TRAUMATIC BRAIN INJURY RESEARCH PRIORITIES

Problem Description

Traumatic brain injury (TBI) is a significant public health problem. Millions of TBIs are sustained annually in the United States, and they contribute to thousands of deaths each year. Survivors of TBI can experience effects that may last from a few days to the rest of their lives, depending on the severity of the injury (mild, moderate, or severe). Most TBIs are of mild severity, and these are often referred to as concussions. Potential health effects of TBI include impairments to thinking, memory, movement, sensations such as vision or hearing, and emotional functioning, such as personality changes or depression. The effects of TBI affect individuals who experience them and their families and communities.

TBI is not just an acute injury event but a chronic condition for many. Adults may face challenges returning to work and normal activities following a TBI of any severity level. They may also struggle with social connectedness. Children with TBI and their parents may face difficulties in getting back to school and resuming other activities, such as sports, because of a lack of coordination and communication between health and school systems.

Of particular concern is the potential lifelong impact of TBI sustained in childhood. A TBI of any severity experienced by the developing brain can disrupt a child's developmental trajectory and may result in restrictions in school and participation in activities. Although most children recover well physically, they often experience changes in behavior and cognition that are not recognized immediately, and some of these post-TBI health problems emerge over time. While longitudinal studies of TBI sustained in adulthood have been conducted, there is a broader need to expand these types of studies to understand the adult impacts of TBI sustained in childhood.

In keeping with CDC's role as a public health agency, the research priorities outlined here are focused on reducing the public health burden of TBI. These objectives are focused on prevention strategies, new methods for data collection to better assess TBI burden, identifying ways to reduce impacts among populations with high rates, and improving the recognition and management of TBI by health care providers and school administrators. CDC seeks to set a clearer path to improving TBI prevention and management generally, including focusing on at-risk populations.

Addressing these research gaps will expand the evidence base for strategies focused on preventing TBI and negative post-TBI outcomes across all populations and identifying tailored strategies that can result in population-level reductions in communities highly impacted by TBI. These priorities also set a goal of strengthening the methods for measuring TBI and identifying risk and protective factors for TBI incidence and post-TBI outcomes. Finally, these efforts seek to support communities in their efforts to achieve substantial reductions in TBI.

Research Gaps and Priorities

Improve methods to **measure, collect, and analyze data** used to monitor TBI burden.

Efforts aimed at determining the prevalence of TBI have largely relied on healthcare administrative datasets that capture TBIs diagnosed in the hospital setting. However, we know that many, if not most, individuals who sustain a TBI do not seek medical evaluation in the hospital and are not included in these datasets. Current prevalence estimates are therefore a significant underestimate of the true burden of TBI. In addition, we don't know the circumstances of this broader set of TBIs, including the most common causes and what populations are most at risk. NCIPC is currently addressing these gaps by analyzing data collected as part of the National Concussion Surveillance System pilot, which used a self-report survey as the basis of collecting more comprehensive estimates of TBI. However, little is known about the validity and reliability of capturing TBI via self-report. Ongoing and future research can inform new methodologies to obtain accurate and comprehensive TBI data. The following questions are posed to guide evidence-based research aimed at identifying new methods and data collection approaches to better define TBI burden.

Examples of research questions include:

- How can the methods to obtain national and state-level estimates of TBI incidence and prevalence be improved, including estimates for populations at high risk?
- What is the validity and reliability of using self-reported TBI as a method for estimating TBI prevalence?
- How can the methods to estimate the economic burden of TBI, including long-term costs, quality-adjusted life years (QALYs), and disability-adjusted life years (DALYs) be improved?

Population prevalence estimates are important for understanding the burden of TBI and what is needed to support population health and well-being.

Develop and evaluate the **effectiveness of strategies for primary prevention** of TBI.

In recent years, researchers have focused on effective ways to prevent and improve identification of and response to sports- and recreation-related TBIs among youth. For example, researchers are investigating safer ways to play contact sports, such as football (e.g., restricting tackling), soccer (e.g., restricting heading to older age groups), and ice hockey (e.g., banning body-checking among youth). More research is needed to identify effective strategies for increasing adoption of evidence-based practices that can help prevent TBI caused by other mechanisms of injury.

Examples of research questions include:

- Which strategies effectively prevent sports- and recreation-related TBIs?
- Which strategies effectively prevent TBIs in non-sports injury mechanisms (e.g., motor vehicle crashes, firearms, falls)?

- How can evidence-based prevention strategies be effectively adapted by groups most affected by TBI?
- What are the unique risk and protective factors (e.g., adverse childhood experiences; societal, community, and economic factors; access to care) for populations with high rates of TBI?

Knowledge about and implementation of evidence-based prevention strategies, as well as increased awareness of risk and protective factors, can help reduce the prevalence and burden of TBI.

Improve the **recognition and management of TBI** in healthcare and community settings.

Research has shown that patients with a TBI who seek care in the emergency department may not be correctly diagnosed. Consequently, patients may not receive education about injury effects and may not be instructed how to manage their injury in the days and weeks that follow. Furthermore, TBI during childhood can cause significant health impacts. Children and their families can experience difficulties accessing appropriate healthcare services. Further work is needed to understand the type and availability of school-based services and to understand how to increase the presence of qualified staff to serve students recovering from TBI, particularly students in rural areas. This objective is intended to guide research that identifies and evaluates interventions for improving the diagnosis and management of TBI at the time of injury and in the weeks that follow. The goals for these research questions are to improve the health and wellness for individuals who experience TBI and to reduce risk of chronic disease.

Examples of research questions include:

- What are the most predictive strategies for screening and identifying TBI in the emergency department to support clinical care?
- What are the challenges in recognition and identification following TBI in populations at high risk and how can these challenges be identified and reduced?
- How can recognition of TBIs be improved in multiple contexts, such as clinicians evaluating patients with suspected TBI, athletes or coaches reporting symptoms, teachers observing symptoms at school, and parents observing changes in their child's behavior?
- To what extent are healthcare providers incorporating best available evidence regarding diagnosing TBI into their healthcare practice? What are the barriers to broader implementation?
- How can best practices related to TBI diagnosis be implemented more broadly?

Recognition and diagnosis in all types of healthcare settings are critical first steps to optimize outcomes for individuals who experience concussion and other TBIs.

Identify modifiable **risk and protective factors** for negative post-TBI impacts and leverage these to improve short- and long-term outcomes.

TBI is experienced by millions of children and adults annually, many of whom will experience negative effects of the injury after their diagnosis. A 2022 report by the National Academies of Sciences, Engineering and Medicine found that TBI care often fails to meet the needs of individuals, families, and communities. Research is needed to identify ways to reduce the long-term effects of TBI, by discovering and leveraging modifiable risk and protective factors for negative TBI outcomes.

Examples of research questions include:

- How do near-term diagnostic and management practices impact TBI-related outcomes?
- What practices related to injury education and the provision of discharge instructions at the time of diagnosis are effective in improving TBI management and preventing adverse effects?
- What are the long-term effects of TBI sustained during childhood and how are they best managed (e.g., TBI as a chronic condition)? What risk and protective factors contribute to long term effects, and what are the unique risk and protective factors among people at high risk that contribute to TBI-related health outcomes?
- What strategies implemented in the days and weeks following a TBI can reduce the negative impacts of TBI among populations at high risk?
- How can return-to-school strategies be improved to reduce negative short- and long-term outcomes after TBI diagnosis?

Understanding injury effects in multiple settings and knowing how to educate individuals about these effects are important to ensure health and wellness following TBI.

CDC's National Center for Injury Prevention and Control (the Injury Center) advances research to prevent injuries and violence and reduce their consequences. Research includes identification of factors that increase or decrease risk and rigorous evaluation of innovative prevention strategies. The Injury Center translates science into effective policies and programs and guides how to adapt evidence-based strategies to community needs to increase widespread use. The research priorities strategically focus on research gaps that the Injury Center can address to strengthen public health action and impact. The Injury Center research priorities are updated as research and public health needs evolve.

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