies Unit, Sydney School of Medicine, University of Sydney, Australia

Traumatic brain injury (TBI) is prevalent among many populations and existing data suggest that those with TBI are at increased risk for death by suicide. This systematic review serves as an update to a previous review, with the aim of evaluating the current state of evidence regarding prevalence and risk of suicide deaths, post-TBI suicidal ideation and suicide attempts, and treatments to reduce suicide-related outcomes among TBI survivors. Review procedures followed the PRISMA statement guidelines. Of all, 1014 abstracts and 83 full-text articles were reviewed to identify 18 studies meeting inclusion criteria. Risk of bias for individual studies ranged from low to high, and very low studies were designed to examine a prior hypothesis related to suicide outcomes of interest. Overall, findings from this systematic review supported an increased risk of suicide among TBI survivors compared to those with no history of TBI. Evidence pertaining to suicidal thoughts and attempts was less clear, mainly due to heterogeneity of methodological quality across studies. One small randomized controlled trial was identified that targeted suicide prevention in TBI survivors. Further research is needed to identify the prevalence of post-TBI ideation and attempts, and to establish evidence-based suicide prevention practices among TBI survivors.

Keywords: suicide, suicide attempt, suicidal ideation, traumatic brain injury, systematic review

Suicide is a rare but devastating outcome post traumatic brain injury (TBI). However, death by suicide is only the tip of the iceberg, as much larger numbers of people with TBI make suicide attempts or report suicidal ideation. Historically, suicides after TBI were first documented among brain-injured Veterans from the First and Second World Wars (e.g., Russell, 1951). Early reports of civilian suicides were contained in broader TBI outcome studies conducted in the United Kingdom and Europe (e.g., Hesketh & Sipstead, 1970; Lewis, Marshall, & Roberts, 1979). Since then, continued efforts to empirically investigate the prevalence of suicide and the impact of TBI on suicide risk have contributed to a growing body of literature on suicide-related outcomes among TBI survivors. Although studies examining prevalence of suicidal ideation, behaviour and death by suicide are not plentiful, they have been conducted in diverse settings, and the findings are consistent with the theoretical underpinnings of suicide.

KQ1. Among adult survivors of TBI, what is the association between history of TBI and post-TBI death by suicide, suicide attempts or suicidal ideation? KQ1 specifically investigated the prevalence of the suicidal behaviours (i.e., death by suicide, suicide attempts and suicidal ideation) and the extent to which the presence of TBI increased risk for suicidal thoughts and behaviours.

KQ2. What interventions are effective in reducing suicide-related outcomes in adult survivors of TBI?
January 2007 – October 2012

1014 Abstracts
83 Full Text

16 studies
n=5 death
n=8 SA/SI
n=3 treatment
5 Studies

Purposes of the studies varied
Individuals who received care between FY 01 and 06

Analyses included all patients with a history of TBI (n = 49,626) plus a 5% random sample of patients without TBI (n = 389,053)

Suicide - National Death Index (NDI) compiles death record data for all US residents from state vital statistics offices

TBI diagnoses of interest were similar to those used by Teasdale and Engberg
Suicide by TBI Severity – VHA Users FY 01-06

- 12,159 with concussion or cranial fracture, of which 33 died by suicide
- 39,545 with cerebral contusion/traumatic intracranial hemorrhage of which 78 died by suicide
- Of those with a history of TBI, 105 died by suicide

Challenges associated with this type of research and need for collaboration (~8 million records reviewed)
Cox proportional hazards survival models for time to suicide, with time-dependent covariates, were utilized. Covariance sandwich estimators were used to adjust for the clustered nature of the data, with patients nested within VHA facilities.

**ICD-9 codes:**
1) concussion (850), cranial fracture—fracture of vault of skull (800), fracture of base of skull (801), and other and unqualified skull fractures (803)
2) cerebral laceration and contusion (851); subarachnoid, subdural, and extradural hemorrhage after injury (852); other and unspecified intracranial hemorrhage after injury (853); and intracranial injury of other and unspecified nature (854).
<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>All</th>
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<th>All</th>
<th></th>
<th>All</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Col%</td>
<td>N</td>
<td>Col%</td>
<td>N</td>
<td>Col%</td>
</tr>
<tr>
<td>VHA users with any TBI (combined)</td>
<td>49,626</td>
<td>100</td>
<td>105</td>
<td>100</td>
<td>49,521</td>
<td>100</td>
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<td>Substance abuse</td>
<td>8,368</td>
<td>16.86</td>
<td>32</td>
<td>30.48</td>
<td>8,336</td>
<td>16.83</td>
</tr>
<tr>
<td>Bipolar I/II</td>
<td>2,265</td>
<td>4.56</td>
<td>10</td>
<td>9.52</td>
<td>2,255</td>
<td>4.55</td>
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<tr>
<td>MDD</td>
<td>4,464</td>
<td>9</td>
<td>24</td>
<td>22.86</td>
<td>4,440</td>
<td>8.97</td>
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<td>Other depression, no MDD</td>
<td>7,616</td>
<td>15.35</td>
<td>23</td>
<td>21.9</td>
<td>7,593</td>
<td>15.33</td>
</tr>
<tr>
<td>Other anxiety</td>
<td>4,326</td>
<td>8.72</td>
<td>16</td>
<td>15.24</td>
<td>4,310</td>
<td>8.7</td>
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<tr>
<td>PTSD</td>
<td>4,880</td>
<td>9.83</td>
<td>23</td>
<td>21.9</td>
<td>4,857</td>
<td>9.81</td>
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<tr>
<td>Schizophrenia/schizoaffective disorder</td>
<td>2,287</td>
<td>4.61</td>
<td>6</td>
<td>5.71</td>
<td>2,281</td>
<td>4.61</td>
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<tr>
<td>VHA users with concussion/fracture</td>
<td>12,159</td>
<td>100</td>
<td>33</td>
<td>100</td>
<td>12,126</td>
<td>100</td>
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<tr>
<td>Substance abuse</td>
<td>2,087</td>
<td>17.16</td>
<td>9</td>
<td>27.27</td>
<td>2,078</td>
<td>17.14</td>
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<td>Bipolar I/II</td>
<td>588</td>
<td>4.84</td>
<td>2</td>
<td>6.06</td>
<td>586</td>
<td>4.83</td>
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<td>MDD</td>
<td>1,198</td>
<td>9.85</td>
<td>10</td>
<td>30.3</td>
<td>1,188</td>
<td>9.8</td>
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<td>Other depression, no MDD</td>
<td>1,831</td>
<td>15.06</td>
<td>7</td>
<td>21.21</td>
<td>1,824</td>
<td>15.04</td>
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<td>Other anxiety</td>
<td>1,148</td>
<td>9.44</td>
<td>7</td>
<td>21.21</td>
<td>1,141</td>
<td>9.41</td>
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<tr>
<td>PTSD</td>
<td>1,376</td>
<td>11.32</td>
<td>7</td>
<td>21.21</td>
<td>1,369</td>
<td>11.29</td>
</tr>
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<td>Schizophrenia/schizoaffective disorder</td>
<td>519</td>
<td>4.27</td>
<td>1</td>
<td>3.03</td>
<td>518</td>
<td>4.27</td>
</tr>
<tr>
<td>VHA users with cerebral contusion/traumatic intracranial hemorrhage</td>
<td>39,545</td>
<td>100</td>
<td>78</td>
<td>100</td>
<td>39,467</td>
<td>100</td>
</tr>
<tr>
<td>Substance abuse</td>
<td>6,728</td>
<td>17.01</td>
<td>25</td>
<td>32.05</td>
<td>6,703</td>
<td>16.98</td>
</tr>
<tr>
<td>Bipolar I/II</td>
<td>1,802</td>
<td>4.56</td>
<td>8</td>
<td>10.26</td>
<td>1,794</td>
<td>4.55</td>
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<td>MDD</td>
<td>3,490</td>
<td>8.83</td>
<td>17</td>
<td>21.79</td>
<td>3,473</td>
<td>8.8</td>
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<tr>
<td>Other depression, no MDD</td>
<td>6,142</td>
<td>15.53</td>
<td>17</td>
<td>21.79</td>
<td>6,125</td>
<td>15.52</td>
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<tr>
<td>Other anxiety</td>
<td>3,377</td>
<td>8.54</td>
<td>11</td>
<td>14.1</td>
<td>3,366</td>
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<td>PTSD</td>
<td>3,757</td>
<td>9.5</td>
<td>17</td>
<td>21.79</td>
<td>3,740</td>
<td>9.48</td>
</tr>
<tr>
<td>Schizophrenia/schizoaffective disorder</td>
<td>1,869</td>
<td>4.73</td>
<td>5</td>
<td>6.41</td>
<td>1,864</td>
<td>4.72</td>
</tr>
</tbody>
</table>
# Suicide Attempt

## TABLE 3
Prevalence of Suicide Attempts (SA) After TBI

<table>
<thead>
<tr>
<th>Source</th>
<th>Design</th>
<th>Sample/setting</th>
<th>Sample sex/age</th>
<th>TBI severity</th>
<th>Age</th>
<th>M (SD) – 30.30 (11.57)</th>
<th>Medical record review, clinical determination of presence of SA, post-TBI</th>
<th>Time-post injury</th>
<th>Prevalence of SA</th>
<th>Risk of bias (category of bias)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breshears et al., 2010</td>
<td>Retrospective cross-sectional</td>
<td>N = 154</td>
<td>149M, 5F</td>
<td>Mild 42</td>
<td>27.3%</td>
<td>28.6%</td>
<td>62.4%</td>
<td>14 yrs post</td>
<td>7.1%</td>
<td>Rating: moderate risk of bias</td>
</tr>
<tr>
<td>Veteran, United States</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Outcome assessors not blinded to exposure (DB) Use of keyword searches instead of diagnostic codes to classify SA (DB) Limited to SA that occurred within 2 years post diagnostic evaluation (DB)</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Potential sources of bias include selection bias (SB), detection bias (DB), performance bias (PB), reporting bias (RB), attrition bias (AB), confounding (CON), and precision (PRE).</td>
</tr>
<tr>
<td>Gutierrez et al., 2008</td>
<td>Retrospective case-series</td>
<td>N = 22</td>
<td>21M, 1F</td>
<td>Mild 1</td>
<td>4.5%</td>
<td>50.0%</td>
<td>45.5%</td>
<td>Mdn = 15</td>
<td>27.3%</td>
<td>Rating: moderate risk of bias</td>
</tr>
<tr>
<td>Veteran, United States</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Those whose hospitalisations occurred prior to computerised records were not included (SB) Outcome assessors not blinded to exposure (DB) Validated measure of SI not used (DB) Data regarding SI limited to hospital discharge records (DB)</td>
</tr>
</tbody>
</table>

TBI: Traumatic Brain Injury; Mod, Moderate; Sev, Severe; M, Male; F, Female; H’x, History; IP, Inpatient; M, Mean; Mdn, Median; NA, Not Applicable; SD, Standard deviation; yrs, years.

* Determined using the Taxonomy of Study Design Tool (Hartling et al., 2010).

** RTI Risk of Bias tool (Viswanathan & Berkman, 2012); potential sources of bias include selection bias (SB), detection bias (DB), performance bias (PB), reporting bias (RB), attrition bias (AB), confounding (CON), and precision (PRE). **

2 studies – both retrospective
Suicide Ideation

2 studies – both retrospective

<table>
<thead>
<tr>
<th>Source</th>
<th>Design</th>
<th>Sample/setting</th>
<th>Sample sex/age</th>
<th>Injury severity</th>
<th>SI source/ time frame</th>
<th>Time-post injury</th>
<th>Prevalence of SI</th>
<th>Risk of bias (category of bias)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsiaoussides et al., 2011</td>
<td>Retrospective</td>
<td>Festival, United States</td>
<td>N = 356</td>
<td>Mild</td>
<td>Score ≥ 1 on SI item on BDHI last 2 weeks</td>
<td>M (SD) = 5.9 (9.2) yrs</td>
<td>28.3%</td>
<td>Rating: low risk of bias (outcome assessors not blinded to exposure (DB)) (single-item measure of SI not validated (DB))</td>
</tr>
<tr>
<td>Gutierrez et al., 2008</td>
<td>Retrospective</td>
<td>case series, United States</td>
<td>N = 22</td>
<td>Mild</td>
<td>Reference to suicide ideation in psychiatric discharge summaries, post-TBI</td>
<td>Mdn = 15 yrs</td>
<td>72.7%</td>
<td>Rating: moderate risk of bias (data regarding SI limited to hospital discharge records (DB))</td>
</tr>
</tbody>
</table>

TBI, Traumatic Brain Injury; Mod, Moderate; Sev, Severe; M, Male; F, Female; BDHI, Beck Depression Inventory II; M, Mean; SD, Standard deviation; Mdn, Median; H’x, History; IP, Inpatient; NA, Not Applicable; yrs, years.

* Determined using the Taxonomy of Study Design Tool (Harling et al., 2010).

**RTI Risk of Bias tool (Yin et al., 2012); potential sources of bias include selection bias (SB), detection bias (DB), performance bias (PB), reporting bias (RB), and attrition bias (AB), confounding (CON), and precision (PRE).
### Treatment

<table>
<thead>
<tr>
<th>Source</th>
<th>Design</th>
<th>Sample, setting</th>
<th>Sex, age</th>
<th>Injury severity/time post injury</th>
<th>Primary outcome, intervention</th>
<th>Measure of suicide ideation (SI)</th>
<th>Attrition, Tx Outcome</th>
<th>Risk of Bias (category of bias)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simpson et al., 2011</td>
<td>RCT</td>
<td>N = 17, Brain injury community rehabilitation service</td>
<td>16M, 1F</td>
<td>Age M (SD) 39.7</td>
<td>Hopelessness, Beck Hopelessness Scale 20h manualised Group CBT programme, 20 hours</td>
<td>16 complete</td>
<td>Rating: low risk of bias</td>
<td></td>
</tr>
<tr>
<td><strong>Civilian, Australia</strong></td>
<td></td>
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<td></td>
<td>PEDro Rating: 8/10</td>
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<td>Therapists and patients not blinded to treatment condition</td>
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<td></td>
<td>Small sample limited power to detect treatment effect for SI (PREC)</td>
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<td><strong>Post-Tx</strong></td>
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<td>N S repeated measures analysis</td>
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<td>Rating: low risk of bias</td>
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<td>PEDro Rating: 7.8 (10.7)</td>
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<td>Pre-Tx 5.1 (8.9)</td>
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<td>Rating: low risk of bias</td>
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<td>Specific suicide ideation values NR</td>
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<td>N S repeated measures analysis</td>
</tr>
<tr>
<td>Rapoport et al., 2008</td>
<td>Before-After Study</td>
<td>N = 65, Mild-moderate TBI clinic, tertiary trauma care centre</td>
<td>38M, 27F</td>
<td>Age M (SD) 39.7</td>
<td>Depression First wave, n = 29 fixed dose citalopram, 20 mg/day, 6 weeks Second wave, n = 36 flexible dose citalopram, Start 20 mg/day, titrating to max. 50 mg/day, 10 wks</td>
<td>54 complete</td>
<td>Rating: uncertain risk of bias</td>
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<td><strong>Civilian, Canada</strong></td>
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<td>Outcome assessors not blinded to intervention (DB)</td>
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<td>Single-item measure of SI not validated (DB)</td>
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<td>Numeric values for SI not reported (RB)</td>
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<td>Impact of loss to follow-up not assessed (AB)</td>
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<td>Partially accounted for important confounders (CON)</td>
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<td><strong>Post-Tx</strong></td>
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<td>N S repeated measures analysis</td>
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<td>Rating: high risk of bias</td>
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<td>Unclear if eligibility criteria was uniformly applied across patients (SB)</td>
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<td>Outcome assessors not blinded to intervention (DB)</td>
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<td>Single item measure of SI not validated (DB)</td>
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<td>Important aspects of the intervention not described (PB)</td>
</tr>
</tbody>
</table>

3 studies – 1 RCT and 2 Before and After Studies
Primary outcome measure:  
Hopelessness

Secondary outcome measures:  
Suicidal ideation and depression
Hope, self-esteem, problem solving

Participants who completed the WtoH program would report a significant reduction in their levels of hopelessness compared to waitlist controls.

Treatment group would demonstrate significant reductions in suicidal ideation and depression, and increased social problem-solving, self-esteem and hopefulness in comparison to the waitlist controls.
Summary

• Robust evidence of the association between TBI and suicide
• Dearth of research regarding the prevalence of SI and SA among those with TBI
• 1 RCT
Limitations of Current Research

- Statistical power
- Lack of appropriate comparison group
- Many studies did not use psychometrically sound tools to measure outcomes of interest
- Few studies controlled for important confounding variables
- Variability noted in exposure and case ascertainment of TBIs and controls
- Few studies where SI or SA was primary outcome
The IOM report supports a Mental Health Intervention Spectrum


Universal preventive interventions take the broadest approach, targeting “the general public or a whole population that has not been identified on the basis of individual risk” (O'Connell, 2009). Universal prevention interventions might target schools, whole communities, or workplaces.

Selective preventive interventions target “individuals or a population sub-group whose risk of developing mental disorders [or substance abuse disorders] is significantly higher than average”, prior to the diagnosis of a disorder (O'Connell, 2009). Selective interventions target biological, psychological, or social risk factors that are more prominent among high-risk groups than among the wider population.

Indicated preventive interventions target “high-risk individuals who are identified as having minimal but detectable signs or symptoms foreshadowing mental, emotional, or behavioral disorder” prior to the diagnosis of a disorder (IOM, 2009). Interventions focus on the immediate risk and protective factors present in the environments surrounding individuals.

Suicide is a behavior not a disorder
Suicide Prevention Intervention Spectrum

Upstream Prevention
- Anti-Stigma
- Mental Health Literacy (Social Media, Tales of Triumph videos, Connectedness (eCards, caring texts, social media))

Intervention
- Screening (18-point head inspection)
- Self-Help (self-help tools, Rich’s List, hope kit)

Crisis Response/Postvention
- Professional referrals (HelpPro, Rich’s List, tele-therapy)
- Crisis response (Crisis Line, about someone)
- Suicide Bereavement Support Services

http://sallyspencertonstomas.blogspot.com/2014/03/mantherapy-20.html
Depression in adults with a chronic physical health problem. Treatment and management - stepped care model

<table>
<thead>
<tr>
<th>Focus of the Intervention</th>
<th>Nature of the Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP 4: Severe and complex(^a) depression; risk to life; severe self-neglect</td>
<td>Medication, high-intensity psychological interventions, electroconvulsive therapy, crisis service, combined treatments, multiprofessional and inpatient care</td>
</tr>
<tr>
<td>STEP 3: Persistent subthreshold depressive symptoms or mild to moderate depression with inadequate response to initial interventions; moderate and severe depression</td>
<td>Medication, high-intensity psychological interventions, combined treatments, collaborative care(^b) and referral for further assessment and interventions</td>
</tr>
<tr>
<td>STEP 2: Persistent subthreshold depressive symptoms; mild to moderate depression</td>
<td>Low-intensity psychosocial interventions, psychological interventions, medication and referral for further assessment and interventions</td>
</tr>
<tr>
<td>STEP 1: All known and suspected presentations of depression</td>
<td>Assessment, support, psychoeducation, active monitoring and referral for further assessment and interventions</td>
</tr>
</tbody>
</table>

---

A Randomized Controlled Trial of Exercise to Improve Mood After Traumatic Brain Injury

Jacoine M. Hoffman, PhD, Kathleen P. Ball, MD, Janet M. Dowell, PhD, James Behr, MD, Erin C. Dunn, PhD, Sreyaa Dilmot, PhD, Charles H. Bombarde, PhD

Objective: To test the hypothesis that a structured aerobic exercise regimen would decrease the severity of depressive symptoms in people with traumatic brain injury (TBI) who reported at least mild depression severity at baseline.

Design: Prospective, randomized, controlled trial.

Setting: Community gymnasium.

Participants: Subjects with a history of a prior TBI (6 months to 5 years post-injury), recruited from the community. Inclusion criteria included scoring ≥5 on the Patient Health Questionnaire-9. Subjects were excluded if they were non-English speakers, had a medical condition precluding exercise, had significant illnesses, regularly exercised, or could not use standard aerobic exercise equipment.

Interventions: Weekly supervised exercise sessions over a 15-week period consisting of education, warm-up, 30 minutes of aerobic exercise, and cool down. The exercise intensity was adjusted to reach a heart rate goal of 60% of the participant's estimated maximal heart rate.

Main Outcome Measurement: BackDepression Inventory (BDI) comparing exercise to control groups. Post-test analyses compared groups exercising ≥30 minutes or <30 minutes per week.

Results: Between-group comparisons at 10 weeks revealed no difference between groups on the BDI (P = .250). For the groups divided by minutes exercised per week, the high-activity group had significantly better depression scores than those in the low-activity group (P = .033).

Introduction

Traumatic brain injury (TBI) is a major cause of disability in the United States and represents a serious public health issue with almost 1.7 million people sustaining traumatic injuries each year [1, 2]. This figure may underestimate the true incidence because many cases of mild TBI are never reported to hospitals or even admitted to emergency departments. Emotional distress and depression commonly occur after a brain injury [3]. Estimates of the rate of depression after TBI vary substantially ranging from 6% to 77% [4–6]. In a recent rigorous study of depression after TBI, Bambauer and colleagues [7] examined mood disorders in 559 TBI patients admitted to a trauma hospital. Subjects were assessed monthly for 6 months then at 12, 18, and 24 months after TBI. Fifty-three percent of the sample met Diagnostic and Statistical Manual of Mental Disorders (DSM) criteria for major depression as some point during the first year after TBI. Depression is not a transient phenomenon for those with TBI. The risk for depression remains elevated for decades after the TBI [8, 9]. Mild TBI is associated with depression at comparably high levels to more severe TBI [10].

Results: Between-group comparisons at 10 weeks revealed no difference between groups on the BDI (P = .250). For the groups divided by minutes exercised per week, the high-activity group had significantly better depression scores than those in the low-activity group (P = .033).
SUICIDE PREVENTION INTERVENTION SPECTRUM FOR THOSE WITH TBI

TREATMENT AND MANAGEMENT - STEPPED CARE MODEL FOR THOSE WITH TBI AT HIGH RISK FOR SUICIDE

What might these look like??
Evidence-based assessment practice: Who is our population of interest?

What are we measuring?
- Suicidal ideation
- Suicidal behavior
- Depression
- Hopelessness
- Function
- Participation
- Belongingness
- Burdensomeness
Indicated Suicide Prevention Intervention or Treatment?
## Behavioral Activation

### TABLE 1 Window to Hope program

<table>
<thead>
<tr>
<th>N</th>
<th>Session title</th>
<th>Core session goal/s</th>
<th>Underlying principles</th>
<th>Key content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Getting started</td>
<td>Group participants get to know each other, introduce overall program theme</td>
<td>Group formation</td>
<td>Ice breaker, identifying feelings, rating impact of injury, rating</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>challenges in maintaining a sense of hope</td>
</tr>
<tr>
<td>2</td>
<td>Living a positive lifestyle</td>
<td>Examine the relationship between affect and lifestyle factors</td>
<td>Behavioural activation</td>
<td>Introduce Positive Lifestyle incorporating Eating, Activity, Sleep and</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Exercise (PLEASE) model</td>
</tr>
</tbody>
</table>

(MIRECC VISN 19 ROCKY MOUNTAIN NETWORK)
## Cognitive Restructuring

<table>
<thead>
<tr>
<th>3</th>
<th>Thoughts and feelings</th>
<th>Learn about the relationship between thoughts and feelings</th>
<th>Socialization to CBT&lt;sup&gt;28&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>4, 5</td>
<td>Take another look (I and II)</td>
<td>To examine how cognitive restructuring can ameliorate distress</td>
<td>Cognitive restructuring&lt;sup&gt;28&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Learning about how thoughts and feelings are connected, changing my thinking style</td>
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<td>Negative self-talk cycle, breaking the negative self-talk by using the Stop Revive Survive model (Stop the thought, Revive—take 4 deep breaths, Survive—use a self-affirmation statement)</td>
</tr>
<tr>
<td>Page</td>
<td>Problem-Solving</td>
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</tbody>
</table>
| 6,7  | Problem-solving (I and II)  
To develop a systematic approach to solving problems |
| 8    | Problem-solving and recovery after TBI  
To develop skills to address the existential challenge associated with the extent of postinjury recovery |
|      | Problem solving  
Introducing the model how to be a STAR (Spot the problem, Think of options, Act on the best one, Review the outcome)  
Problems associated with recovery after TBI (trying to get back to the way things were before the injury), Introducing the model “Ask the Coach” and the 4 plays: (1) doing the same thing in a different way, (2) doing something else that meets the same need, (3) breaking a large goal down into smaller steps, (4) if goal out of reach, choosing something else to focus on) |
<p>|      | Compensatory techniques |</p>
<table>
<thead>
<tr>
<th></th>
<th>Building hope</th>
<th>To identify means of building hope after TBI, develop self-esteem</th>
<th>Relapse prevention$^{28}$ Posttraumatic growth$^{29}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Building hope</td>
<td>Making meaning of the TBI, positive expectancy, and building connections</td>
<td>Continue work on model for hope—building connections, having a sense of purpose, expecting good things to happen</td>
</tr>
</tbody>
</table>
Building Hope – 3 Legged Stool

Valuing Our Self
EVERYDAY HERO

Feeling a Connection
Sense of Purpose
Working Towards Good Things Happening
Selective Suicide Prevention Intervention?
Concussion Coach Mobile App

Learn about:
- concussions, related symptoms, and treatment
- ways to improve concentration, thinking, and memory
- types of headaches, how to assess, and available treatments
- sleep and tools to help manage sleep problems
- symptoms of anxiety and PTSD and the relationships to concussions
- irritability and tips to help manage it

Select a coping tool, or begin by identifying a symptom and indicating your distress from 0 to 10. Based on your rating you will be offered a tool for crisis management or for your specific symptom. Rate your distress again after using the tools and receive feedback.

Give a thumbs up or down to each tool, making it more or less likely to come up again.

Evaluate your symptoms with a self-assessment and receive interpretive feedback, including symptom severity and information about how your score compares to your last assessment.

View previous assessments on a line graph and schedule reminders to take it in the future.

Set goals to keep yourself motivated, track your symptoms and what has been effective in managing them in the Wellness Journal, make a plan to reduce isolation by selecting social activities and adding them to your calendar, and learn about smartphone features that may make it easier to keep up with daily activities and help with recovery.

Connects user with public and private resources to contact when support is needed, information to help user find professional care, and links for more extensive education.

Concussion Coach was a collaborative effort between the Department of Veterans Affairs Rehabilitation & Prosthetic Services, the Department of Veterans Affairs National Center for PTSD (NCPTSD), and the Department of Defense National Center for Telehealth and Technology (T2).
“...talk to a professional. That's why you guys are here professionally trained to deal with people with my problem or problems like I have, you know...Left to myself, I'd probably kill myself. But that didn't feel right so I turned to professionals, you guys. “

- VA Patient/TBI Survivor
Use Your Smartphone to Visit the VISN 19 MIRECC Website

Requirements:
1. Smartphone with a camera
2. QR scanning software (available for free download just look at your phones marketplace)

www.mirecc.va.gov/visn19