The Neuroscience and Law Center presents

The Diagnosis, Treatment, and Prevention of Concussion

Wednesday, October 17, 2018
8:30 a.m. – 5 p.m.
Skadden Conference Center

Lunchtime Keynote Speaker
DeMaurice F. Smith, Executive Director, National Football League Players Association

CLE Course Materials
Part 1
Dr. Butler is a board-certified neurologist with additional clinical subspecialty training in neuropsychiatry and epilepsy. Her clinical work consists of evaluation and treatment of neurologic signs and symptoms in patients with severe psychiatric disease.

Dr. Butler has published over 40 articles in peer-reviewed scientific journals on a wide range of topics in neuroscience and neurology. Her research uses neuroimaging and complementary methods to improve understanding of the brain and the basis of neuropsychiatric disorders such as traumatic brain injury, epilepsy and Alzheimer’s disease as well as normal aging. A recent project funded by the Brain and Behavior Research Foundation aimed to determine whether some military veterans with psychiatric symptoms and a history of multiple concussions might have evidence of the neurodegenerative disease, Chronic Traumatic Encephalopathy. New research interests center on understudied risk factors for neurodegeneration that are more common in women than in men, including hormonal dysregulation and intimate partner violence with repeated brain injury.

She received a B.A. in philosophy from Amherst College and an M.D. from Columbia College of Physicians and Surgeons. She completed neurology residency at Columbia.

Art C. Cody, J.D.
Captain USN (Ret.); Deputy Director, Veterans Defense Program, New York State Defenders Association

Captain Art Cody, USN (Retired) is Deputy Director of the Veterans Defense Program of the New York State Defenders Association. Art first served as a U.S. Army helicopter pilot, followed by similar service in the Navy Reserve. In total, his active and reserve military career spans thirty years and he is a veteran of multiple combat zone deployments. He served aboard USS Enterprise (CVN-65) in the initial response to the 9-11 attacks and was most recently deployed to Afghanistan (2011-2012) as the Director of the Rule of Law Section, US Embassy Kabul. As a civilian lawyer, he has represented criminal defendants for over twenty years and chaired the Capital Punishment Committee of the New York City Bar Association. He frequently presents nationally on the defense of veterans, provides counsel to lawyers for veterans, and recently served as lead counsel in a veteran capital clemency hearing. A graduate of West Point, Art has a Master’s Degree from the University of Southern California and graduated magna cum laude from Notre Dame Law School where he was the Executive Editor of the Notre Dame Law Review. His military decorations include the Navy Bronze Star Medal, Meritorious Service Medal, Naval Aviator Badge, Army Aviator Badge and the German Armed Forces Parachutist Badge.

Kristen Dams-O’Connor, Ph.D.
Director, Brain Injury Research Center and Associate Professor, Department of Rehabilitation, Icahn School of Medicine at Mount Sinai

Kristen Dams-O’Connor, Ph.D., completed a bachelor’s Degree in Behavioral Neuroscience at Colgate University, a Ph.D. at the University at Albany, doctoral training at the Rusk Institute of Rehabilitation Medicine at New York University Medical Center and a postdoctoral fellowship in Clinical Neuropsychology at Mount Sinai Medical Center. Her work is focused on understanding and improving long-term outcomes after brain injury, and characterizing clinicopathological signatures of TBI. She leads the Late Effects of TBI (LETBI) brain donor program, and serves as Project Director of the New York Traumatic Brain Injury Model System. Her research is supported by federal grants from the National Institutes of Health, National Institute for Disability Independent Living and Rehabilitation Research, Department of Defense, Centers for Disease Control, and Patient Reported Outcomes Research Institute. She has published over 70 peer-reviewed manuscripts and chapters on traumatic brain injury treatments and outcomes and has presented her research internationally.

Deborah W. Denno, Ph.D., J.D.
Arthur A. McGivney Professor of Law and Founding Director, Neuroscience and Law Center, Fordham University School of Law

Deborah Denno is the Arthur A. McGivney Professor of Law and founding director of the Neuroscience and Law Center at Fordham University School of Law. She received her B.A. from the University of Virginia, her M.A. from the University of Toronto, her Ph.D. in sociology with a specialty in criminology from the University of Pennsylvania, and her J.D. from the University of Pennsylvania Law School, where she was the managing editor of the University of Pennsylvania Law Review. Prior to joining the Fordham Law faculty in 1991, Denno clerked for the Honorable Anthony J. Scirica of the Third Circuit Court of Appeals and worked as an associate at Simpson, Thacher and Bartlett. Denno’s Neuroscience and Law Center provides evidence-based information to academics, lawyers, and the public about legally relevant advances in neuroscience with the goal of fostering legal scholarship and the use of neuroscience in legal circles. Also at Fordham Law, Denno teaches criminal law, criminal procedure, torts, and seminars on topics such as law and neuroscience as well as advanced criminal law and advanced criminal procedure. In 2016, the Fordham Student Bar Association named Denno Teacher of the Year. In 2007, the National Law Journal selected Denno as one of its Fifty Most Influential Women Lawyers in America. Seven of Denno’s articles have been cited by the United States Supreme Court, and the Court has cited four of her articles in the last three years (2015–2017). Denno has published on a broad range of topics relating to criminal law, criminal procedure, social sciences and the law, and the death penalty, including the constitutionality of execution methods. Denno has also initiated cutting-edge examinations of criminal law defenses pertaining to insanity, rape law, gender differences, consciousness, biological and genetic links to crime, drug offenses, jury decision-making, and the impact of lead poisoning. Currently she is working on a book to be published by Oxford University Press analyzing all criminal cases during a two-decade period that have addressed neuroscience evidence. This same study is discussed in her recent article “Concocting Criminal Intent,” 105 Georgetown Law Journal 323 (2017).

Steven R. Flanagan, M.D.
Howard A. Rusk Professor of Rehabilitation Medicine, Chair of the Department of Rehabilitation Medicine, NYU Langone Health

Nationally and internationally recognized as one of the leading experts in the area of brain injury rehabilitation, Dr. Steven Flanagan joined NYU Langone Medical Center in 2008 as Professor and Chairman of Rehabilitation Medicine and Medical Director of Rusk Rehabilitation after serving as Vice Chairman of Rehabilitation Medicine at Mount Sinai School of Medicine from 2000-2008. While at Mount Sinai, Dr. Flanagan and his colleagues developed a seamless continuum of care for people with brain injury that was unique in New York State.

He serves on numerous medical advisory boards, including the India Head Injury Foundation, the Brain Trauma Foundation, and the Brain Injury Association of New York State. He is a peer reviewer for several scientific journals, has previously chaired the Central Nervous System Membership Council of the American Academy of Physical Medicine and Rehabilitation Medicine, and currently chairs the Medical Education Committee and sits on its Board of Governors. He authored numerous chapters and peer-reviewed publications and participated in both federally- and industry-sponsored research. He served as Panel Chair for the TBI/Stroke Group for the VA Merit Review from 2007-2013.
He received awards from several organizations, including the Brain Injury Association of New York State, Attending Physician of the Year Award from the Department of Nursing, and Teacher of the Year from the residents in Rehabilitation Medicine at Mount Sinai. He has been continually listed as one of America’s Top Doctors by Castle Connolly since 2010.

**Michael Flomenhaft, J.D.**  
Principal, The Flomenhaft Law Firm, PLLC

Michael Flomenhaft concentrates on representing victims of traumatic brain injury and severe chronic pain. He is a graduate of Boston University School of Law and the Trial Lawyers College. He has been a featured speaker to the New York State Bar Association on cases involving traumatic brain injury. In 2008, Columbia University Medical Center designated him director of neurolaw for its Program for Imaging and Cognitive Sciences. In 2009, he was invited to deliver grand rounds on advanced brain imaging applications for traumatic brain injury to the radiology residency program at Columbia University College of Physicians and Surgeons. In 2011, he was a featured speaker at the Second Circuit Conference on "The Legal Brain-scape: Neuroscience & the Law," where he spoke on imaging neuroscience and its assessment of chronic pain and delivered the paper "The Emerging Imaging Science of Chronic Pain: Objectifying the Subjective." In 2014, he chaired and was a key speaker at the all-day CLE at Fordham Law School "Neuroscience in the Courtroom." He has been featured on CUNY Science Television on neuroscience and law. In 2017, he was featured in a webinar by the American Bar Association as the attorney spokesman for its first ever CLE on neuroscience and law, "Neuroscience and the Law: Using Neuroscience in Criminal and Civil Cases." He is a member of the board of advisors to the Neuroscience and Law Center at Fordham Law School. In his trial work, he has pioneered the admission into evidence of various advanced brain imaging applications. These include diffusion tensor imaging (DTI), quantitative volumetric analysis of MRI, and functional MRI (fMRI).

**Yelena Goldin, Ph.D.**  
Staff Neuropsychologist, JFK Johnson Rehabilitation Institute; Clinical Assistant Professor, Rutgers-Robert Wood Johnson Medical School

Dr. Yelena Goldin received her doctorate degree from Ferkauf Graduate School of Psychology at the Albert Einstein Medical School of Yeshiva University in 2009. She completed her fellowship training in clinical neuropsychology and rehabilitation at Mount Sinai School of Medicine. Dr. Goldin is a clinical and research neuropsychologist in the Cognitive Rehabilitation Department of JFK Johnson Rehabilitation Institute. She is the principal investigator of JFK TBI Model System site specific project and the JFK TBI Model System Coordinator. She is an Assistant Clinical Professor at Rutgers-Robert Wood Johnson Medical School and Adjunct Assistant Professor at Ferkauf Graduate School of Psychology. Her areas of specialization are traumatic brain injury, stroke, aging, and gender issues. She has experience in comprehensive neuropsychological evaluations and cognitive rehabilitation. She has extensive experience in basic and clinical research in the area of traumatic brain injury. Her research has been presented at national and international conferences and earned several prestigious awards.

Dr. Goldin is involved with research training of residents and fellows at JFK Johnson Rehabilitation Institute. She is an active member of the American Congress of Rehabilitation Medicine, where she sits on the Program Committee, chairs the Poster Committee, is actively involved in the Cognitive Rehabilitation Task Force, and is the co-chair of the Brain Injury Special Interest Group task force on Girls and Women with Acquired Brain Injury. She is an advocate for individuals with traumatic brain injury.

**Wayne A. Gordon, Ph.D., ABPP-CN**  
Jack Nash Professor, Icahn School of Medicine at Mount Sinai

Wayne A. Gordon, Ph.D., ABPP-CN, is the Jack Nash Professor of Rehabilitation Medicine at the Icahn School of Medicine at Mount Sinai. He is a board-certified neuropsychologist. His recent research is focused on cognitive rehabilitation, screening for traumatic brain injury (TBI), developing and testing the utility of behavioral interventions to improve the function of individuals with TBI, and examining the long-term secondary conditions associated with TBI. He has received numerous awards from both professional and consumer organizations, including the Jacobi Medallion for distinguished achievements and extraordinary service to the Mount Sinai Medical Center, the Gold Key Award from the American Congress of Rehabilitation Medicine, the William Falls Caveness Award from the Brain Injury Association of America, the Robert L. Moody Prize for Distinguished Initiatives in Brain Injury Research and Rehabilitation and the Champion of Hope award from the Brain Injury Association of New York State. He has published more than 175 articles and book chapters and has presented nationally and internationally on his research. Dr. Gordon has been the project director on many federally funded grants from the National Institutes of Health, Centers for Disease Control and Prevention and National Institute on Disability and Rehabilitation Research involving multiple research projects along with training and outreach. Dr. Gordon’s current research portfolio is funded by grants from NIH, NIDRR, CDC and the Brain Injury Association of America.

**Clare Huntington, J.D.**  
Associate Dean for Research, Joseph M. McLaughlin Professor of Law, Fordham University School of Law

Huntington is an expert in the fields of family law and poverty law. Her book Failure to Flourish: How Law Undermines Family Relationships (Oxford 2014) won an Honorable Mention for the Professional and Scholarly Excellence (PROSE) Award in Law and Legal Studies from the Association of American Publishers. Huntington has published widely in leading law journals, exploring the intersection of poverty and families and with a recent focus on non-marital families. Huntington serves as an associate reporter for the American Law Institute’s Restatement of the Law, Children and the Law. Huntington’s legal experience includes serving as an attorney advisor in the Justice Department’s Office of Legal Counsel as well as clerking for Justice Harry A. Blackmun and Justice Stephen Breyer of the Supreme Court of the United States, Judge Merrick B. Garland of the United States Court of Appeals for the District of Columbia Circuit, and Judge Denise Cote of the United States District Court of the Southern District of New York. Prior to joining the Fordham faculty in 2011, Huntington was an associate professor at the University of Colorado Law School. Huntington earned her J.D. from Columbia Law School and her B.A. from Oberlin College.

**Samuel Issacharoff, J.D.**  
Bonnie and Richard Reiss Professor of Constitutional Law, New York University School of Law

Samuel Issacharoff’s wide-ranging research deals with issues in civil procedure (especially complex litigation and class actions), law and economics, constitutional law (particularly with regard to voting rights and electoral systems) and employment law. He is one of the pioneers in the law of the political process, where his Law of Democracy casebook (co-authored with Stanford’s Pam Karlan and NYU’s Rick Pildes) and dozens of articles have helped to create a vibrant new area of constitutional law. He is also a leading figure in the field of procedure, both in the academy and outside. He served as the reporter for the Principles of the Law of Aggregate Litigation of the American Law Institute.
Brad S. Karp, J.D.
Chairman, Paul, Weiss, Rifkind, Wharton & Garrison LLP

Brad Karp is one of the country’s leading litigators and corporate advisers. Karp has successfully defended financial institutions and other companies in numerous “bet the company” litigations and regulatory matters. Prior to being named chairman of Paul, Weiss in 2008, Brad chaired the firm’s Litigation Department.

Karp has received numerous industry recognitions over the years. Most recently, in January 2018, Karp was named The American Lawyer’s “Litigator of the Year” and Best Lawyers’ “Securities Lawyer of the Year.” In 2017, Karp was selected as a “Litigation Trailblazer” by the National Law Journal and Best Lawyers’ “Banking Lawyer of the Year.” Karp has been repeatedly named by the National Association of Corporate Directors on its list of most influential people in the boardroom community and selected by Chambers as a “Star” in multiple practice areas.

Karp is active in the community, serving on more than 20 public interest and educational institution boards. Brad is the chairman of the Legal Action Center and a director/trustee of the Riverdale Country School, Mount Sinai Hospital, The Partnership for New York City (Executive Committee), the Harvard Law School Leadership Council, the Lincoln Center Business Advisory Council, the New York City Bar Association (Vice President), the American Constitution Society, Junior Achievement Global, Harvard Law School Center on the Legal Profession, Practicing Attorneys for Law Students Program, Inc., the Leadership Council of the Legal Services Corporation, the Harvard Law School Visiting Committee, the Leadership Council on Legal Diversity, American Friends of Hebrew University, the New York Bar Foundation, the Program Advisory Board of the Brennan Center for Justice, the Mark Messier Foundation, the Best Lawyers Advisory Board, the Economic Club of New York, the Federal Bar Council Second Circuit Inn of Court, the Union College President’s Council, and the United States Supreme Court Historical Society.

Karp graduated from Harvard Law School in 1984 and has spent his entire professional career at Paul, Weiss.

James Kelly, M.A., M.D., F.A.A.N., F.A.N.A.
Executive Director, Marcus Institute for Brain Health, University of Colorado Anschutz Medical Campus; Professor of Neurology, University of Colorado School of Medicine; Fellow, Military Service Initiative, George W. Bush Institute

Dr. James Kelly accepted a Congressional appointment to the US Air Force Academy and later transferred to Western Michigan University where he obtained his B.A. in Psychology in 1974 and MA in Clinical Psychology in 1977. He served his neurology residency and behavioral neurology fellowship at the University of Colorado. He joined the faculty of the University of Colorado School of Medicine in 1989 where he studied brain-behavior relationships and started its first concussion treatment program.

Dr. Kelly is the Senior Fellow at the George W. Bush Institute’s Military Service Initiative, serving as an advisor to the former President on traumatic brain injury (TBI) and psychological health conditions in our military veterans – the “Invisible Wounds” of our current conflicts in Iraq and Afghanistan.

Prior to his current position, Dr. Kelly served as the founding Director of the National Intrepid Center of Excellence (NICoE), where he led the creation of an innovative interdisciplinary team of healthcare professionals who blended high-tech diagnosis and treatment with complementary and alternative medical interventions in a holistic, integrative approach to the care of US military personnel with the complex combination of TBI and psychological conditions such as post-traumatic stress, depression and anxiety. Dr. Kelly has co-authored numerous reports in civilian and concussion care, through funding provided by the U.S. Department of Defense, the Centers for Disease Control, and international sports organizations, including FIFA.

Regina McGlinchey, Ph.D.
Director, VA RR&D TBI Research Center: TRACTS; Associate Director for Research Training; GRECC, VA Boston Healthcare System; Professor in Psychiatry, Harvard Medical School

Regina McGlinchey is Professor of Psychiatry at Harvard Medical School, Supervisory Research Scientist and Associate Director for Research Training for the Geriatric Research, Education and Clinical Center at the VA Boston Healthcare System. Since receiving her Ph.D. in Experimental Psychology from Tufts University, she has been conducting clinical neuropsychological and neuroscience research on cognitive and neural changes associated with aging, stroke, alcoholism, and military-related brain and psychological trauma. Some of her most important contributions to science have come from her role as Principle Investigator and Director of the VA Rehabilitation Research and Development National Network Center for Traumatic Brain Injury called the “Translational Research Center for TBI and Stress Disorders” (TRACTS). Together with a team of researchers at TRACTS, she is developing a multimodal characterization of mild traumatic brain injury and military blast exposure, and demonstrating how associated stress disorders, including PTSD, depression, substance abuse, etc., influence how brain injury is expressed at the psychological, biological and neurobiological levels.

Barclay Morrison III, Ph.D.
Professor of Biomedical Engineering, Vice Dean of Undergraduate Programs, School of Engineering & Applied Sciences, Columbia University

Barclay Morrison, Ph.D., is a professor of Biomedical Engineering, director of the Neurotrauma and Repair Laboratory, and serves as Vice Dean of Undergraduate Programs for the Engineering School at Columbia University. His research focus is on the biomechanics of traumatic brain injury (TBI) at the tissue level to better prevent brain injuries, as well as on the biochemical, genomic, and molecular pathways responsible for post-traumatic cell dysfunction in the search for novel therapies to better treat brain injuries. He has published over 80 peer-reviewed scientific manuscripts, serves as a council member and vice president for the International Research Council on Biomechanics of Injury, is a board member of Football Research Inc., and is associate editor for the Journal of Biomechanical Engineering and the Journal of Neurotrauma. He received his BS in biomedical engineering from Johns Hopkins University, his Ph.D. in bioengineering from the University of Pennsylvania, and continued his academic training as a post-doctoral fellow in the Clinical Neurosciences department at Southampton University in the United Kingdom. Dr. Morrison is past recipient of the Rickard Skalak Best Paper Award given by the American Society for Mechanical Engineers for a publication in the Journal of Biomechanical Engineering and the John Paul Stapp Award for the best paper in the Stapp Car Crash Journal. More recently, he was the keynote speaker at the annual conference of the International Research Council on Biomechanics of Injury.
James M. Noble, M.D., M.S., C.P.H., F.A.A.N.
Assistant Professor of Neurology, Columbia University Irving Medical Center, Taub Institute for Research on Alzheimer’s Disease and the Aging Brain, G.H. Sergievsky Center, Department of Neurology, Columbia University Medical Center

Dr. Noble specializes in behavioral neurology & neuropsychiatry with disorders ranging from concussion to dementia. Since 2011 he has led a concussion care and research initiative at Columbia University and is involved with the care of athletes at Columbia University, Fordham University, as well as the New York Giants. He works with the 22-school Big 10-Ivy Traumatic Brain Injury collaborative research program, the Brain Injury Association of New York State, and is a member of the New York State Athletic Commission Medical Advisory Board, which sets medical policy for combat sports in New York. His recent concussion-related publications include articles in the American Journal of Sports Medicine, JAMA Neurology, the Journal of the American Academy of Orthopedic Surgeons, and Neurology: Clinical Practice.

Kimanli Paul-Emile, J.D., Ph.D.
Associate Professor of Law, Associate Director, Center on Race, Law & Justice, Faculty Co-Director, Stein Center for Law & Ethics, Fordham University School of Law

Paul-Emile is an associate professor of law, associate director and head of domestic programs and initiatives at Fordham Law School’s Center on Race, Law & Justice and faculty co-director of the School’s Stein Center for Law & Ethics. Paul-Emile specializes in the areas of law and biomedical ethics, antidiscrimination law, and health law. Her scholarship has been published widely in such journals as the Virginia Law Review, Georgetown Law Journal, UCLA Law Review, George Washington Law Review, and the New England Journal of Medicine. Paul-Emile’s scholarship has appeared in or been covered by over 30 national and international news organizations and other outlets, including The New York Times, National Public Radio, CBS News, MSNBC, CNN, Al Jazeera America, and The Guardian.

In 2017, Paul-Emile was awarded a Making a Difference in Real World Bioethics Dilemmas Grant by the Greenwall Foundation. In 2013, the foundation selected her to receive a Faculty Scholar Award in Bioethics: an award intended to enable outstanding junior faculty members to conduct original research to help resolve important policy and clinical dilemmas at the intersection of ethics and the life sciences. In 2012, she was awarded a public health law research grant from the Robert Wood Johnson Foundation, the nation’s leading philanthropy on health and health care.

Prior to pursuing her doctoral degree, Paul-Emile served as associate counsel at the Brennan Center for Justice at New York University School of Law, and practiced civil rights law at the Center for Constitutional Rights, where she was a National Association for Public Interest Law (now Equal Justice Works) Fellow and later the William Moses Kunstler Fellow for Racial Justice. She also served as senior faculty development consultant at the New York University Center for Teaching Excellence. Paul-Emile holds an A.B. in political science and in American civilization, with honors, from Brown University; a J.D. from Georgetown University Law Center; and a Ph.D. in American studies from New York University.

Amanda L. Sacks-Zimmerman, Ph.D., ABPP-CN
Assistant Professor of Neuropsychology, Department of Neurological Surgery, Weill Cornell Medicine

Amanda L. Sacks-Zimmerman, Ph.D., ABPP-CN, is a board-certified clinical neuropsychologist who has had extensive experience in assessing and treating neurological disorders with cognitive remediation as well as researching the cognitive impact of brain injury. She treats a variety of patients who suffer from cognitive and emotional difficulties that may be the result of epilepsy; radiation or chemotherapy; cardiopulmonary bypass procedures; surgery; cerebrovascular disease; stroke; silent infarcts; brain tumor resection; movement disorders such as multiple sclerosis, Parkinson’s disease, and Huntington’s disease; metabolic disorders; infectious processes such as encephalitis or Lyme disease; chemical toxin exposure; traumatic brain injury; and dementia diagnoses including mild cognitive impairment, Alzheimer’s disease, multi-infarct dementia, and frontal temporal dementia.

Dr. Sacks-Zimmerman received her undergraduate degree in Psychology from The George Washington University and her Ph.D. in Clinical Psychology from Fairleigh Dickinson University. She completed two postdoctoral fellowships, one at University Behavioral Healthcare, UMDNJ, where her research examined cognitive correlates of emotion in dementia, and one at Mount Sinai Medical Center in New York in the Department of Rehabilitation Medicine, where she was trained in assessing, treating, and researching acquired and traumatic brain injury. During that fellowship she assisted in deriving manualized Cognitive Behavioral Treatment for individuals post-TBI for the purpose of researching the efficacy of this treatment. As a faculty member of the Department of Anesthesiology at NYU Langone Medical Center, Dr. Sacks-Zimmerman analyzed and presented data on post-operative cognitive dysfunction as well as derived research studies on cognitive issues post-operatively in cardiac patients and cognitive issues related to compliance in the wound care population. She is currently conducting research to examine the efficacy of cognitive remediation programs on post-operative cognitive difficulties in brain tumor patients.

Christopher A. Seeger, J.D.
Founding Partner, Seeger Weiss LLP

Chris Seeger is a founding partner of Seeger Weiss and one of the nation’s leading attorneys in the areas of complex and mass tort actions. He has earned leadership appointments from state and federal courts throughout the U.S. in many noteworthy multi-distict litigations, including pharmaceutical actions involving Vioxx, Zyprexa, Gadolinium, and DePuy ASR, among others. In 2012, the U.S. District Court for the Eastern District of Pennsylvania appointed Chris to lead the multi-district litigation against the National Football League arising out of concussion-related injuries sustained by thousands of former NFL players. In 2016, he was appointed to the Plaintiffs’ Steering Committee for the MDL concerning the Volkswagen diesel emissions controversy, in the U.S. District Court for the Northern District of California. Chris serves on the Settlement Committee and was one of the lead negotiators of a $14.7 billion settlement which includes a massive buyback program for consumers and billions of dollars for environmental remediation. Most recently, he was appointed Plaintiffs’ Co-Lead Counsel for the Proton Pump Inhibitor multidistrict litigation in the U.S. District Court for the District of New Jersey; to the Executive and Settlement Committees for the National Prescription Opiate litigation in U.S. District Court for the Northern District of Ohio; and to the Plaintiffs’ Settlement Committee, serving as Lead Negotiator, for the Syngenta GMO Corn litigation, resulting in a $1.5 billion nationwide settlement. He is an elected member of the American Law Institute; a member of the Board of Advisors to the NYU School of Law, Center on Civil Justice; and serves on an Advisory Council to the Duke Law Center for Judicial Studies.
DeMaurice F. Smith, J.D.
Executive Director, National Football League Players Association

During his tenure as the Executive Director of the NFL Players Association (NFLPA), DeMaurice Fitzgerald Smith signed a 10-year Collective Bargaining Agreement (CBA) with NFL management, leading the Players through the owners’ 132-day lockout. The new CBA codifies new health and safety protocols for Players, achieved longer off-seasons, significantly reduces the amount of contact during practices, provides for unannounced inspections of training camps, creates the first compliance and accountability structure for NFL medical personnel, and provides the Players’ with their highest share of TV contract revenues in history.

Prior to his post at the NFLPA, Smith was an Assistant United States Attorney in the District of Columbia and was Counsel to then-Deputy Attorney General Eric H. Holder, Jr. After Government service, Smith served as a Partner in the law firms of Latham & Watkins, LLP and Patton Boggs, LLP, in Washington, D.C. where he represented corporations, boards of directors and senior executives in civil and criminal matters.

Smith is a 1989 graduate of the University of Virginia School of Law and a 1985 graduate of Cedarville University. He resides in the Washington D.C. metropolitan area with his wife and two children.

Ryan Surujnath, J.D.
Dean’s Fellow, Fordham University School of Law

Ryan Surujnath is a Dean’s Fellow with the Center for Neuroscience and Law, where he works with legal problems facing artificial intelligence. He obtained his J.D. from Fordham Law School in 2017 and his B.A. in history and political science from Rutgers University in 2014. While in law school, he published his Note on the use of blockchain technology in derivatives market infrastructure. His current research continues to focus on uses and regulatory implications of blockchain.

Terri Tanielian, M.A.
Senior Behavioral Scientist, RAND Corporation

Terri Tanielian is a senior behavioral scientist at the RAND Corporation. She is a nationally recognized expert in military and veteran health care policy. Tanielian was co–study director for RAND’s seminal 2008 study Invisible Wounds of War: Psychological and Cognitive Injuries, Their Consequences, and Services to Assist Recovery and the principal investigator for RAND’s comprehensive study of military and veteran caregivers titled Hidden Heroes: America’s Military Caregivers. She has conducted several assessments of issues facing veterans living in the Detroit Metropolitan Area, Massachusetts and in New York State. She has led several other studies including the Deployment Life Study, a study of military families across the deployment cycle, and a study examining community based models for expanding mental health care for veterans and their families under the Welcome Back Veterans Initiative. Tanielian has published numerous peer-reviewed articles, book chapters, and serves on many advisory committees related to veteran mental health policy. Tanielian was recognized with the AcademyHealth Impact Award in 2009 for her work related to the Invisible Wounds of War. Tanielian has a M.A. in psychology from American University.
Table of Contents

1. Speaker Biographies

2. CLE Materials

Panel 1: The Hidden Harm of Traumatic Brain Injuries

Schmitt, Michael N. and Highfill, Chad E.. Invisible Injuries: Concussive Effects and International Humanitarian Law.


Panel 2: Approaches to the Prevention and Treatment of Concussion

American Academy of Neurology: Legal and ethical implications in the evaluation and management of sports-related concussion.


ARTICLE

Invisible Injuries:
Concussive Effects and International Humanitarian Law

Michael N. Schmitt* and Chad E. Highfill†

* Professor of International Law, University of Exeter; Charles H. Stockton Professor, United States Naval War College; Francis Lieber Distinguished Scholar, United States Military Academy at West Point. The views expressed are those of the author in his personal capacity.
† U.S. Army Judge Advocate, Office of the Judge Advocate General, Pentagon; former Military Professor of International Law, Stockton Center for the Study of International Law, United States Naval War College. The views expressed are those of the author in his personal capacity.

Copyright © 2018 by the President and Fellows of Harvard College, Michael N. Schmitt, and Chad E. Highfill.
Abstract

The concussive effects of weapons used on the modern battlefield can cause Traumatic Brain Injury (TBI). Indeed, TBI has been termed the "signature wound" of the ongoing conflicts in Iraq and Afghanistan. To date, the injury has not been taken into account by armed forces in their application of international humanitarian law norms regarding attacks that affect civilians. Of particular note in this regard are the rule of proportionality and the requirement to take precautions in attack. This article opens the discussion about this recently discovered consequence of warfare for the civilian population. It examines the state of the science regarding TBI and queries whether the understanding of such injuries has reached the point at which commanders in the field are obligated to begin considering, as a matter of humanitarian law, the risk of causing TBI to civilians when they attack enemy forces. It concludes with a practical assessment of how they might do so.
Table of Contents

Introduction .......................................................................................................................... 75
I. Concussive Effects ............................................................................................................ 76
II. Concussive Effects and International Humanitarian Law .................................. 81
   A. Proportionality ........................................................................................................... 83
      1. “May be expected” .............................................................................................. 83
      2. “To cause” ............................................................................................................. 86
      3. “Incidental injury” .............................................................................................. 90
      4. “Excessive” .......................................................................................................... 94
   B. Precautions in Attack .............................................................................................. 95
Conclusion ............................................................................................................................. 98
Introduction

Traumatic brain injury (TBI) has become the “signature wound” of the conflicts in Iraq and Afghanistan.\(^1\) The highly effective and very frequent use of improvised explosive devices (IEDs) during these conflicts, particularly in roadside attacks against vehicles and in terrorist attacks against individuals, has spurred in-depth medical research into blast exposure and related concussively caused brain injuries. However, consideration of the legal implications of the phenomenon has not kept pace. This Article assesses key international humanitarian law conduct of hostilities rules in light of the current state of the science, which is somewhat tentative albeit improving, regarding concussive effects.

Research into combat-related blast exposure began in earnest after World War I, during which exposure to artillery fire had been common. As a result, many soldiers suffered from what was colloquially known as “shell shock,” the symptoms of which included amnesia, headaches, depression, difficulty concentrating, and insomnia.\(^2\) Although at the time a number of medical researchers characterized the condition as *commotio cerebri* (concussion, an agitation of the brain induced by shock waves),\(^3\) a debate within the medical community ensued because the soldiers appeared otherwise uninjured.

While purely psychological effects may result from exposure to battle, contemporary research is revealing that concussive force generated by blasts physically impacts, and causes injury to, the brain.\(^4\) Most research on such “invisible”\(^5\) injuries deals primarily with the diagnosis, treatment, and protection of combatants. However, that research is no less applicable to civilians who are exposed to the concussive force of a blast when, for instance, they are in the vicinity of an attack on a military objective that employs explosive munitions.\(^6\)

---


3 Jones, *supra* note 2, at 1641–42.

4 *See infra* Part I.

5 Some medical literature uses the term “invisible injury” to refer exclusively to cognitive or psychological injuries, while others use it to refer to mild TBI. The authors use it to mean all injuries, including physical injuries that are not apparent without the aid of advanced imaging.

The potential injury to civilians makes the information now available on the concussive effects of blasts relevant to a state’s obligations under international humanitarian law. Although it is not unlawful to inflict concussive effects upon enemy combatants during an attack on them or in pursuit of other military objectives, international humanitarian law is implicated to the extent that civilians are affected by a blast’s concussive effects. Proper application and interpretation of international humanitarian law must be based on sensitivity to the foundational balance between military necessity and humanitarian concerns that underpin it, regardless of whether the potential injury to civilians is visible or invisible. To ignore injuries that result from concussive effects would be to throw the balance askew.

To place the inquiry into the relevant international humanitarian law context, this Article begins in Part I with a description of concussive brain injuries and discusses the state of the science. This Part also highlights certain policy approaches to these injuries. The Article then turns to legal issues in Part II. It first examines the rule of proportionality, which prohibits attacks that are expected to cause excessive injuries to civilians. Even an attack that is consistent with the rule of proportionality is subject to the additional requirement to take precautions in attack, such as selecting weapons that will achieve the desired combat effect while causing the least harm to civilians. Therefore, the application of this rule is likewise examined in Part II. Finally, the Article concludes with the authors’ thoughts on possible practical means of incorporating the reality of concussive effects into the targeting process.

I. Concussive Effects

The term “concussive effects” is an acknowledgment that the blast effects of munitions—whether the blast wave itself or blast-induced motion or debris—can include TBIs of varying degrees of severity. “Traumatic brain injury” denotes a “traumatically induced structural injury or physiological disruption of brain function” caused by an external force, including those produced by blasts or

---


8 Though some of the medical literature separates blast-induced brain injury from mild traumatic brain injury (concussion), the definitions often overlap and the two are used interchangeably. This Article uses “concussive effects” to collectively refer to all brain injuries sustained from blast effects (blast wave, blunt trauma, or acceleration/deceleration/rotational movement), and “concussive injury” to refer to all severities of TBI. See generally INST. OF MED., GULF WAR AND HEALTH, VOL. 7: LONG-TERM CONSEQUENCES OF TRAUMATIC BRAIN INJURY 2 (2009), http://www.nap.edu/catalog/12436.html [hereinafter IOM Rep.].

9 Memorandum from Jonathan Woodson, Assistant Sec’y of Def. for Health Aff. to Assistant Sec’y of the Army, Navy, and Air Force (Manpower and Res. Aff.) (Apr. 6, 2015), http://docplayer.net/49471857-The-assistant-secretary-of-defense-1200-defense-pentagon-washington-dc.html [http://perma.cc/TL7P-KHZL] [hereinafter OSD Memorandum]. The memo adds that at least one of the following signs immediately follows a TBI: “Any alteration in mental
Medical literature often describes these forces as the physical cause (or mechanism) of immediate injury. The injury occurs at the moment of the concussive event and causes a mechanical alteration of the brain, including tissue destruction—damage to axons or laceration, bleeding, or bruising of the brain—that immediately leads to macroscopic, microscopic, and cellular pathological changes. As the brain moves within the skull, axons (the stretched fibers that provide structure and support to the brain and communicate with the rest of the body) strain and sever. Since the force tears the brain from within, traditional radiological imaging often reveals no apparent structural damage.

When an individual experiences a TBI, a myriad of biomechanical processes in the brain trigger symptoms such as loss of consciousness, headaches, confusion, and amnesia. The injury may also result in “several biologic processes that occur in the minutes to days following TBI.” Inflammation, swelling, or hemorrhage caused by the original injury can lead to further brain damage as the brain pushes against the skull. Additionally, concurrent injuries in other parts of the body may exacerbate the initial brain injury. For example, injuries sustained to other organs might cause blood pressure to drop, which in turn reduces blood flow to the brain. The reduction can exacerbate the extent or severity of the initial brain injury. Severity of the injury and the extent to which it is observable differ depending on such factors as the individual’s position relative to the blast, the impact to or angular rotation of the brain, and pre-existing brain conditions.
TBIs can cause physical, cognitive, and psychological\textsuperscript{19} impairment. While some symptoms manifest immediately, “signs and symptoms may be delayed from days to months (e.g., headaches, subdural hematoma, seizures, hydrocephalus, spasticity, etc.). [They] may occur alone or in varying combinations, and may result in a functional impairment.”\textsuperscript{20} The consequences may quickly resolve themselves, persist for extended periods, or be permanent.\textsuperscript{21} As discussed below, the psychological symptoms of post-traumatic stress disorder (PTSD) and depression often overlap with the physical symptoms of TBI, making diagnosis and prognosis difficult.\textsuperscript{22} While recent studies suggest that physical damage to brain circuitry may account for many of the psychological symptoms associated with combat-induced PTSD, the precise relationship between TBI and PTSD is unclear.\textsuperscript{23}

Irrespective of whether injury results solely from the blast wave or from a combination of blast mechanisms, concussive effects cause brain injury.\textsuperscript{24} Injury from the blast wave itself is determined by factors such as pressure intensity, duration, and shape (which may be influenced, for instance, by whether the blast occurs in an open field or an urban environment).\textsuperscript{25} Although the effects of blast overpressure on organs such as the intestinal tract, ears, and lungs are well known, those on the brain are less well understood.\textsuperscript{26} Two key limitations are the lack of testable living brain tissue and the fact that individuals near a blast may also be affected by other harmful forces, such as fragmentation of the weapon and other blast-induced debris.\textsuperscript{27} Nevertheless, studies confirm that, at the least, mild traumatic brain injuries are likely to result from blast overpressure.\textsuperscript{28} They also substantiate the fact that neurological effects, such as deficits in learning, memory, and motor skills, can arise from repeated low-level blast exposure.\textsuperscript{29}

\textsuperscript{19} The terms psychological, emotional, behavioral, and mental are sometimes used interchangeably in various contexts by different fields of expertise. This Article refers to all of these concepts as psychological.
\textsuperscript{20} OSD Memorandum, supra note 9, at 2.
\textsuperscript{21} Id.
\textsuperscript{22} U.S. DEP’T OF DEF., LONGITUDINAL STUDY ON TRAUMATIC BRAIN INJURY INCURRED BY MEMBERS OF THE ARMED FORCES IN OPERATION IRAQI FREEDOM AND OPERATION ENDURING FREEDOM 3–4 (2017).
\textsuperscript{24} See IOM REP., supra note 8, at 3; see also Hailong Song et al., \textit{Linking Blast Physics to Biological Outcomes in Mild Traumatic Brain Injury: Narrative Review and Preliminary Report of an Open-Field Blast Model}, 340 BEHAV. BRAIN RES. 147, 148 (2016).
\textsuperscript{25} There may be further implications for concussive effects in urban operations, where blast waves reflect off structures, thereby potentially increasing the concussive severity of the blast. See KENNETH CROSS ET AL., ARMAMENT RES. SERV., EXPLOSIVE WEAPONS IN POPULATED AREAS: TECHNICAL CONSIDERATIONS RELEVANT TO THEIR USE AND EFFECTS 14–16 (2015).
\textsuperscript{26} See IOM REP., supra note 8, at 33.
\textsuperscript{27} See id. at 36–39.
\textsuperscript{28} See id. at 8, 36.
\textsuperscript{29} See id. at 8.
The understanding of concussive effects on the brain has been improving dramatically.30 Breakthroughs in advanced imaging techniques are a major contribution.31 Also promising is research into the use of brain biomarkers that provide, quite literally, a map of various brain injuries.32 By monitoring biomarkers, the ability to establish patterns between the initial trauma to the brain and mid- to long-term harm is enhanced.33

However, shortcomings in the knowledge base remain.34 In particular, mild TBIs—the predominant consequence of concussive effects—are underreported and underestimated.35 Studies using advanced brain imaging technologies reveal that mild TBIs do not appear on computerized tomography (CT) or magnetic resonance imaging (MRI) scans.36 Since traditional diagnostic imaging fails to detect pathological changes in the brain caused by a mild concussive injury,37 the most common battlefield brain injuries remain “invisible.” Accordingly, they are usually only identified through self-reporting, which lacks the empirical fidelity necessary for establishing probabilities. Much remains unknown about brain injuries, especially the link between blast overpressure and brain injury and between brain injury and long-term health outcomes.

Despite these limitations, the United States and other states have begun incorporating medical knowledge of concussive effects into military policy and practice. Since 2000, the Department of Defense (DOD), which now defines TBI as an “injury,” has reported approximately 375,230 TBIs, eighty-two percent of which were classified as mild.38 Note that these figures are drawn from a military population that is likely to underreport because of the negative perception within

---

30 Levin et al., supra note 18, at 4.
32 A biomarker is an indicator that assists in identifying the natural or historical pathology of a particular injury, illness, or disorder. Dambinova et al., supra note 12, at 5; see also Chengang Yu et al., A Systems Biology Strategy to Identify Molecular Mechanisms of Action and Protein Indicators of Traumatic Brain Injury, 93 J. NEUROSCI. RES. 199, 203–12 (2015).
33 See Dambinova et al., supra note 12, at 5; NATO Rep., supra note 31, at 6–29; Rep. to Cong., supra note 6, at 5 (noting that these technologies “must be refined and validated” as they evolve).
34 Rep. to Cong., supra note 6, at xv.
35 See id.; see also Sardar Bahadur et al., Injury Severity at Presentation is not Associated with Long-Term Vocational Outcome in British Military Brain Injury, 162 J. ROYAL ARMY MED. CORPS 120, 120–21 (2016) (finding the injury-severity scoring systems at the point of the concussive event to be a poor predictor of long-term outcomes).
36 See Mac Donald et al., supra note 13, at 371–78; NATO Rep., supra note 31, at 2–2; Rep. to Cong., supra note 6, at 5. This is problematic given that to be considered a mild traumatic brain injury, the U.S. DOD requires that conventional CT or MRI scans reveal normal structural neuroimaging. U.S. Dep’t of Def., Instr. 6490.11, DoD Policy Guidance for Management of Mild Traumatic Brain Injury/Concussion in the Deployed Setting 14 (2012) [hereinafter DODI 6490.11].
37 See Mac Donald et al., supra note 13, at 371–78; NATO Rep., supra note 31, at 2–2; Rep. to Cong., supra note 6, at 5.
the armed forces of having a behavioral problem.39 Clearly, there is a “fundamental need to better understand and quantify the direct and indirect effects of blast to individuals engaged in modern warfare.”40

In response to this need, Congress passed the 2008 Traumatic Brain Injury Act, which requires certain government agencies to examine the incidence and prevalence of TBI and to develop better diagnostic, treatment, and tracking tools.41 Of particular note, the armed forces incorporated blast sensors (concussion-monitoring devices) into the helmets of thousands of deploying troops.42 These sensors are being upgraded to allow for the identification of a brain injury with greater speed and accuracy.43 Concerned with the injury’s “potential for short and long-term effects on the Service member,” DOD also now requires “proper identification, documentation, treatment, and tracking of those Service members who have sustained a TBI.”44 An especially telling indicator of DOD’s acknowledgement of TBI as an “injury” is its recognition of even mild TBIs as meriting award of the Purple Heart. The award is made in the event of concussions caused by “enemy-generated explosions” or mild traumatic brain injuries that result in loss of consciousness, persistent symptoms, a clinical finding, or impaired brain function for longer than forty-eight hours.45

Global awareness of TBI is rising because of the increased use of IEDs in armed conflict and because of the increase in reported sports-related TBIs. Today, many governments recognize TBI as an injury of significant public health and

40 Fain et al., supra note 1, at 201.
44 OSD Memorandum, supra note 9, at 1.
45 U.S. Dep’t of Army, Reg. 600-8-22, Military Awards para. 2-8 (e), (g)(5–6) (July 25, 2015).


Of particular significance to the legal issues raised below is the fact that TBI-related research involving armed conflict centers on injury to combatants. There is, accordingly, a significant lacuna in the knowledge base regarding the likelihood of TBI to members of the civilian population. Nevertheless, as with combatants, blast injuries among civilian populations are certainly also on the rise in light of such factors as the increasing prevalence of urban warfare and of tactics, such as human shielding, that move armed conflict into the proximity of civilians. Additionally, civilians are especially vulnerable during hostilities because they lack protective equipment such as vests and helmets. Further complicating matters is the fact that assessing concussive effects among the civilian population is particularly difficult because they are often located in areas under enemy control, lack access to modern medical care, and are not subject to mandatory reporting requirements. And while combatants generally fall into a homogenous group in terms of age and physical fitness, the heterogeneous category of “civilians” includes children, the elderly, and individuals with widely varying physical conditions. These factors, among others, suggest that the results of research on combatant TBI may not be perfectly transferable to the civilian population.

II. Concussive Effects and International Humanitarian Law

Concussive effects caused by combat have normative implications primarily for the international humanitarian law governing the “conduct of hostilities,” specifically in the law of targeting. Targeting law requires (1) that the weapon used in an attack be lawful per se in the sense that it is neither inherently indiscriminate nor of a nature to cause unnecessary suffering or superfluous injury to individuals who may be lawfully targeted; (2) that the individual or object


47 See NATO REP., supra note 31, at ES-1. The phrases “deployment-related” and “military” traumatic brain injury include blast-related traumatic brain injury.

48 Ramona R. Hicks et al., Neurological Effects of Blast Injury, 68.5 J. TRAUMA 1257, 1257 (2010).

49 See id.

50 Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts arts. 35(2), 51(4)(b–c), June 8, 1977, 1125 U.N.T.S. 3 [hereinafter AP I]; see also 1 CUSTOMARY INTERNATIONAL HUMANITARIAN LAW Rules 11–13, 70 (Jean-Marie Henckaerts & Louise Doswald-Beck eds., 2005) [hereinafter CIHL STUDY]. Although the United States is not a party to AP I, it generally accepts those provisions thereof that are cited in this Article as reflective of customary international law. See OFF. OF THE GEN. COUNS., U.S. DEP’T OF DEF., LAW OF WAR MANUAL §§ 6.6, 6.7 (rev. ed. 2016) [hereinafter DOD LAW OF WAR MANUAL].
targeted qualify as a military objective;\textsuperscript{51} (3) that the tactics employed be discriminate;\textsuperscript{52} (4) that the expected harm to civilians and civilian objects not be excessive relative to the anticipated military advantage of the attack, that is, that the attack comply with the rule of proportionality;\textsuperscript{53} and (5) that precautions be taken by the attacker to minimize harm to civilians and civilian objects.\textsuperscript{54}

Since explosive weapons designed to kill are not \textit{per se} unlawful, it is unlikely that the concussive effects of a particular weapon would significantly alter the \textit{per se} lawfulness analysis.\textsuperscript{55} Nor do concussive effects directly bear on the principle of distinction, the requirement that attacks only be directed at military objectives. This is because an attack directed at civilians, civilian objects, or other protected persons or objects is unlawful irrespective of the nature of the harm likely to be caused. Finally, the international humanitarian law rule that tactics must be discriminate likewise has little relevance to the occurrence of concussive effects, for merely failing to aim a weapon (as distinct from aiming it at protected persons or objects) is unlawful regardless of the effects that weapon causes. The same is true with regard to treating a number of targets in a concentration of civilians as a single military objective when it is possible to distinguish among them.

Therefore, concussive effects bear most directly upon the requirements of proportionality and precaution, both of which are designed to ensure an appropriate balance between humanitarian considerations and military necessity. Codified in Articles 51 and 57 of the 1977 Additional Protocol I (AP I), these requirements reflect customary international law applicable in international and non-international armed conflicts and are, accordingly, binding on all states.\textsuperscript{56} Injuries to combatants,

\footnotesize
\textsuperscript{51} AP I, \textit{supra} note 50, arts. 51(1), 52(2); \textit{see also} CIHL \textit{STUDY}, \textit{supra} note 50, rules 7–10; DOD \textit{LAW OF WAR MANUAL}, \textit{supra} note 47, § 5.6.
\textsuperscript{52} AP I, \textit{supra} note 50, art. 51(4); \textit{see also} CIHL \textit{STUDY}, \textit{supra} note 50, rules 11–13, at 37–45; DOD \textit{LAW OF WAR MANUAL}, \textit{supra} note 50, § 5.5.
\textsuperscript{54} AP I, \textit{supra} note 50, art. 57; \textit{see also} AMW MANUAL, \textit{supra} note 53, rules 30–40; CIHL \textit{STUDY}, \textit{supra} note 50, rules 15–19; FRITS KALSHOVEN, \textit{REFLECTIONS ON THE LAW OF WAR: COLLECTED ESSAYS} 222 (2007); DOD \textit{LAW OF WAR MANUAL}, \textit{supra} note 50, § 5.2.3.
\textsuperscript{55} The sole situation the authors could conceive of in which this might be the case is a weapon designed primarily to cause concussive effects that manifest well after the likely conclusion of the conflict, for such injuries would yield no military advantage to an attacker and thus cause unnecessary suffering. Obviously, the development and fielding of such a weapon is unlikely.
\textsuperscript{56} See CIHL \textit{STUDY}, \textit{supra} note 50, rules 14–19; \textit{see also} Prosecutor v. Kupreskić, Case No. IT-95-16-T, Judgment, ¶ 524 (Int’l Crim. Trib. for the Former Yugoslavia Jan. 14, 2000); AMW MANUAL, \textit{supra} note 53, § G, ¶ 2; DOD \textit{LAW OF WAR MANUAL}, \textit{supra} note 50, § 17.7; ICRC \textit{COMMENTARY}, \textit{supra} note 7, ¶ 4772; MICHAEL N. SCHMITT ET AL., \textit{THE MANUAL ON THE LAW OF NON-INTERNATIONAL ARMED CONFLICT WITH COMMENTARY} ¶¶ 2.1.1.4, 2.1.2 (2006); TALLINN \textit{MANUAL 2.0 ON THE INTERNATIONAL LAW APPLICABLE TO CYBER OPERATIONS} Rules 113, 114–20 (Michael
members of organized armed groups, or civilians directly participating in hostilities have no normative significance under international humanitarian law as such individuals may be lethally targeted by the weapons that produce the concussive effects. It is the potential harm to civilians that is relevant to the humanitarian law inquiry.

A. Proportionality

The rule of proportionality prohibits attacks that “may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated.”\(^{57}\) It acknowledges that the unintended, albeit foreseeable, injury of civilians is permissible when that incidental injury (and collateral damage to civilian objects) is not excessive relative to the military gain that the attacker reasonably expected to achieve from the attack.

The science of blast-induced TBI raises the possibility that those who plan and conduct attacks must consider concussive effects in their proportionality analysis. Such a requirement might be questioned for four reasons. First, concussive injuries are not easily foreseeable. Second, a concussive injury may manifest later in time, raising questions as to its cause. Third, concussive injuries are sometimes characterized as psychological in nature (or intertwined with psychological injuries),\(^{58}\) and psychological effects are typically not considered in proportionality calculations.\(^{59}\) Finally, concussive injuries might be considered an intangible injury and thus not quantifiable in a proportionality analysis. Addressing these and related matters requires deconstructing the rule of proportionality into its constitutive elements: 1) expectation of harm, 2) causation, 3) qualification as incidental injury, and 4) excessiveness.

1. “May be expected”

Proportionality analysis considers only incidental injury to civilians and collateral damage to civilian objects that “may be expected” to result from an attack. From the perspective of a commander planning an attack, then, the inquiry is whether concussive injuries are of a nature to be “expected,” as that term is understood in the context of the rule of proportionality. Pursuant to the Vienna Convention on the Law of Treaties (VCLT), which is generally regarded as setting forth accepted modes of interpretation, “[a] treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in

\(^{57}\) AP I, supra note 50, arts. 51(5)(b), 57(2)(a)(iii), 57(2)(b); see also CIHL STUDY supra note 50, rules 14, 18–19.

\(^{58}\) Mac Donald et al., supra note 23, at 12.

\(^{59}\) See infra notes 130–132 and accompanying text.
their context and in the light of its object and purpose.”60 The dictionary definition of the term “expect” has remained relatively constant since the drafting of AP I. For instance, the 1976 Concise Oxford Dictionary defined “expect” as “to regard as likely,”61 whereas the present Oxford English Dictionary explains that the term denotes something “likely to happen.”62 The drafting history of AP I also sheds light on the condition that the incidental injury and collateral damage be expected. During the Diplomatic Conference that led to adoption of the treaty, the drafters rejected a suggestion to replace the phrase “which may be expected to cause” with “which risks causing,” opting instead for an explicit standard of foreseeability.63

The term “expected” confirms that proportionality is assessed ex ante, not post factum.64 In other words, compliance with the rule is judged against what those involved in the targeting process foresaw with respect to likely incidental injury and collateral damage, not against what happened in the particular case. The law imposes the objective standard of reasonableness on this inquiry, such that harm that should have been expected in the circumstances will be considered when judging compliance with the rule even if the attacker did not in fact expect it.65 Thus, in explicating the standard, some commentators have phrased it as “reasonably foreseeable”66 and “probable.”67

While it is clear that the incidental injury to be considered in the proportionality assessment must be reasonably foreseeable, the question remains as to how certain the decision-maker must be of the resulting incidental injury before it is foreseeable. As a general legal concept, foreseeability is the point on a continuum of certainty at which responsibility for an act attaches.68 If an act’s possible effects fall short of this point, there is no duty, and thus no responsibility, because the actor could not have reasonably foreseen that the act would cause a particular effect. To hold otherwise in the targeting context would impose a form

63 ICRC COMMENTARY, supra note 7, ¶ 2209.
64 See Schmitt, supra note 7, at 826; see also MICHAEL BOTHE ET AL., NEW RULES FOR VICTIMS OF ARMED CONFLICTS: COMMENTARY ON THE TWO 1977 PROTOCOLS ADDITIONAL TO THE GENEVA CONVENTIONS OF 1949 320, 352 (2d ed. 2013) [hereinafter BOTHE COMMENTARY]; KALSHOVEN, supra note 54, at 220.
66 Michael N. Schmitt, AIR WARFARE, IN THE OXFORD HANDBOOK OF INTERNATIONAL LAW IN ARMED CONFLICT 139 (Andrew Clapham et al. eds., 2014).
67 AMW MANUAL, supra note 53, rule 14, ¶ 6.
68 See 57A AM. JUR. 2D NEGLIGENCE §§ 413, 416 (2017); see also DOD LAW OF WAR MANUAL, supra note 50, § 5.12.2.1 (comparing foreseeable and remote harms).
of absolute liability for all injuries causally linked to an attack. As this would amount to an unworkable and intolerable burden on parties to a conflict, such a rule would run afoul of the balancing of humanitarian concerns and military necessity that underlies international humanitarian law.

In the international humanitarian law context, as in other areas of the law, the ubiquitous standard of reasonableness informs where the point of foreseeability lies. In other words, a result is foreseeable when a reasonable commander or other person involved in planning, approving, or executing an attack would have foreseen the consequence in question with a reasonable degree of certainty. This has led some states, including the United States, to adopt a standard of “reasonable certainty,” a standard familiar in other areas of international and domestic law.

While reasonableness does not require mathematical certainty, the standard excludes conjecture and speculation. Reasonable certainty is based instead on rational inferences and probabilities. Whether concussive injuries to civilians are reasonably likely to occur, and, therefore, have to be factored into the proportionality analysis depends on the probability that the effects will occur in the attendant circumstances and the state of the current scientific understanding of TBI. It also depends on the extent to which the science can be deemed reasonably available to decision-makers at the time of an attack.

A critical factor in determining whether the science has reached the point where it is appropriate to consider concussive injuries is consistency of consequence. A degree of consistency is necessary to identify causal relationships, as well as the probability ratios from which reasonable expectations that an effect will occur must derive. Such consistency appears to be lacking at present, although as technologies emerge and further research is conducted, this deficiency may be remedied. For example, a 2014 international state-of-the-science conference concluded that, despite the use of soldier-worn blast sensor monitoring devices for a number of years, there is still no “biomedically valid, clear safe distance from a given blast because the “ability to quantify blast intensity and correlate that data to acute and chronic intracranial effects is limited.” Based in part on this conclusion,

69 See Bothe Commentary, supra note 64, at 320, 351–52; see also AMW Manual, supra note 53, rule 14, ¶ 4 (equating effects that are “too remote” with those that “cannot be reasonably foreseen”).
70 CFLCC ROE Card, reprinted in U.S. Army, Operational Law Handbook 109 (2015); MNC-I ROE Cards, reprinted in id. at 110; see also Off. of the Chief of Staff, Armed Forces of the Phil., AFP Standing Rules of Engagement § 8f (2005).
72 See id.
73 See id.
74 Summary of Meeting Proceedings, Key Findings, and Expert Panel Recommendations, Dep’t of Def. Blast Injury Res. Program Coordinating Off., International State-of-the-Science Meeting on the Biomedical Basis for Mild Traumatic Brain Injury Environmental Threshold Values, at ii (Nov. 4–6,
the U.S. Army decided in 2016 that mass deployment of its blast sensors would be unproductive, citing their lack of sensitivity and explaining that the sensors failed to provide consistent data correlating blast overpressure with brain injury. The Army is now in search of new sensors of greater sensitivity, ones equipped with longer battery life, and wireless data transfer.

Irrespective of such uncertainty, some countries have implemented blast distance thresholds for their soldiers that trigger mandatory TBI screening. A leader in the field, the U.S. military requires all personnel within fifty meters (indoors or outdoors) of a blast event to undergo TBI screening. Although this policy reflects the potential for, not necessarily the probability of, concussive effects, it is nonetheless instructive. The United States recognizes that concussive effects, in ways that might not be fully understood yet, lead to brain injury and, accordingly, has set thresholds to protect its combatants despite the lack of precision in the science.

To summarize, the science is not yet at the point where it can be said that the expectation of concussive injury is reasonably certain in any particular attack. It is undeniable that the concussive effects of a blast can cause TBI, but insufficient scientific research exists to determine the probability of injury or the distance within which such effects manifest. Fortunately, there is current research directed at answering these questions. Although most is focusing on the safety of the armed forces, it would apply mutatis mutandis to the expectation that a civilian will suffer an incidental brain injury as a result of an attack. Once the capacity is developed to predict with a reasonable degree of certainty the likelihood of civilian brain injury within a given blast radius, the “to be expected” aspect of the proportionality rule will be satisfied.

2. “To cause”

The expected injury an attacker must factor into the proportionality analysis is limited to that which the attack “causes.” Unfortunately, AP I provides no definition or explanation of causality. Moreover, the treaty’s travaux préparatoires and the International Committee of the Red Cross (ICRC) Commentary on the instrument offer no insight. Nevertheless, the prevailing view is that both direct and indirect effects are included as incidental injury (and collateral damage to objects) in the proportionality analysis, so long as they are, as discussed above, foreseeable.

75 SECARMY Letter, supra note 42, at 1.
76 Id.
77 See NATO REP., supra note 31, ¶¶ 6.2.2, 6.3.4.1.
78 See DODI 6490.11, supra note 36, at 9.
79 See SECARMY Letter, supra note 42, at 1–2.
Direct effects are “the immediate, first-order consequences of a military action . . . unaltered by intervening events or mechanisms. They are usually immediate and easily recognizable.”\textsuperscript{81} Indirect effects are “the delayed and/or displaced second-, third-, and higher-order consequences of action, created through intermediate events or mechanisms.”\textsuperscript{82} Although direct effects are typically immediate and easily recognizable, they need not be, as is the case with injuries to internal organs.\textsuperscript{83} The concussive effect on the brain is such a direct effect, whereas, for instance, an automobile accident occurring later because the brain injury caused a loss of consciousness would be an indirect effect.

The legal challenge with regard to TBIs and causation in the proportionality context is two-fold. First, symptoms of the brain injury may not be identified or fully develop until well after the attack. Indeed, research is increasingly linking longer-term injuries and symptoms to TBIs. The findings of one recent study indicate that “a substantial number (74\%) of concussive blast TBI service members were found to have” brain imaging abnormalities five years after the concussive event.\textsuperscript{84} Conventional imaging taken closer to the concussive event had not revealed the abnormalities.\textsuperscript{85} However, remoteness in time is not a barrier to causation. AP I places no temporal limitation on the proportionality rule despite calls for such limits at the time of drafting.\textsuperscript{86} There is no basis for suggesting that customary law deviates from its treaty counterpart in this regard. Therefore, the mere lapse of time, even if measured in years, does not bar consideration of a TBI in the proportionality analysis. Rather, the issues are the foreseeability of that harm, discussed above, and actual causation.

The second challenge is more daunting. To be considered an incidental injury, there must be an unbroken causal chain between the attack and the harm suffered. In some cases, the individual concerned might have developed the condition even without having suffered the brain injury. In others, the attack might produce a condition wherein unforeseeable intervening causes interact to produce an injury. For example, a concussive brain injury caused by blast exposure might later be exacerbated by subsequent, independent brain trauma. In these situations,
causal attenuation or rupture would bar characterization of the ensuing condition as incidental injury for the purposes of the proportionality rule.

However, research is increasingly confirming that many mid- to long-term effects are foreseeable sequelae—a medical term denoting a chronic pathological condition that is different from, but nonetheless a consequence of, the initial injury. Of particular note is PTSD, which has been linked recently to concussive injury. In a study examining six-to-twelve month trends following concussive effects, for example, a “substantial majority” of subjects experienced greater depression and more severe PTSD than control groups. This result reinforced the findings of a 2014 longitudinal study that found increased PTSD severity three months post-deployment among active-duty U.S. Marines who sustained concussive injuries while deployed. However, and of particular relevance in the legal context, while the findings identify a “strong link” between concussive injury and PTSD, the study was quick to note that the “causality . . . cannot be determined from the current results.”

Brain injuries are increasingly also believed to be related to a wide array of other conditions. For example, a 2009 Institute of Medicine (IOM) report linked TBI to long-term conditions like unprovoked seizures, Alzheimer-type dementia, Parkinsonism, endocrine dysfunction, growth hormone insufficiency, depression, aggressive behaviors, and post-concussion symptoms such as concentration and memory loss, dizziness, and headaches. The study categorized the relationship between TBI and specific symptoms into causal relationships, consistent associations, and suggestive evidence of an association. Moreover, all of the relevant research that the study located found an association between TBI and those secondary adverse effects or illnesses studied.

These findings induced changes to U.S. law regarding illnesses that are “proximately due” to TBI and deemed service-connected for veterans’ claims purposes. The following illnesses are labeled as proximately resulting from a service-connected moderate or severe brain injury: Parkinson’s disease,

---

88 Mac Donald et al., supra note 23, at 2206, 2216.
89 Id. at 2216.
90 Id. at 2218.
91 IOM Rep., supra note 8, at 11.
92 Id. at 112 (defining causal relationship as sufficient evidence of a positive association in human studies between brain injury and a specific health outcome and also satisfying a number of factors “used to assess causality: strength of association, dose-response relationship, consistency of association, temporal relationship, specificity of association, and biologic plausibility”).
93 Id. (defining consistent association as sufficient evidence of a positive association in human studies between brain injury and a specific health outcome where “chance and bias, including confounding, could be ruled out with reasonable confidence”).
94 Id. (defining association as suggestive evidence of a positive association in human studies between brain injury and a specific health outcome because “chance, bias, and confounding could not be ruled out with reasonable confidence”).
95 See id. at 112–13.
unprovoked seizures, various dementias (manifested within fifteen years of brain injury), depression (manifested within three years of brain injury), and hormone deficiency diseases (manifested within one year of brain injury).\textsuperscript{96} The law also designates mild TBI as the proximate cause of depression that manifests within one year of the initial injury.\textsuperscript{97}

It must be cautioned that the government noted that it was not, as a matter of law, establishing a regulatory presumption of a causal nexus between service-connected brain injury and these long-term illnesses. Rather, it indicated that the IOM report evidence was sufficient to infer a causal nexus. In other words, the government was merely codifying “sound medical principles recognized in the IOM Report.”\textsuperscript{98} Moreover, most recent research examined by the report is now over a decade old. While subsequent research has strengthened the associations that the IOM report noted, no additional comprehensive state-of-the-science studies have been completed.\textsuperscript{99}

The research increasingly suggests a causal link between concussive injuries and harm that occurs later. And, plainly, brain trauma is now an accepted result of concussive effects. But sufficient granularity is lacking to establish a definitive chain of causation for injuries beyond the immediate trauma, much less a causal chain that is foreseeable, at least with respect to that degree of causality required for application of the rule of proportionality. Recent breakthrough studies into mild TBI, for example, contain caveats such as “the long-term impact of [mild TBI] is just beginning to be appreciated” (2017);\textsuperscript{100} “the long-term . . . impact . . . remains incompletely described” (2016);\textsuperscript{101} “the long-term effects . . . are more complex” (2016);\textsuperscript{102} and “the long-term health consequences . . . are not yet well known” (2015).\textsuperscript{103} Additionally, the more time that elapses between the initial injury and its manifestation, the greater the opportunity for intervening causes or unforeseen exacerbating conditions.

The requisite causal connection between concussive effects and certain mid- or long-term conditions remains tenuous in the contemporary scientific literature. Eventually, though, that connection is likely to be reliably established.

\textsuperscript{96} 38 C.F.R. § 3.310(d)(i–iv) (2017).
\textsuperscript{97} Id. § 3.310(d)(iv).
\textsuperscript{100} Mac Donald et al., supra note 13, at 371.
\textsuperscript{101} Mac Donald et al., supra note 23, at 2206.
\textsuperscript{102} Davenport, supra note 1, at 2.
\textsuperscript{103} Hayes et al., supra note 13, at 149.
Further research will also likely determine the probability of such conditions manifesting. Such probability data are important not only to establish foreseeability (relevant to the condition that the incidental injury be “expected”), but also with respect to whether an attack will cause future harm as a factual matter. Once it is reasonably available, the causal condition precedent to applying the proportionality rule to an attack having concussive effects will be satisfied.

3. “Incidental injury”

As noted, the rule of proportionality requires incidental injury to be “expected,” and it must be “caused” by the concussive effect. However, a perhaps more-central question is the meaning of “incidental injury.” It is a difficult question in this context because brain injury produces one or more of physical,\(^{104}\) cognitive,\(^ {105}\) or psychological\(^{106}\) consequences.\(^ {107}\)

The term “incidental” indicates that the injury is unintended, albeit expected.\(^ {108}\) However, the meaning of “injury” is less clear, especially with respect to cognitive or psychological injuries. No accepted definition of injury exists in treaty or customary international humanitarian law. The negotiating history of AP I captures debates over qualification as “superfluous injury” under Article 35\(^ {109}\) and “serious injury” for purposes of accountability under Article 85,\(^{110}\) but there was no discussion of the meaning of “incidental injury” as the term appears in Articles 51 or 57. The 1987 ICRC Commentary and case law are similarly unhelpful.

It may be that the drafters intentionally left the meaning of the term unaddressed. This was the case with respect to the related term “wounded and sick” in Article 12 of the 1949 Geneva Convention I. The ICRC’s Commentary on the article noted:

No attempt has ever been made in the Geneva Convention to define what is meant by a “wounded or sick” combatant; nor has there ever

\(^{104}\) For example, sensory loss, headache, dizziness, sleep disturbances, uncontrollable muscle contraction, inability to understand or express speech, to swallow properly, and seizure, balance, and coordination disorders. OSD Memorandum, \textit{supra} note 9, at 2.

\(^{105}\) For example, deficits in the mental processes of memory, perception, judgment, comprehension, reasoning, learning, production of language, and executive function. \textit{Id.}

\(^{106}\) For example, those conditions associated with behavior and emotion, like stress, anxiety, depression, irritability, and aggression. \textit{Id.}

\(^{107}\) Although cognitive deficits may result from either physical or psychological injuries, such deficits after a concussive effect commonly result from physical damage or alteration in the brain; however, until recently, the underlying mechanism between the physical damage and the cognitive deficit was not well understood. \textit{See, e.g.}, Kirsi Maria Kinnunen et al., \textit{White Matter Damage and Cognitive Impairment after Traumatic Brain Injury}, 134 \textit{Brain} 449, 449–50 (2011).

\(^{108}\) AMW \textit{MANUAL}, \textit{supra} note 53, rule 1(I), ¶ 3.

\(^{109}\) ICRC \textit{COMMENTARY}, \textit{supra} note 7, ¶ 1429; see also DOD \textit{LAW OF WAR MANUAL}, \textit{supra} note 50, § 6.6.1.

\(^{110}\) AP I, \textit{supra} note 50, art. 85; ICRC \textit{COMMENTARY}, \textit{supra} note 7, ¶ 3474; see also Convention (III) Relative to the Treatment of Prisoners of War art. 121, Aug. 12, 1949, 6 U.S.T. 3316, 75 U.N.T.S. 135 [hereinafter Geneva Convention III].
been any definition of the degree of severity of a wound or a sickness entitling the wounded or sick combatant to respect. That is as well; for any definition would necessarily be restrictive in character, and would thereby open the door to every kind of misinterpretation and abuse. The meaning of the words “wounded and sick” is a matter of common sense and good faith.\textsuperscript{111}

In fact, the lack of qualifying or interpretive guidance in this instance points to an ordinary reading of the term consistent with the interpretive guidance found in the VCLT.\textsuperscript{112}

The ordinary meaning of injury is “hurt, damage, or loss sustained.”\textsuperscript{113} Numerous expert and military manuals support a broad definition by referring to incidental injury as \textit{harm}, without reference to the nature or severity thereof.\textsuperscript{114} Moreover, while the text of the rule of proportionality expressly limits anticipated military advantage to that which is “concrete and direct,” it imposes no limitations on the nature of the incidental injury that qualifies for inclusion in the proportionality calculation.\textsuperscript{115} This being so, and although serious illness and disease may not have been discussed at the Diplomatic Conference with respect to incidental injury, there is no reason to exclude them from the scope of the term

\footnotesize{
\begin{enumerate}
\item Int’l Comm. for the Red Cross, Commentary to Geneva Convention I for the Amelioration of the Condition of the Wounded and Sick in the Armed Forces in the Field 136, art. 12, ¶ 1.C (Jean Pictet ed., 1952). Though AP I subsequently provided a definition of “wounded and sick,” the definition necessarily focused on the scope of the protection rather than the ordinary meaning of the terms. Article 8 of AP I defines “wounded and sick” as military or civilian personnel in need of medical assistance due to “trauma, disease or other physical or mental disorder or disability,” and who refrain from hostile acts. This definition explicitly includes pregnant women, young children, and the elderly. AP I, supra note 50, art. 8.
\item Vienna Convention, supra note 60, art. 31.
\item See, e.g., AMW Manual, supra note 53, rule 1(l), ¶ 4; Chief of the Gen. Staff (Can.), B-GJ-005-104/FP-021, \textit{Law of Armed Conflict at the Operational and Tactical Levels} ¶ 204.5 (2001) (describing incidental injury as “adverse effect upon civilians”); DOD Law of War Manual, supra note 50, § 5.12; Tallinn Manual 2.0, supra note 56, rule 113, ¶ 2. In those publications, discussions regarding severity or nature of injury thresholds generally surround only the meaning of superfluous injury under Article 35, see AMW Manual, supra note 53, rule 5(b), ¶ 4; DOD Law of War Manual, supra note 50, §§ 6.6.1-6.6.3; ICRC Commentary, supra note 7, ¶ 1439, or “attack” in the conduct of hostilities rules, though the latter is usually limited to damage to objects, see AP I, supra note 50, art. 49; Tallinn Manual 2.0, supra note 56, rule 92, ¶ 4.
\item AP I, supra note 50, arts. 51, 57; see also CIHL Study, supra note 50, rules 14–21.
\end{enumerate}
}
“injury,” especially since illness is accounted for in Geneva Conventions I, II, III, and IV, as well as in Additional Protocols I and II.

Given this broad definition, and interpreting the term teleologically in light of international humanitarian law’s humanitarian object and purpose, its scope would logically extend to known sequelae of TBIs. As will be explained, there is no convincing rationale for omitting cognitive or psychological consequences of a brain injury from “injury.” Further, the exclusion of “inconvenience, irritation, stress, or fear” from the broader category of collateral damage by some expert manuals, while correct, does not discount such sequelae, for the exclusions relate to the general conduct of civilian life, rather than to particular physiologies.

Yet, the term could not be interpreted to encompass purely psychological harm unrelated to TBI, at least in the current state of the law. While some have argued for inclusion based either on analogy to Article 51(2)’s prohibition on the spread of terror or teleological interpretation, their suggested approach is aspirational in character. As noted in the travaux préparatoires, the prohibition on the intentional infliction of psychological harm (terror) in Article 51(2) “is directed to intentional conduct specifically directed toward the spreading of terror and excludes terror which was not intended by a belligerent and terror that is merely an

---


118 See Geneva Convention III, supra note 110, art. 30; see also INT’L COMM. FOR THE RED CROSS, COMMENTARY TO GENEVA CONVENTION III RELATIVE TO THE TREATMENT OF PRISONERS OF WAR 211, ¶ 2 (Jean Pictet ed., 1960).


120 AP I, supra note 50, art. 8.

121 Protocol Additional to the Geneva Conventions of August 12, 1949, and Relating to the Protection of Victims of Non-International Armed Conflicts art. 7, June 8, 1977, 1125 U.N.T.S. 609; see also ICRC COMMENTARY, supra note 7, ¶¶ 4636–37.

122 See TALLINN MANUAL 2.0, supra note 56, rule 92, ¶ 8.

123 AMW MANUAL, supra note 53, rule 14, ¶ 2; TALLINN MANUAL 2.0, supra note 56, rule 113, ¶ 5. Recognizing this distinction, the DOD Law of War Manual juxtaposes, very appropriately, inconveniences and temporary disruption of civilian life in general with civilian loss of life, injury, and damage to objects. DOD LAW OF WAR MANUAL, supra note 50, § 5.12.1.2.

124 TALLINN MANUAL 2.0, supra note 56, rule 92, ¶ 8.

incidental effect of acts of warfare which have another primary object and are in all other respects lawful.”126

That said, cognitive or psychological conditions should be understood to be encompassed within the “incidental injury” when they are caused by physical brain trauma, which undeniably qualifies as incidental injury for the purpose of the rule of proportionality when suffered by a civilian. The IOM report mentioned earlier, for example, found consistent association between all brain injury severities, depression, and aggressive behaviors.127 Post-concussive effect symptoms—such as memory and vision impairment, confusion, and a loss of balance—are also now explained through biomechanical processes resulting from “variable degrees of injury to neurons, glia, the blood-brain barrier, and vascular structures, leading to transitory ionic functional disturbances with clinical manifestations.”128 Other studies involving blast-exposed patients have demonstrated that abnormalities in the brain’s white matter were “significantly” or “directly” associated with physical post-concussive symptom severity, albeit not with emotional post-concussive symptoms.129

In fact, physical brain injuries and psychological injuries may “interact in a synergistic fashion to worsen outcomes; TBI may damage the brain’s emotional regulation circuitry, and the trauma-associated psychopathology may interfere with recovery from TBI.”130 Studies have revealed hyperactivity in the brain’s emotional processing circuitry in blast-exposed veterans suffering from major depressive disorders.131 Blast-induced mild TBI patients also “exhibited a diminished interhemispheric coordination of brain activity, which was not the consequence of combat-stress symptoms (PTSD or depression) or commonly prescribed medications.”132

Establishing clear-cut distinctions between physical and psychological harms for combat-related brain injuries will require further research into the relevant brain circuitry affected by concussive effects, if such distinctions are possible.133 Scientists anticipate that brain mapping with the use of the biomarkers discussed above could allow for better discrimination between cognitive deficits and psychological manifestations of physical brain injury on the one hand and, on the other, psychological harms in the classic sense. Distinguishing between them

127 IOM REP., supra note 8, at 11.
128 Dambinova et al., supra note 12, at 2.
130 Mac Donald et al., supra note 23, at 2218.
131 See NATO REP., supra note 31, at 7-2.
132 Id.
133 See REP. TO CONG., supra note 6, at 74; see also Mac Donald et al., supra note 23, at 13.
will remain somewhat contentious until an international medical testing standard for physical brain injury induced consequences is adopted.\textsuperscript{134}

Regardless, the law is clear. All direct physical consequences of a brain injury qualify as incidental injury to civilians regardless of the level of severity or permanence. There may be obstacles to considering them during the proportionality analysis due to the “expected” criterion discussed above, but to the extent that science demonstrates that they are “caused” as a result of the brain injury, they would constitute incidental injury.

Incidental injury to civilians is only one factor in the proportionality analysis. The injury, in addition to being “expected” and “caused,” must also be weighed against anticipated military advantage in a test of excessiveness.

4. “Excessive”

Whether expected injuries to civilians are “excessive” in relation to expected military advantage is the central question of the principle of proportionality.\textsuperscript{135} Although international humanitarian law provides no definition of “excessive,” most commentators agree that excessive does not merely equate to “extensive;” injury is compared to advantage, not considered in absolute terms.\textsuperscript{136} For example, minor concussive injuries may be excessive if the anticipated military advantage is slight, whereas very serious, and even widespread, concussive injuries to civilians may be lawful where a sufficiently significant “concrete and direct” military advantage is anticipated to result from the attack.\textsuperscript{137}

The practical difficulty that arises from concussive effects is how to “value” them in the proportionality analysis, especially the cognitive or psychological manifestations of a brain injury. This difficulty is not limited to such effects; indeed, proportionality always involves comparing dissimilar values—harm to civilians and civilian property against military advantage. Therefore, the challenge of “valuing” concussive effects and their consequences presents no unique legal obstacle to application of the rule of proportionality. To the extent that concussive effects meet the other conditions of the rule of proportionality, discussed above, their weight against military advantage will be determined by a “reasonable

\textsuperscript{134} NATO Rep., supra note 31, at 1–9.
\textsuperscript{135} Schmitt, supra note 7, at 804–805.
\textsuperscript{136} See AMW Manual, supra note 53, rule 14; see also ICRC Commentary, supra note 7, ¶ 1980 (“[E]ven if they are very high, civilian losses and damages may be justified if the military advantage is of great importance.”); Michael N. Schmitt, Precision Attack and International Humanitarian Law, 87 Int’l Rev. Red Cross 445, 457 (2005); Robert D. Sloane, Puzzles of Proportion and the “Reasonable Military Commander”: Reflections on the Law, Ethics, and Geopolitics of Proportionality, 6 Harv. Nat’l Sec. J. 299, 316–17 (2015).
\textsuperscript{137} See AP I, supra note 50, arts. 51(5)(b), 57(2)(a)(iii), 57(2)(b); see also CIHL Study, supra note 50, rules 14, 18–19.
commander” standard. The notional “reasonable commander” will assess the value of the concussive effects that an attack is foreseeably expected to cause.

B. Precautions in Attack

Even an attack against a lawful military objective expected to result only in incidental injury and collateral damage that is not excessive relative to its anticipated concrete and direct military advantage is subject to the additional requirement that all feasible precautions be taken to avoid, or at least minimize, that injury or damage. Codified in Article 57 of AP I, the obligation is recognized as customary international law. It requires an attacker to consider every feasible option for avoiding harm to civilians and civilian property in achieving the intended military advantage. Thus, the attacker must consider, inter alia, weapons, tactics, and target options, and must, when possible under the circumstances, warn a civilian population of attacks that may affect it.

Article 57 begins by imposing a requirement that, “[i]n the conduct of military operations, constant care shall be taken to spare the civilian population, civilians, and civilian objects.” Constant care is a humanitarian law principle that informs the practical application of the various precautionary requirements that follow it in Article 57 (and their customary law counterparts). It also imposes a general duty of care on parties to the conflict. Although some, like DOD, have asserted that the constant care requirement is limited to “planning and conducting attacks,” the better view is that the duty extends to all military operations, not just those that qualify as attacks under international humanitarian law. Accordingly, the requirement to take constant care requires parties to a conflict to consider the possibility of harmful concussive effects during operations like ordnance disposal, mine clearing, engineering demolition operations, and other activities generating concussive effects that may affect civilians negatively.

Moreover, “constant care” requires military personnel to avoid any harm to civilians, not just that which qualifies as incidental injury or collateral damage

---

138 See Galić, IT-98-29-T, Trial Judgment, ¶ 58.
140 AP I, supra note 50, arts. 57(2)(a)(ii), 57(2)(c), 57(3); see also CIHL STUDY supra note 50, rules 15–21; DOD LAW OF WAR MANUAL, supra note 50, § 5.3.
141 AP I, supra note 50, art. 57(1); see also CIHL STUDY, supra note 50, rule 15; ICRC COMMENTARY, supra note 7, ¶ 2191.
142 ICRC COMMENTARY, supra note 7, ¶ 2191.
143 See DOD LAW OF WAR MANUAL, supra note 50, § 5.3.3. An attack is defined in international humanitarian law as an act of “violence against the adversary, whether in offense or defense.” AP I, supra note 50, art. 49(1). Not all military operations qualify as attacks. See AMW MANUAL, supra note 53, rule 1(e).
144 See Jean-François Quéguiner, Precautions Under the Law Governing the Conduct of Hostilities, 88 INT’L REV. RED CROSS 793, 797 (2006); see also U.S. COMMANDER’S HANDBOOK, supra note 53, at 8-1.
pursuant to the rule of proportionality.\textsuperscript{145} Therefore, the issue of whether concussive effects qualify as incidental injury is not relevant with respect to precautions in attack. Nor is there a requirement of either definitive expectation of harm or the establishment of causation that is not overly attenuated. To the extent that an operation may place civilians at risk, the obligation attaches.\textsuperscript{146} While this obligation may sound onerous, some militaries are already taking such care with respect to their troops.\textsuperscript{147}

Most of the remaining precautions requirements, set forth in Article 57(2–3), apply only to attacks. These include choice of weapon system, tactic, and target, as well as a duty to warn. All are subject to a condition of feasibility.\textsuperscript{148} Feasible precautions are “those precautions which are practicable or practically possible taking into account all circumstances ruling at the time, including humanitarian and military considerations.”\textsuperscript{149} The obligation is to act with due diligence and in good faith in attempting to avoid harming civilians.\textsuperscript{150} However, the precautionary obligations to consider alternative weapons, tactics, and targets apply only in cases in which incidental injury is expected, as those terms were described above.\textsuperscript{151} Despite this limitation in the text, the requirement to take constant care nevertheless obligates the attacker to avoid negative effects generally on the civilian population.

\textsuperscript{145} The distinction is clear from the absence of a reference in Article 57(1) to any type of harm. By contrast, Article 57(2), which imposes the requirement to take “feasible precautions” in an attack, refers to “loss of civilian life, injury to civilians and damage to civilian objects,” that is, the type of harm that must be considered in the proportionality assessment. See ICRC COMMENTARY, supra note 7, ¶ 2191; U.S. COMMANDER’S HANDBOOK, supra note 53, at 8-1.

\textsuperscript{146} The text of Article 57(1) simply requires parties to the conflict to take “constant care . . . to spare the civilian population, civilians and civilian objects.” AP I, supra note 50, Art. 57(1). See also ICRC COMMENTARY, supra note 7, ¶ 2191; U.S. COMMANDER’S HANDBOOK, supra note 53, at 8-1.

\textsuperscript{147} See DODI 6490.11, supra note 36 (establishing procedures for the management of concussive injuries in the deployed setting); see also BLAST INJ. RES. PROGRAM COORDINATING OFF., U.S. DEP’T OF DEF., PREVENTION, MITIGATION, & TREATMENT OF BLAST INJURIES: FY 15 REPORT TO THE EXECUTIVE AGENT 113 (2015) (detailing the development of sensors to assist commanders in determining when service members have reached a concussive injury “safety limit of exposure that would put them at risk for long-term [mild] TBI-related medical conditions”).

\textsuperscript{148} See G.A. Res. 2675 (XXV), at 76 (Dec. 9, 1970) (“In the conduct of military operations, every effort should be made to spare the civilian populations from the ravages of war, and all necessary precautions should be taken to avoid injury, loss or damage to civilian populations.”); DOD LAW OF WAR MANUAL, supra note 50, § 5.3.3; Matheson, supra note 139, at 426–27 (“We support the principle that all practicable precautions, taking into account military and humanitarian considerations, be taken in the conduct of military operations to minimize incidental death, injury, and damage to civilians and civilian objects, and that effective advance warning be given of attacks which may affect the civilian population, unless circumstances do not permit.”).

\textsuperscript{149} Protocol on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices as amended on 3 May 1996 art. 3(10), May 3, 1996, S. TREATY DOC. No. 105-1 (1997), 2048 U.N.T.S. 93; see also BOTHE COMMENTARY, supra note 64, at 404; ICRC COMMENTARY, supra note 7, ¶ 2198.

\textsuperscript{150} See Michael Bothe, Legal Restraints on Targeting: Protection of Civilian Population and the Changing Faces of Modern Conflicts, 31 ISR. Y.B. ON HUM. RTS. 35, 45 (2001); ICRC COMMENTARY, supra note 7, ¶ 2208.

\textsuperscript{151} See AP I, supra note 50, art. 57(2)(a)(ii); CIHL STUDY, supra note 50, rule 17.
Feasibility depends on context. The extent of information available to an attacker, the weapons systems that can be used to conduct the attack, the need to protect the attacker’s forces, and the extent of civilian presence in the target area are, inter alia, factors bearing on the feasibility of taking precautions. Precautions are contingent in that a soldier must take them only if doing so is reasonable in the attendant circumstances.

To illustrate, if an attack is likely to cause concussive effects, the attacker may need to consider the use of more precise weaponry, weapons with lesser blast effect, or advanced intelligence, surveillance, and reconnaissance assets to help reduce the risk of concussive injury to civilians. For instance, consider an attack with conventional weapons that is likely to cause concussive effects that can be expected to result in incidental injury to civilians, but not otherwise physically harm them. If it is feasible to neutralize the target through cyber means, and doing so would sacrifice no military advantage, the attacker would be obligated to employ a cyber weapon as a matter of law. Other factors that might reduce concussive effects include angle at which the target is struck, altitude of release, fusing, munition release heading adjustment, and terrain implications. The attacker should also consider the possibility of striking alternative targets to achieve the same or a similar military advantage if concussive effects are less likely to result from a strike on them.

International humanitarian law also requires an effective advanced warning of an attack when it “may affect the civilian population.” If one is reasonably certain that concussive injuries to civilians are going to be caused by an attack, such warnings are required, albeit only to the extent practicable in the circumstances. The active warning area would depend on the likelihood of concussive injury occurring, based on the munition used. Note that the warning requirement applies whenever the attack will “affect” the civilian population. This being so, the issue of whether the concussive injuries qualify as incidental injury is irrelevant; so long as it can be expected that the civilian population will be affected, the obligation attaches.

Finally, the defending party has an obligation to take “passive” precautions against the effects of an attack. Concussive effects would clearly be included in the effects that this duty is meant to avoid. In fact, the party in control of the territory upon which the civilian population is situated is well-positioned to minimize concussive injury by avoiding the placement of military objectives near civilians or by moving civilians from the vicinity of such objectives. Of course,

152 See AP I, supra note 50, art. 57(2)(a)(ii); CIHL STUDY, supra note 50, rule 17.
153 AP I, supra note 50, art. 57(2)(c); see CIHL STUDY, supra note 50, rule 20.
155 See AP I, supra note 50, art. 58; CIHL STUDY, supra note 50, rules 22–24.
156 See AP I, supra note 50, art. 58; CIHL STUDY, supra note 50, rules 22–24.
157 See DOD LAW OF WAR MANUAL, supra note 50, § 5.3.1.
as noted throughout this Article, the ability of a party in conflict to comply effectively with this and other legal obligations depends on the quality of information regarding concussive effects that is available to them.

Conclusion

Given the current state of science, it is arguably premature to impose a legal requirement to consider TBIs, especially their mid- and long-term consequences, in proportionality analysis and relevant aspects of the requirement to take precautions in attack. Yet, it is clear that as science advances, particularly if progress is made in the understanding of concussive effects on the civilian population, parties to a conflict could be required to do so as a matter of law.

Minimizing the harm caused by concussive effects will depend on sound and robust operational planning and execution, particularly with respect to targeting. Presently, most militaries do not treat concussive injury as incidental injury in their prescribed proportionality calculation methodologies. For instance, the collateral damage estimation methodology (CDEM) employed by U.S. forces addresses the probability of injury to persons within a certain blast radius as a result of such factors as primary blast, fragmentation, secondary debris from crater ejecta, and blunt trauma from building collapse, but it does not account for effects on the brain.\textsuperscript{158}

However, as the science is refined, reliable threshold values for the probability of mild, moderate, and severe TBI within a given blast zone could be developed and included in the CDEM to assist in mitigating such injuries. To illustrate, a collateral effects radius (CER) with respect to concussive effects could be calculated for particular classes of munitions or individual types of munitions.\textsuperscript{159} Using a CER, a collateral hazard area—an area within which an unacceptable probability of injury exists—can be calculated and assigned a casualty factor.\textsuperscript{160}

And once greater understanding of concussive effects is acquired, targeting processes can accommodate them. Because military attack decisions often occur under significant time, space, force, and informational constraints, incidental civilian-injury expectations are embedded into rules of engagement and tactics, techniques, and procedure protocols.\textsuperscript{161} The decision-maker is meant to use these tools in good faith, under the attendant circumstances, based on all information

---

\textsuperscript{158} See Chairman, Joint Chiefs of Staff, Instr. 3160.01B, No-Strike and the Collateral Damage Estimation Methodology (Dec. 11, 2015).

\textsuperscript{159} See id. at E-3 (noting that a collateral effects radius is a value that includes total error probable and the radius of primary warhead effects).

\textsuperscript{160} A collateral hazard area is formed by measuring the CER from either an aim point or the edge of a target area and drawing a circle around the target. Id.

\textsuperscript{161} Both Commentary, supra note 64, at 352 (arguing that tailored rules of engagement and observer-controlled training exercises best prepare military commanders for the sensitivities involved in conducting a proportionality analysis).
reasonably available, to assist in complying with his or her legal obligations.\textsuperscript{162} Such tools are designed to ingrain best practices, identify collateral concerns, employ mitigation techniques, and assess risk to determine an appropriate approval authority for the attack. Due to the “invisible” nature of concussive injury, it will be especially critical to account for them in such processes and methodologies.

While the science continues to develop, concussive effects still must be considered to the extent reasonable in the circumstances and in light of the current state of the science when conducting military operations because of the obligation to take constant care. Indeed, U.S. targeting doctrine encourages planners to “consider . . . second-, third-, and higher order effects,” both pre- and post-attack.\textsuperscript{163} The doctrine accounts for various categories of effects, including direct, indirect, cumulative, cascading, and unintended.\textsuperscript{164} Moreover, target-development standards require taking note of non-physical “collateral effects such as impact on communications, electrical power, and other infrastructure.”\textsuperscript{165} Irrespective of any further legal requirement, then, the United States may consider in targeting the potential effects of concussive injuries as a matter of policy and good operational sense.

Finally, while technological development may increase the effectiveness of attacks and their capacity to cause concussive effects on individuals, it may also help clarify the obligations of states under international humanitarian law. As the understanding of concussive effects grows, so too will the clarity and granularity of relevant obligations under international humanitarian law. At present, states are striving to better understand brain injury to their combatants. But the knowledge they acquire also will bear fully on their obligations to protect civilians on the battlefield, obligations that they must be preparing to shoulder.

\textsuperscript{163} JP 3-60, supra note 81, at II-36.
\textsuperscript{164} See id.
\textsuperscript{165} Chairman, Joint Chiefs of Staff, Instr. 3370.01B, Target Development Standards, at D-B-5 (May 6, 2016).
shots

TREATMENTS

Domestic Violence’s Overlooked Damage: Concussion And Brain Injury

LISTEN · 3:56  Download Transcript

May 30, 2018 · 3:23 PM ET
Heard on All Things Considered

WILL STONE

FROM KJZZ

Hundreds of survivors of domestic violence have come through the doors of neurologist Glynnis Zieman's Phoenix clinic in the past three years.

"The domestic violence patients are the next chapter of brain injury," she says.

Zieman begins every new patient visit with a simple question: "What are the symptoms you hope I can help you with?"

For most, it's the first time anyone has ever asked even how they may have been injured in the first place. "I actually heard one patient tell me the only person who ever asked her if someone did this to her was a paramedic, as she was being wheeled into an ambulance," Zieman says. "And the husband was at the foot of her stretcher."

While many patients initially seek out the clinic because of physical symptoms, such as headaches, exhaustion, dizziness or problems sleeping, Zieman says her research shows anxiety, depression and PTSD usually end up being the most severe problems.

Studies of traumatic brain injury have revealed links to dementia and memory loss in veterans and athletes. And TBI has also been linked to PTSD in current or former service members.
Another group may be suffering, still largely in silence — survivors of domestic violence.

About 70 percent of people seen in the ER for such abuse are never actually identified as survivors of domestic violence. It's a health crisis cloaked in secrecy and shame, one that Zieman is uncovering through her work at the Barrow Concussion and Brain Injury Center.

She runs what she says is the first program dedicated to treating traumatic brain injury for survivors of domestic violence.

"About 81 percent of our patients had so many hits to the head, they lost count, which, you compare that to athletes, is astronomical," Zieman says.

Zieman says it's not just the sheer number of injuries that makes these patients' cases so complex.

"One single athletic concussion is hard enough to treat, but these patients are beyond that," she says. "Unlike athletes, they do not have the luxury, if you will, of recovering after an injury before they are injured again."

Domestic violence is estimated to affect 10 million people each year. Head and neck injuries are some of the most common issues, and Zieman is uncovering how frequently traumatic brain injury is a part of the picture.

Still, she says, the lack of recognition of the severity of the abuse-related problems has left many survivors without a definitive diagnosis. Many get blamed for their cognitive impairment.
"They have been labeled for so long with all these horrible things," says Zieman. "And in the end, it's not only not their fault but there is a true medical reason behind these issues and there are some things that can be done."

Data on domestic violence and traumatic injury are sparse because it's so underreported, but Zieman says their initial findings indicate it's even more prevalent than previously thought.

A 2016 review of the medical files of patients in the program — almost all women — discovered only one-fifth of them had seen a physician for their injuries. Eighty-eight percent had sustained more than one head injury from abuse.

Zieman works with local domestic violence shelters to identify women who may be suffering from brain injuries. Workers will send them to Zieman's clinic where their physical symptoms, such as headaches or dizziness, can be treated along with the cognitive and emotional effects of their abuse. Thanks to grants and private donations, Zieman says the care is free, whether or not people have insurance.

Ashley Bridwell, a social worker at Barrow, works hand in hand with Zieman to help survivors manage life with a brain injury. "Some of these simple things like filling out an application or remembering an appointment, or being able to give a solid social or medical history— it’s close to impossible considering what they are experiencing," she says.
Bridwell helped start the program six years ago after doing outreach to the homeless community and realizing many clients had traumatic brain injuries from domestic violence. She says patients often have long histories of emotional and physical abuse. Many have cognitive impairment from repeated mild traumatic brain injury.

Patients will sometimes arrive at their clinic with a constellation of seemingly unexplainable symptoms. Bridwell remembers one who lost her job because of her forgetfulness. The woman thought she had Alzheimer's.

"And for her to come in and get some information about head injury, and about how multiple hits to the head can impact your memory, your attention, your concentration, your speed of processing, it was incredibly validating for her," says Bridwell.
The diagnosis gave her a new way to talk about and understand her private struggle. "They realize it's not their fault," Bridwell says.

And Zieman says PTSD and trauma affect this population deeply.

"The significance of the mood symptoms in this population far exceeds what we see in our other patients," she says.

Zieman says we're still in the early stages of understanding the effects of repetitive brain injury and how we can better treat it. The trauma of domestic violence only complicates the picture, but the survivors she sees remain her favorite to treat.

"I feel that we can make the biggest difference for these patients," she says.

*This story is part of a reporting partnership with NPR, KJZZ and Kaiser Health News. You can follow Will Stone on Twitter: @WStoneReports.*

concussion  ptsd  domestic violence  brain injury  women's health

---

**Support KJZZ**

Stories like these are made possible by contributions from readers and listeners like you.

DONATE NOW

VISIT THE STATION

---

More Stories From NPR
Domestic Violence: A Leading Cause Of Women's Brain Injuries : Shots - Health News : NPR

Vacation Days Piling Up? Here's How To Get The Most Out Of A Short Vacation

Why Hospitals Are Getting Into The Real Estate Business

Popular on NPR.org

LAW
Man Who Sexually Assaulted Airline Passenger Convicted, Could Face Life In Prison

NATIONAL
Pope Francis On Clergy Sex Abuse: 'We Showed No Care For The Little Ones'
President Trump Attacks Report On White House Counsel's Cooperation With Mueller

To Fix That Pain In Your Back, You Might Have To Change The Way You Sit
NPR Editors’ Picks

ENVIRONMENT
Beer, Drinking Water And Fish: Tiny Plastic Is Everywhere

MUSIC FEATURES
St. Vincent Is The 21st Century's Guitar Vanguard

Traumatic brain injury and PTSD symptoms as a consequence of intimate partner violence

Katherine M. Iverson, Christina M. Dardis, Terri K. Pogoda

Abstract

Objective: To effectively diagnose and treat women who have experienced intimate partner violence (IPV), it is important to identify the full range of physical and mental health consequences, including hidden wounds such as traumatic brain injury (TBI) and posttraumatic stress disorder (PTSD). We aimed to identify the occurrence of IPV-related TBI and associated PTSD symptoms among women veterans who experienced IPV.

Methods: A web-based survey was administered in 2014 to a national sample of U.S. women veterans. Among 411 respondents (75% participation rate), 55% reported IPV during their lives. These participants (N = 224) completed screening measures of IPV-related TBI, PTSD, and past-year IPV and comprised the current sample.

Results: A total of 28.1% (n = 63) met criteria for IPV-related TBI history, and 12.5% (n = 28) met criteria for IPV-related TBI with current symptoms. When adjusting for race, income, and past-year IPV, women with IPV-related TBI with current symptoms were 5.9 times more likely to have probable IPV-related PTSD than those with no IPV-related TBI history. Despite symptom overlap between TBI and PTSD, women with IPV-related TBI with current symptoms were significantly more likely to meet criteria for all four DSM-5 PTSD symptom clusters compared to women with an IPV-related TBI history without current symptoms (Cramér’s V’s = .34–.42).

Conclusion: Findings suggest there may be clinical utility in screening women who experience lifetime IPV for both TBI and PTSD symptoms in order to help clinicians better target their examinations, treatment, and referrals.

1. Introduction

Intimate partner violence (IPV) against women is a worldwide population health problem [1], and is associated with poor psychological and physical health, disability, and premature death [1,2]. It is a leading cause of injury to women in the United States (U.S.) [3], and women veterans are 1.6 times more likely to experience IPV during their lifetime than non-veteran women [4]. Although the field does not yet have a comprehensive understanding of why women who have served in the military are at heightened risk for IPV, several studies have found that a history of interpersonal violence, particularly military sexual trauma, increased risk for IPV among women Veterans [5–7]. Research suggests that much of the IPV that women veterans
experience occurs following their military service — when women are veterans [8]. It is therefore important to identify the health and healthcare needs of women veterans who have experienced IPV in order to inform a comprehensive healthcare agenda for the rapidly growing population of women veterans. Such research is needed because the Veterans Health Administration (VHA), the single largest provider of health care for more than 2.1 million women Veterans, is developing IPV screening programs that target women [9]. These efforts are consistent with the Institute of Medicine [10] and U.S. Preventive Services Task Force [11] recommendations to screen women and provide counseling as standard preventive care. To inform clinical practice, there is a need to identify the full range of physical and mental health consequences of IPV among women generally, and women veterans specifically, in order to improve screening, assessment, treatment, and ultimately clinical outcomes, among this at-risk population [12,13].

One of the most serious yet understudied consequences of IPV is traumatic brain injury (TBI) [14–16], defined as an alteration in brain function from an external force that disrupts the normal physiological functioning of the brain [17–19]. Not all external forces to the head, neck, or face will result in a TBI. The severity of a TBI can range from “mild,” i.e., a brief change in mental status or consciousness to “severe,” i.e., an extended period of unconsciousness or amnesia after the head injury [19]. Mild TBIs are more common than moderate and severe TBIs [20]. Health problems stemming from mild TBI usually resolve within hours or days; however, a significant portion of individuals continue to experience residual mental and physical health symptoms [15].

There has been substantial attention to TBI resulting from sports injuries and military service, [21] but scant research on TBI as an IPV after-effect [22–24]. IPV-related TBI can result from such events as being hit in the head or face with fists; having one’s head or face pushed against a hard object; violent shaking; or attempted strangulation [24]. Estimates of TBI prevalence in female IPV survivors seeking emergency shelter or care in the emergency department range from 30% to 74% [24]. Unfortunately, many TBIs go undetected and thus untreated by health care providers [23,25], which could contribute to disparities in access to needed TBI treatment such as cognitive and neurological rehabilitation [26] and other mental health care for women. There are likely a number of factors that contribute to under-detection, including women’s recovery from symptoms stemming from mild TBI, lack of provider inquiry regarding IPV and associated injuries, and women’s reluctance for disclosure (e.g., fear for self or partner’s safety). In order to enhance detection of IPV-related TBI among women, it is important to gain greater awareness of the occurrence of TBI among populations who may be most at risk. Given that women veterans are at high risk for IPV [4], they may also be at risk for IPV-related TBI and its attendant mental health consequences [12]. In the only published study examining this issue among women veterans, Iverson and Pogoda [27] found that 19% of female VHA patients experienced probable IPV-related TBI. The researchers only examined IPV-related TBI history and it is unknown whether women in their study experienced IPV-related TBI with current symptoms. That is, some women in the prior study likely experienced symptom resolution following mild TBI.

Although many individuals experience a full recovery following mild TBI, a significant proportion experience persistent physical and mental health symptoms that could benefit from clinical treatments [15]. Acute and/or chronic symptoms following TBI typically include physical problems (e.g., headaches), cognitive impairments (e.g., memory difficulties), and emotional difficulties (e.g., anxiety) [14,28]. In addition, posttraumatic stress disorder (PTSD) is a common condition among women who experience IPV. [29–32] It is important to consider that there is substantial overlap between PTSD and TBI symptomatology [28,33], especially for DSM-5 [34] PTSD criterion E (i.e., arousal symptoms) [34]. As such, clinicians may assume that irritability or sleep problems are a manifestation of PTSD stemming from IPV [28]. However, if women with IPV-related TBI report greater symptoms across PTSD criteria, comorbidity may be more likely, and both conditions warrant consideration. Understanding whether women who experience IPV-related TBI with current symptoms are more likely to meet specific PTSD criteria would have implications for mental health assessment and treatment [35].

The aims of this study were to: 1) identify the occurrence of IPV-related head events and IPV-related TBI history with and without current symptoms in a national sample of women veterans who experienced lifetime IPV; 2) examine the associations among IPV-related TBI with sociodemographic characteristics, IPV-related PTSD diagnosis, and past-year IPV; and 3) determine the associations between IPV-related TBI with current symptoms and likelihood of meeting specific DSM-5 PTSD symptom criteria.

2. Material and methods

2.1. Sample

Data were drawn from a larger national study of women veterans’ preferences for IPV-related counseling conducted between November and December 2014 [32]. Participants completed a 30-min anonymous web-based survey administered by GfK survey research firm. GfK maintains KnowledgePanel®, a probability-based, non-volunteer access survey panel of 55,000 U.S. adults that is representative of approximately 97% of U.S. households [36]. The study included an informed consent fact sheet and was approved by the local institutional review board.

As reported in detail elsewhere [32], all 548 women veterans in the KnowledgePanel® were invited to participate in the survey and 411 women participated (75.0% participation rate). Comparisons between responders and non-responders on demographic characteristics from GfK’s roster file revealed that that responders were slightly older
Pushed or shoved your head into a wall, car, furniture, or other object

Has a past or current intimate partner (for example, boyfriend, girlfriend, husband or wife) ever done any of the following to you?

Probable IPV-related TBI was assessed using a modified version of the VA TBI screening tool [39] (available from authors upon request). The modification was for item 1 of the measure in which we replaced the examples of deployment-related events that may increase risk for TBI with IPV-related head events. Specifically, women were considered to have experienced an IPV-related head event if they reported experiencing at least 1 of 7 acts by an intimate partner (see Table 1). Consistent with the VA/Department of Defense clinical guidelines [17], women were then considered to meet screening criteria for possible IPV-related TBI history (hereafter referred to as IPV-related TBI history) if they reported that IPV-related head events were associated with loss of consciousness, altered consciousness (i.e., being dazed or confused), posttraumatic amnesia (i.e., not remembering events before or after the injury), concussion, or head injury. Women were then considered to meet criteria for IPV-related TBI with current symptoms (hereafter referred to as IPV-related TBI history with current symptoms) if they reported that one or more of the following symptoms began or got worse following the IPV-related head event and occurred within the past week: memory problems or lapses; balance problems or dizziness; sensitivity to bright light; irritability; headaches; sleep problems. Consistent with the VA/Department of Defense clinical guidelines [17], women who endorsed 1 or more IPV-related head events items without any TBI-related sequelae were categorized as having no IPV-related TBI history.

Past-year IPV was assessed using the four-item HARK tool [37]. As has been done in prior HARK research [6], we made slight modifications to items to remove emotionally-laden terms (i.e., “rape”) and increase examples of emotional mistreatment. The modified HARK is a four-item screening measure of IPV from a partner or ex-partner, assessing emotional IPV, fear, sexual IPV, and physical IPV. Response options are dichotomous (yes/no). The number of positively endorsed items was summed [37]. The HARK has demonstrated high sensitivity and specificity in detecting IPV experiences [37].

We used the PTSD Checklist-5 (PCL-5) [40], a 20-item self-report measure of current DSM-5 PTSD symptoms that are rated on a 5-point scale. For this study items were anchored to IPV experiences by prompting participants to report how much they were bothered by each problem in the past month “...due to an unsafe or unhealthy intimate relationship that you may have been in at any point in your life”. A cut-off score of 33 was used to determine probable PTSD diagnosis (yes/no) [41]. Cut-offs for the DSM-5 PTSD criteria including B (Intrusion), C (Avoidance), D (Cognition/Mood) and E (Arousal) were created consistent with DSM-5 guidelines, such that participants met Criterion B or C if they endorsed at least one item, and met Criterion D or E if they endorsed at least 2 items (yes/no). The PCL-5 has demonstrated sound internal consistency (α = .96), test–retest reliability (r = .84) and convergent and discriminant validity in samples of veterans [41]. The internal consistency in this study was excellent (α = .97), with good to excellent internal consistency for DSM-5 B, C, D, and E symptom (α’s = .93, .88, .94, and .92, respectively).

Several sociodemographic items were assessed in the survey.

Table 1

<table>
<thead>
<tr>
<th>Total Sample (n = 224)</th>
<th>Endorsed IPV-related Head Event(s) (n = 129)</th>
<th>χ²</th>
<th>p</th>
<th>Cramér’s V</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Has a past or current intimate partner (for example, boyfriend, girlfriend, husband or wife) ever done any of the following to you?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hit you in the head with an object, hand or fist</td>
<td>35.3% (n = 79)</td>
<td>45.5% (n = 30)</td>
<td>82.9% (n = 29)</td>
<td>71.4% (n = 20)</td>
</tr>
<tr>
<td>Pushed or shoved your head into a wall, car, furniture, or other object</td>
<td>33.0% (n = 74)</td>
<td>45.5% (n = 30)</td>
<td>65.7% (n = 23)</td>
<td>75.0% (n = 21)</td>
</tr>
<tr>
<td>Broken your teeth or jaw</td>
<td>3.6% (n = 8)</td>
<td>3.0% (n = 2)</td>
<td>5.7% (n = 2)</td>
<td>14.3% (n = 4)</td>
</tr>
<tr>
<td>Caused eye or ear injuries</td>
<td>10.7% (n = 24)</td>
<td>10.6% (n = 7)</td>
<td>22.9% (n = 8)</td>
<td>32.1% (n = 9)</td>
</tr>
<tr>
<td>Shook you</td>
<td>28.6% (n = 64)</td>
<td>48.5% (n = 32)</td>
<td>48.6% (n = 17)</td>
<td>53.6% (n = 15)</td>
</tr>
<tr>
<td>Strangled/choked you</td>
<td>25.0% (n = 56)</td>
<td>30.3% (n = 20)</td>
<td>54.3% (n = 19)</td>
<td>60.7% (n = 17)</td>
</tr>
<tr>
<td>Threw you down the stairs</td>
<td>5.4% (n = 12)</td>
<td>3.0% (n = 2)</td>
<td>11.4% (n = 4)</td>
<td>21.4% (n = 6)</td>
</tr>
<tr>
<td>Caused other injury to your head, neck, or face</td>
<td>11.6% (n = 26)</td>
<td>7.6% (n = 5)</td>
<td>25.7% (n = 9)</td>
<td>42.9% (n = 12)</td>
</tr>
</tbody>
</table>

*a n = 95 women who did not endorse experiencing any IPV-related head events. abSuperscripts that differ in each row represent significant group differences at p < .05.
2.3. Data analysis

Descriptive statistics were computed for IPV-related head events, IPV-related TBI history with and without current symptoms, sociodemographic variables, past-year IPV, and probable PTSD diagnosis. ANOVA and chi-square analyses (with Bonferroni corrections) were performed to examine differences in these variables among the three groups (i.e., those with no IPV-related TBI history, IPV-related TBI history without current symptoms, and IPV-related TBI with current symptoms). Effect size values are presented for these associations (Cohen’s $f$ for continuous and Cramér’s $V$ for categorical variables). For variables in which homogeneity of variance was violated, Brown–Forsythe robust test results are presented. Hierarchical logistic regression examined the impact of group differences in IPV-related TBI status on PTSD diagnosis when controlling for variables significantly associated with IPV-related TBI status. The contribution of IPV-related TBI status to the model was assessed via the $R^2$ value and the change in $R^2$, as well as the effect sizes for these variables (odds ratios [ORs] and 95% confidence intervals [CIs]). Chi-square tests assessed group differences in DSM-5 PTSD symptom criteria across the three IPV-related TBI groups. Analyses were performed with SPSS, Version 22 [42].

3. Results

3.1. IPV-related head events and IPV-related TBI status

Overall, approximately 28% (n = 63) of the 224 women in this sample screened positive for IPV-related TBI. Table 1 presents the percentages of women who reported IPV-related head events, and for those who met screening criteria for IPV-related TBI history with and without current symptoms. Approximately 58% (n = 129) of women reported one or more IPV-related head events. Among women who experienced IPV-related head events, 51.2% did not report probable TBI symptoms, 27.1% reported IPV-related TBI history without current symptoms, and 21.7% reported IPV-related TBI history with current symptoms. Among these three groups, there were some significant differences in the types of IPV-related head events experienced (Table 1). In general, the pattern was such that compared to women with IPV-related TBI history with current symptoms, a lower rate of women with no probable TBI history reported IPV-related head events. Those who experienced IPV-related TBI history without current symptoms were intermediate to, and not significantly different from, either group.

From these results, three separate groups were created, those with: [1] IPV-related TBI history with current symptoms (n = 28), [2] IPV-related TBI history without current symptoms (n = 35), and [3] no history of IPV-related TBI (either no IPV-related head events or IPV-related head events with no TBI history; n = 161). These three groups were the focus of subsequent analyses.

3.2. Sociodemographic, PTSD diagnosis, and past-year IPV characteristics by IPV-related TBI status

Table 2 depicts sociodemographic characteristics, PTSD diagnosis, and sum of past-year IPV by IPV-related TBI status. There were a few sociodemographic differences among groups. Those with IPV-related TBI history with current symptoms were more likely to be non-White and more likely to report incomes of less than $25,000/year than were women with no IPV-related TBI history. Women with IPV-related TBI history without current symptoms did not differ sociodemographically from either group. The majority of those with IPV-related TBI history with current symptoms met screening criteria for PTSD (64%), representing a significantly greater percentage than those with IPV-related TBI history without current symptoms (29%) or no IPV-related TBI history (17%). Those with IPV-related TBI history with current symptoms also experienced more past-year IPV forms than did those with no IPV-related TBI history. These results held across each form of IPV, with medium effect sizes observed. Those with IPV-related TBI history without current symptoms did not differ significantly from the other groups on number of past-year IPV types experienced; the exception was for past-year sexual IPV, in which they reported significantly more types than those with no IPV-related TBI history.

3.3. Associations between IPV-related TBI and PTSD

Table 3 displays findings from a hierarchical logistic regression that examined the association between IPV-related TBI status and current PTSD status, when controlling for race, income, and sum of past-year IPV types. The full model (Table 3, Step 2) explained 22.4% of the variance in PTSD diagnosis, with IPV-related TBI status accounting for 7.7% of the variance. Women with IPV-related TBI history with current symptoms had a greater likelihood of having PTSD than did those with no IPV-related TBI history (OR = 5.86; 95% CI = 2.22–15.48), controlling for race, income, and past-year IPV. Those with an IPV-related TBI history without current symptoms did not differ in the likelihood of having PTSD relative to women with no IPV-related TBI history.

3.4. Associations between IPV-related TBI status and PTSD symptom criteria

Table 4 presents findings from chi-square tests that assessed group differences in DSM-5 PTSD symptom criteria across the three groups. Women with IPV-related TBI history with current symptoms were significantly more likely to meet each of the four PTSD symptom criteria than were those with IPV-related TBI history without current symptoms and women with no IPV-related TBI history. Medium effect sizes were observed for each symptom criterion, with Cramér’s $V$ ranging from .34 for intrusion symptoms to .42 for arousal symptoms.
4. Discussion

This study identified the occurrence of self-reported IPV-related TBI and associated PTSD symptoms among a national sample of women veterans who had experienced lifetime IPV. More than 1 in 4 women (28%) in this study met screening criteria for IPV-related TBI history, with 1 in 8 women (12.5%) reporting IPV-related TBI history with current symptoms. These findings replicate prior research [27] documenting a high rate of IPV-related TBI history among female VHA patients and extend this research by demonstrating that a significant proportion of women veterans continue to experience symptoms following an IPV-related TBI.

Women who experienced IPV-related TBI with current symptoms had a high likelihood of meeting screening criteria for IPV-related PTSD. Overall, these findings are consistent with research demonstrating strong associations between deployment-related TBI and PTSD among samples of service members and veterans [43,44]. Iverson et al. found that 60% of women veterans with deployment-related TBI had a diagnosis of PTSD in their VHA medical records [45].

Table 2
Sociodemographic, PTSD, and past-year IPV characteristics by IPV-related TBI status.

<table>
<thead>
<tr>
<th></th>
<th>IPV-related TBI With Current Symptoms (n = 28)</th>
<th>IPV-related TBI Without Current Symptoms (n = 35)</th>
<th>No IPV-related TBI History (n = 161)</th>
<th>( \chi^2 )</th>
<th>p</th>
<th>Cohen's f/Cramér's V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (M, SD)</td>
<td>45.29 (13.78)</td>
<td>51.69 (13.40)</td>
<td>50.38 (13.20)</td>
<td>2.10</td>
<td>.125</td>
<td>.019</td>
</tr>
<tr>
<td>Race (%)</td>
<td></td>
<td></td>
<td></td>
<td>7.97</td>
<td>.019</td>
<td>.189</td>
</tr>
<tr>
<td>Non-White</td>
<td>57.1% (n = 16)</td>
<td>45.7% (n = 16)</td>
<td>31.7% (n = 51)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education (%)</td>
<td></td>
<td></td>
<td></td>
<td>1.66</td>
<td>.436</td>
<td>.086</td>
</tr>
<tr>
<td>College graduate or more</td>
<td>35.7% (n = 10)</td>
<td>37.1% (n = 13)</td>
<td>46.0% (n = 74)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than $25,000</td>
<td>39.3% (n = 11)</td>
<td>22.9% (n = 8)</td>
<td>10.6% (n = 17)</td>
<td>16.01</td>
<td>&lt;.001</td>
<td>.267</td>
</tr>
<tr>
<td>Marital Status (%)</td>
<td></td>
<td></td>
<td></td>
<td>1.36</td>
<td>.506</td>
<td>.078</td>
</tr>
<tr>
<td>Married/Partnered</td>
<td>50.0% (n = 14)</td>
<td>45.7% (n = 16)</td>
<td>55.9% (n = 90)</td>
<td>3.97</td>
<td>.410</td>
<td>.134</td>
</tr>
<tr>
<td>Military Branch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Army</td>
<td>50.0% (n = 14)</td>
<td>48.5% (n = 16)</td>
<td>42.5% (n = 68)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Navy</td>
<td>14.3% (n = 4)</td>
<td>30.3% (n = 10)</td>
<td>21.9% (n = 35)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Force/Marines/Coast Guard</td>
<td>35.7% (n = 10)</td>
<td>21.2% (n = 7)</td>
<td>35.6% (n = 57)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probable PTSD Diagnosis (PCL-5 ≥ 33)</td>
<td></td>
<td></td>
<td></td>
<td>29.20</td>
<td>&lt;.001</td>
<td>.363</td>
</tr>
<tr>
<td>Yes</td>
<td>64.3% (n = 18)</td>
<td>29.4% (n = 10)</td>
<td>16.9% (n = 27)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># Past Year IPV Forms (0–4) (M, SD)</td>
<td>2.32 (1.44)</td>
<td>1.57 (1.63)</td>
<td>0.95 (1.19)</td>
<td>11.20</td>
<td>&lt;.001</td>
<td>.118</td>
</tr>
<tr>
<td>Emotional Mistreatment</td>
<td></td>
<td></td>
<td></td>
<td>13.93</td>
<td>.001</td>
<td>.249</td>
</tr>
<tr>
<td>Yes</td>
<td>75.0% (n = 21)</td>
<td>45.7% (n = 16)</td>
<td>37.3% (n = 60)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Afraid</td>
<td>57.1% (n = 16)</td>
<td>42.9% (n = 15)</td>
<td>25.6% (n = 41)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>53.6% (n = 15)</td>
<td>37.1% (n = 13)</td>
<td>19.3% (n = 31)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sexual</td>
<td>46.4% (n = 13)</td>
<td>31.4% (n = 11)</td>
<td>13.0% (n = 21)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a,bSuperscripts that differ in each row represent significant group differences at \( p < .05 \); c Levene's test for homogeneity of variances was significant, with Brown-Forsythe robust test results presented.

Table 3
Associations between IPV-related TBI status and IPV-related PTSD diagnosis status, controlling for race, income, and sum of past-year IPV types (0–4) (n = 222).

<table>
<thead>
<tr>
<th>Variable</th>
<th>B (SE)</th>
<th>Wald df</th>
<th>p</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>( \chi^2 ) [3] = 23.20, ( p &lt; .001 ), Nagelkerke ( R^2 = .147 )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Racea</td>
<td>-0.16 (0.36)</td>
<td>0.20</td>
<td>1</td>
<td>.654</td>
</tr>
<tr>
<td>Incomeb</td>
<td>-0.66 (0.43)</td>
<td>2.39</td>
<td>1</td>
<td>.122</td>
</tr>
<tr>
<td>Sum of PY IPV Types</td>
<td>0.49 (0.12)</td>
<td>17.62</td>
<td>1</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Step 2</td>
<td>( \Delta \chi^2 ) [2] = 13.10, ( p = .001 ), ( \Delta R^2 = .077 )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>-0.32 (0.38)</td>
<td>0.71</td>
<td>1</td>
<td>.400</td>
</tr>
<tr>
<td>Income</td>
<td>-0.35 (0.47)</td>
<td>0.55</td>
<td>1</td>
<td>.459</td>
</tr>
<tr>
<td>Sum of PY IPV Types</td>
<td>0.37 (0.12)</td>
<td>9.25</td>
<td>1</td>
<td>.002</td>
</tr>
<tr>
<td>IPV-related TBI Statusc</td>
<td>12.73</td>
<td>2</td>
<td>.002</td>
<td></td>
</tr>
<tr>
<td>Probable TBI History</td>
<td>0.47 (0.46)</td>
<td>1.03</td>
<td>1</td>
<td>.310</td>
</tr>
<tr>
<td>Probable Current TBI</td>
<td>1.77 (0.50)</td>
<td>12.73</td>
<td>1</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

*PY = Past-Year.

a Reference: White.

b Reference: Less than $25,000/year.

c Reference: No IPV-related TBI History.
In this study, approximately two-thirds of women with IPV-related TBI history with current symptoms experienced probable PTSD compared to 29% of those with IPV-related TBI history without current symptoms, and 17% of those with no IPV-related TBI. Even when adjusting for race, income, and past-year IPV, women with IPV-related TBI with current symptoms were 5.9 times more likely to meet screening criteria for IPV-related PTSD than were women with no IPV-related TBI history. This suggests that current PTSD is a significant issue for women experiencing IPV-related TBI with current symptoms. These findings are particularly informative given that all the women in this sample experienced one or more forms of IPV during their lifetime, and therefore suggest that having endured an IPV-related TBI and experiencing current symptoms contributes to a particularly complex presentation marked by both TBI and PTSD symptomatology. Clinical attention to both conditions is important in these cases, as their treatment modalities differ (i.e., cognitive rehabilitation for TBI, cognitive-behavioral therapy for PTSD) and may need to be integrated or delivered sequentially to help women achieve maximal clinical benefits.

Moreover, women with IPV-related TBI with current symptoms were more likely than the other groups to meet all four of the DSM-5 PTSD symptom clusters (i.e., intrusion, avoidance, negative alterations in cognition/mood, and alterations in reactivity/arousal). That the effect sizes for the differences among groups were medium further suggests that IPV-related TBI is contributing in a clinically significant manner to women’s current health needs. If current symptoms were merely a reflection of the overlap among TBI and PTSD symptoms, we would have expected to see differences mainly in the arousal and intrusion clusters. Although not examined in this study, reports of somatosensory (e.g., pain and nausea) and vestibular (e.g., balance and coordination) symptoms may also be indicative of TBI-related distress [46] and assessment of these factors may assist clinicians with diagnoses and treatment planning.

A somewhat unexpected finding was the high proportions of women who endorsed various IPV-related head events. For example, 1 in 3 women in this study reported that a partner pushed or shoved their head into an object such as a wall, car, or furniture. In addition, 1 in 4 women in this sample reported being strangled, a form of violence that increases risk for intimate partner homicide [47,48]. Such events were particularly associated with IPV-related TBI history. These data provide evidence that such severe forms of physical aggression are all-too-common experiences among women veterans who report IPV and contribute to their mental and physical health needs.

Taken together, the findings highlighting the high rates of IPV-related TBI history with current symptoms along with the robust associations between IPV-related TBI and current PTSD suggest that clinicians should engage in careful screening and assessment for both TBI and PTSD symptoms among women who experience lifetime IPV. When IPV is detected, in addition to offering education, information, and safety planning [32,49], it may be clinically indicated to screen for IPV-related TBI, make referrals for more comprehensive evaluations of TBI, and measure the impact of TBI on women’s current functioning. It is important to identify and treat PTSD among women who experience IPV as reductions in such symptoms not only can ameliorate distress but also may reduce risk for future IPV [50,51]. In the case of PTSD with co-occurring TBI, mental health clinicians may choose to first treat PTSD symptoms while monitoring the effects of the treatment on a broad array of health symptoms that are relevant to TBI using measures such as the Neurobehavioral Symptom Inventory [46]. Clinicians can then tailor their treatment and referrals to address remaining symptoms. Interventions to address TBI symptoms may include psychoeducation, cognitive remediation, neurological rehabilitation, and physical therapy.

This study was comprised of a general sample of women veterans who experienced lifetime IPV. Although the sample is similar to other representative samples of U.S. women veterans in terms of several demographic characteristics (e.g., age) [52,53], non-response bias based on unmeasured factors may still impact this study. As such, findings may not generalize to all women veterans. In addition, the sample was modest in size, resulting in some large confidence intervals for significant effects; replication among larger samples is needed. Moreover, findings should be replicated in samples of women in the community who experience IPV. Future studies should examine a range of physical and mental health needs to better inform clinical practice. In particular, such work should include a focus on depressive symptoms as this type of distress is common among women who experience IPV [30] and some depressive symptoms overlap with those of PTSD and TBI [28,33].

The reliance on cross-sectional data and self-report screening measures are additional limitations. The psychometric properties of the IPV-related TBI screener have not been evaluated. The screener is a modified version of the one
used by the VHA to screen patients for deployment-related TBI. It should be noted that the evidence regarding the psychometric properties of the original tool is somewhat mixed, especially in the context of PTSD. Notwithstanding, the measure used in this study is highly consistent with recent IPV-related TBI screening recommendations [26]. Given that women with current IPV-related TBI reported more past-year IPV, it is possible that women were in current relationships with the perpetrator of the TBI. Such information would be particularly important to assess in the context of clinical care. This study used a self-report measure of PTSD symptoms and therefore PTSD diagnosis is considered “probable”; however, the PTSD Checklist-5 [40] has high agreement with PTSD diagnoses determined by clinical interview [41]. Future research should also examine contextual variables, including the timing and number of IPV-related TBIs endured and healthcare utilization using longitudinal designs in order to advance this line of inquiry. It is important to remember that IPV is often chronic and can result in multiple TBIs [25], which can have a cumulative impact on health and functioning [24]. This may explain the strong associations observed in this study between IPV-related TBI history with current symptoms and current IPV-related PTSD symptoms. Moreover, women veterans can experience TBIs during their military service from a wide array of etiologies, including combat and blast exposure, training exercises, and motor vehicle accidents [54]. Future research should measure these additional potential forms of TBI as well as their relative contributions to women veterans’ health. Similarly, this study focused specifically on IPV-related PTSD symptoms. Future work should account for symptoms stemming from other common traumas, such as combat and military sexual trauma.

IPV is a major cause of psychiatric distress and suffering. Findings demonstrate high rates of IPV-related TBI among a national sample of women veterans. Women who experience IPV-related TBI with current symptoms are particularly likely to experience probable PTSD and various forms of past-year IPV, making them an important population for interventions to promote recovery from the often invisible physical and mental injuries that are common consequences of IPV. It is hoped that the current findings will inform screening, assessment, and treatment for women who experience IPV by increasing clinician awareness and encouraging further research and clinical inquiry into this important yet understudied topic.

References


Legal and ethical implications in the evaluation and management of sports-related concussion

Matthew P. Kirschen, MD, PhD
Amy Tsou, MD
Sarah Bird Nelson, JD
James A. Russell, DO, FAAN
Daniel Larriviere, MD, JD, FAAN
On behalf of the Ethics, Law, and Humanities Committee, a Joint Committee of the American Academy of Neurology, American Neurological Association, and Child Neurology Society

Correspondence to
Dr. Kirschen: kirschenm@chop.edu

SPECIAL ARTICLE

ABSTRACT

Objective: To examine the ethical and legal issues physicians face when evaluating and managing athletes with sports-related concussions, and to offer guidance to physicians as they navigate these situations.

Results: This position paper reviews and compares the components of sports-related concussion laws, including education, removal from play, and clearance for return to play. It highlights the challenges privacy laws present relevant to providing care to concussed athletes and suggests ways to help physicians overcome these obstacles. The report also explores the ethical considerations physicians should bear in mind as they evaluate and manage concussed athletes, addressing them through a framework that includes considerations of professionalism, informed decision-making, patient autonomy, beneficence, nonmaleficence, conflicts of interest, and distributive justice.

Conclusions: Physicians caring for concussed athletes have an ethical obligation to ensure that their primary responsibility is to safeguard the current and future physical and mental health of their patients. Physicians have a duty to provide athletes and their parents with information about concussion risk factors, symptoms, and the risks for postconcussion neurologic impairments. Physicians should facilitate informed and shared decision-making among athletes, parents, and medical teams while protecting athletes from potential harm. Additionally, including concussion evaluation and management training in neurology residency programs, as well as developing a national concussion registry, will benefit patients by the development of policies and clinical guidelines that optimize prevention and treatment of concussive head injury. Neurology® 2014;83:352-358

GLOSSARY

AAN = American Academy of Neurology; CDC = Centers for Disease Control and Prevention; HIPAA = Health Insurance Portability and Accountability Act.

Over the past few years, sports-related concussion has become a major health concern in the United States. The Centers for Disease Control and Prevention (CDC) estimates that 1.6–3.8 million sports-related concussions occur each year. Although a majority of these injuries occur while playing football, concussions are also common in other contact sports, like soccer, lacrosse, hockey, rugby, and basketball. Concussions can have devastating effects, such as short-term impairments in athletes’ cognitive and athletic performance. Repetitive concussions, and even subconcussive impacts, have been associated with long-term impairments in neurocognitive functioning, behavioral problems, premature dementia, and chronic traumatic encephalopathy.

Evaluating and managing sports-related concussion raises a variety of distinctive ethical and legal issues for physicians, especially relating to return-to-play decisions. A recent survey conducted by the American Academy of Neurology (AAN) demonstrated that while a majority of neurologists see patients with sports-related neurologic concerns, most do not receive formal or informal training regarding concussion. The purpose of this position paper is to explore the ethical and legal issues physicians face when evaluating and managing athletes with sports-related concussions, and to offer guidance to physicians as they navigate these situations. This report is primarily intended for physicians who evaluate and manage youth and amateur athletes with a suspected concussion, and to serve as a compendium

From the Division of Neurology (M.P.K.), Department of Pediatrics, and Department of Anesthesia and Critical Care Medicine, The Children’s Hospital of Philadelphia, Perelman School of Medicine at the University of Pennsylvania; the Emergency Care Research Institute and Philadelphia Veterans Affairs Medical Center (A.T.), PA; the American Academy of Neurology (S.B.N.), Minneapolis, MN; the Department of Neurology (J.A.R.), Lahey Clinic, Tufts University School of Medicine, Boston, MA; and the Ochsner Neuroscience Institute (D.L.), Ochsner Medical Center, New Orleans, LA.

Members of the AAN Ethics, Law, and Humanities Committee and AAN staff who participated in development of this report are listed on the Neurology® Web site at Neurology.org.

Go to Neurology.org for full disclosures. Disclosures deemed relevant by the authors, if any, are provided at the end of this article.

352
© 2014 American Academy of Neurology

© 2014 American Academy of Neurology. Unauthorized reproduction of this article is prohibited.
to current concussion diagnosis and management guidelines that have been produced by the AAN.14 Readers may also be interested in reviewing guidelines produced by the American Academy of Pediatrics, American Medical Society for Sports Medicine, and others.15–18

Physicians should be aware that these clinical concussion guidelines are largely derived from data generated from high school and university athletes. There are limited data from pediatric populations to determine concussion risk factors, validity and reliability of diagnostic tests, and interventions that purport to alter the natural history of concussion recovery or reduce long-term sequelae of concussion.

LEGAL CONTEXT Concussion laws. While federal legislation specific to sports-related concussion has been introduced,19,20 there are currently no federal sports-related concussion laws. States, however, have responded to concerns stemming from sports-related concussion by passing laws intended to protect young athletes. As of January 2014, all 50 states (plus the District of Columbia) have adopted youth sports concussion laws.21 The first of these laws—and the one that is considered model legislation—went into effect in 2009 in Washington and includes 3 main components:

1. Education: Each school district’s board of directors must work with the state’s interscholastic activities association to develop guidelines and other materials to inform and educate coaches, athletes, and their parents or guardians of the nature and risk of concussion and head injury, including continuing to play after concussion or head injury. An athlete and his or her parent or guardian must sign a concussion and head injury information sheet each year before the athlete can practice or compete in his or her sport.

2. Removal from play: If an athlete is suspected of having sustained a concussion during practice or a game, the athlete must be removed from competition at that time.

3. Clearance for return to play: An athlete who has been removed from play may not return to play until a licensed health care provider trained in the evaluation and management of concussion evaluates and provides written clearance for the athlete to return to play.22

Most statutes address these 3 components, but there are some noteworthy differences among the laws. For example, statutes differ as to who may provide clearance to return to play: some states only allow physicians to make this decision, while others permit athletic trainers, nurse practitioners, and physician assistants to do so. States do not uniformly require that individuals providing clearance be trained in the evaluation and management of concussion. In addition, some states require written clearance to be given, while others require only verbal clearance. Liability protection for evaluators also varies among statutes, with some states affording protection to volunteers who provide clearance in certain contexts. Thus, it is important for physicians to be cognizant of both their state law and laws in states where their patients reside so that they are familiar with their legal responsibilities and protections.23

While not flawless, state concussion laws are beneficial to youth athletes. The low removal-from-play threshold present in the statutes will likely reduce the number of athletes who may otherwise continue to play with a concussion and increase the number of athletes who receive appropriate evaluation and care. The existence of these laws, in addition to their educational requirements, should encourage coaches, parents, and athletes across the country to take the risks associated with concussion more seriously. Unfortunately, the reporting schemes established by the laws may create potential conflicts between athletes and their care providers, and the laws are generally silent on the issue of protecting athletes from the harmful effects of repeated concussions.

Privacy laws. In addition to state concussion laws, physicians who perform concussion evaluations must consider federal and state privacy laws. The federal Health Insurance Portability and Accountability Act (HIPAA), as well as many state privacy laws, restricts providers from sharing personal health information without patient consent. These restrictions can present challenges for physicians in the context of athlete–patients who want to return to play prematurely. For example, a concussed athlete may disregard his or her doctor’s recommendation to refrain from participation and “doctor shop” until he or she finds a physician who will provide the necessary clearance. The athlete may also request that the physician’s evaluation and denial for clearance to return to play remain confidential. While this may seem extreme, many athletes will jeopardize their physical and mental health to continue competing, as evidenced by the frequent underreporting of concussion symptoms to avoid removal from play despite receiving education about concussion risks.24 Thus, the evaluating physician could find himself or herself in the difficult position of being legally restricted from sharing a concussion evaluation with the athlete’s coaches and school personnel, even though making such a disclosure might be in the best interest of the athlete’s health.

Fortunately, waivers offer one way for physicians to avoid this situation. Some institutions (e.g., school districts or athletic organizations) have policies that require athletes to sign waivers at the start of the season that allow information to be shared between physicians, coaches, and other team or school staff. These waivers typically apply only to physicians specifically
affiliated with school athletic departments. A physician without any school affiliation might require an athlete–patient or his or her parents to sign a consent form that specifically allows the physician to communicate the results of a concussion evaluation with team personnel before the physician begins an assessment. As with the institution-generated waivers, this approach would satisfy HIPAA and state laws that require written patient consent for the release of health information.

If having athletes sign HIPAA waivers is not feasible, physicians may still be able to disclose an athlete’s personal health information to a coach. HIPAA does allow physicians to disclose personal health information when the physician has a good-faith basis to believe the disclosure is “necessary to prevent or lessen a serious and imminent threat to the health or safety of a person.” This is a very limited exception that is highly dependent on the facts of a given situation. Thus, if a physician wants to entertain this disclosure option, he or she should consult an attorney familiar with HIPAA and any applicable state privacy laws.

ETHICAL CONSIDERATIONS Professionalism. The AAN Code of Professional Conduct states that “The neurologist must practice only within the scope of his/her training, experience, and competence. The neurologist should provide care that represents the prevailing standards of neurologic practice.” It is, therefore, essential that physicians responsible for either the sideline or subsequent medical care of athletes who have sustained sports-related head trauma have adequate training and experience in the recognition and evaluation of the existence and severity of potential brain injury. Physicians should also be familiar with current management guidelines, such as those recently released by the AAN, as well as national (e.g., CDC’s Heads Up initiative) and state-specific (e.g., Pennsylvania Department of Education’s BrainSTEPS) programs to raise awareness and improve concussion education. As previously mentioned, some state laws specify training requirements for physicians who are making return-to-play recommendations for concussed athletes. Adult neurologists may treat pediatric patients with concussions, and vice versa, if managing these patients is within the physician’s scope of knowledge and practice, and is approved by their credentialing institution. Since neurology training programs have only recently begun to offer formal training in the evaluation and management of concussion, most practicing physicians will qualify by virtue of experience or by participating in continuing medical education courses covering this topic.

Informed decision-making and respecting autonomy. Respect for autonomy emphasizes the importance of allowing patients and parents to participate in making medical decisions, including decisions about returning to play, and the right to refuse recommended treatment. All physicians have an ethical duty to educate their athlete–patients and the patients’ parents about concussion. Specifically, physicians have a duty to inform them (in understandable language) about the evidence for potential short- and long-term neurocognitive and neurobehavioral risks associated with single and multiple concussions as well as common clinical concussion manifestations. This duty to educate is independent of whether an athlete has previously had a concussion. Physicians may choose to discuss data that demonstrate reduced learning and memory performance after playing contact sports—effects thought to be secondary to the accumulation of multiple subconcussive head impacts—even when overt concussions are not reported. Effective concussion education exists in multiple forms, including videos, Web sites, lectures, and handouts. As a result of concussion laws, many schools and physicians now require athletes and parents to sign paperwork affirming that they understand the risks of concussion before the athlete participates in a sport.

There are at least 2 circumstances where a surrogate may be required for decision-making after concussive head injury. An acute concussive injury may transiently compromise an athlete’s cognitive ability to such a degree that he or she will lack capacity to make a decision regarding his or her medical care or participation in research studies. Physicians have an ethical obligation to protect their patients in these situations, and may need to rely on family or athletic staff to ensure the patient’s safety. Researchers who seek to enroll acutely concussed individuals in studies should consider obtaining informed consent from potential subjects or their proxies (usually parents for minor children) before the start of an athletic season in order to adequately balance the competing obligations of research subject protection and study enrollment.

Physicians should clarify whether health information will be shared with parents, patients, coaches, trainers, and other team or school personnel at the time they initiate care. Providing patients and their parents with information to allow them to make truly informed decisions about their concussion management, and return to play in particular, is a key component of protecting patient autonomy and promoting shared decision-making. Since potential athletic scholarships may influence athletes’ return-to-play decisions, these patients and their parents may benefit from being referred to resources that detail the probability of receiving of such awards.

In those instances in which the athlete is a minor, parents or legal guardians will serve as medical decision-makers for their children. In rare cases, minors can make medical decisions for themselves if they have been
granted the legal status of emancipation or have been deemed a mature minor for the purpose of making medical decisions. Situations in which minors are deemed to be fully or partially emancipated are determined by statute and vary from state to state. Limited literature suggests that an adolescent who is at least 14 years old may have the same ability to make health care decisions as an adult.

Cases may arise in which the opinions of an athlete and parent diverge. In this situation, the physician should be aware that coercive forces from other parties, such as coaches, teachers, or teammates, may be exerting undue pressure on the athlete. Providers should also consider the possibility that athletes or their parents may harbor ulterior motives for wishing to be evaluated for postconcussive symptoms, such as requesting academic accommodations, needing an explanation for athletic or academic performance that does not meet expectations, or acquiring neuropsychotropic medications. In these situations, the physician’s perspective may be helpful to ensure that medical decisions preserve the best long-term interest of the athlete.

**Beneficence and nonmaleficence.** The corollary goals of beneficence and nonmaleficence (do no harm) are fundamental to any ethical framework. When managing athletes who have sustained a concussion, physicians must consider the current and future best interests of the patient. While the long-term effects from a single concussion are unclear, repetitive head injuries have been associated with chronic neurocognitive deficits, neuropsychiatric dysfunction, and neurobehavioral impairments.

Two important factors may increase an athlete’s risk of harm. First, compared to older athletes, younger athletes are at increased risk for more severe symptoms, cognitive deficits, and a prolonged recovery from concussion. Second, the probability of harmful short- and long-term sequelae from concussion likely increases with the number of concussions an athlete sustains. Thus, the physician’s ethical duty to safeguard all athletes, particularly younger athletes, from the risks of additional concussions increases with each injury.

Many considerations could lead an athlete or his or her parent to prefer premature return to play after a concussion. How might physicians balance respect for patient autonomy and their duty to attempt to protect their patients from harm? Providers should explore and be sensitive to the many factors motivating an athlete to return to play despite the athlete’s acknowledgement of the risks of further (and potentially permanent) neurologic impairment. These factors may include career aspirations, a commitment to a sport, school, or team, or pressure to meet expectations from family, teammates, or a coach.

However, despite these important considerations, athletes, and particularly adolescent athletes, may not truly understand the risks of potential long-term sequelae of concussion. Thus, restricting concussed athletes from prematurely returning to play, or from returning to play after multiple concussions, is grounded in the physician’s commitment to beneficence and protecting athletes from potential harm. While medical ethics has rightly emphasized the importance of preserving patient autonomy, this principle is not absolute and does not outweigh all other ethical imperatives. A physician’s commitment to beneficence and duty to protect his or her patient from harm may occasionally supersede patient autonomy from an ethical perspective.

**Conflicts of interest.** Ideally, physician reimbursement pertaining to sports-related concussion should be solely derived from patient evaluation, management, and counseling activities. Physicians and other members of concussion management teams (e.g., physical therapists and neuropsychologists) should disclose all financial arrangements that could influence patient care decisions to athletes and parents, including contractual relationships with teams, organizations, or governing bodies, involvement (scientific or financial) in the development of diagnostic or protective equipment, or paid sponsorships. Physicians who have the potential to benefit financially by direct reimbursement or indirectly by reputation from referrals, publicity, or name recognition from treating athletes with concussion should disclose these potential conflicts of interest and must ensure their primary duty is to the health of the athletes.

Physicians employed by athletic teams may find that their duty to an injured athlete may directly conflict with the interests of their employer. In this context, physicians may receive implicit or explicit pressure to prematurely clear athletes to return to play. It is of paramount importance for physicians to affirm clearly that their primary responsibility is to protect the health and well-being of their patients, regardless of financial interests or employment considerations. Failure to prioritize patient well-being represents a breach of ethical and professional conduct. Such action could result in termination of AAN membership, which is reportable to the National Practitioner Databank. Physicians should also be aware that even the perception that they may be unduly influenced by the teams that employ them may result in a detrimental erosion of trust between physicians and their athlete–patients.

**Distributive justice.** Ideally, all athletes would have access to timely concussion-related medical care from qualified providers trained to evaluate and manage concussion and its complications. However, treatment disparities have been well-documented for many aspects of care delivery in numerous neurologic conditions and concussion care is unlikely to be an exception. Schools and athletic organizations...
should consider the potential financial burden athletes and their families may incur in order to obtain evaluation and treatment of a sports-related brain injury; such costs may prove prohibitive for disadvantaged families. These entities should also ensure that, at a minimum, a concussion evaluation is available to all athletes.

Access to providers familiar with concussion management may be particularly challenging in rural or underserved areas, which may have fewer providers with concussion expertise. Educational models that use videoconferencing technology to train primary care providers to manage complex medical conditions outside their expertise have demonstrated excellent results and may be applied to concussion medicine as a means of improving the quality of concussion care in these communities.  

Other types of disparities may also impact access to high-quality resources for concussion prevention and evaluation. For example, athletes (especially those in school districts with few financial resources) may have limited access to protective equipment that could prevent or reduce concussion injury. Baseline and interval neuropsychological testing are increasingly used to monitor athletes for potential cognitive injury. However, it is important to ensure that these tests perform well across culturally and ethnically diverse populations, including athletes who speak English as a second language. Further work is needed to ensure that neuropsychological testing is valid and generalizable to all athletes.

DISCUSSION Sports-related concussions are a growing public health concern, especially for youth and amateur athletes. Physicians caring for these athletes have an ethical responsibility, grounded in the principles of beneficence and nonmaleficence, to ensure that they safeguard the physical and mental health of their athlete–patients. While autonomy is a fundamental ethical principle, it is not absolute and should not supersede other principles such as beneficence in ethical deliberations surrounding concussion management. It is therefore of paramount importance for physicians to promote informed and shared decision-making with athletes, parents, and medical teams that aims to respect patient autonomy while protecting athletes from potential harm. Physicians can accomplish this by providing unbiased information to athletes and their parents about common concussion symptoms as well as the potential short- and long-term risks of single and repetitive head injuries. Physicians need to be aware of how to navigate the ethical and legal impediments to achieving these goals, particularly the numerous potential conflicts of interest.

Overall, the evaluation and management of concussed athletes, as well as concussion research and policy, may benefit from (1) the inclusion of education about concussion pathophysiology, diagnosis, evaluation, and management into neurology residency training programs; (2) wider implementation of baseline cognitive testing, particularly for high-risk athletes, to improve our understanding of the short- and long-term cognitive impact of concussions; and (3) the development of a national concussion registry (optimally with a mandatory reporting scheme) to document more rigorously the incidence, recurrence, and neurologic sequelae of concussion at all levels of play.

In the future, more widespread baseline cognitive testing and the creation of a national concussion database would facilitate monitoring concussion rates and outcomes as various strategies for prevention (i.e., rule changes or modifications to protective equipment) are implemented. These strategies could help identify the threshold at which the number and severity of head injuries leads to irreversible brain injury. They may also help clarify how concussion risk varies with factors like age, sex, pubertal stage, and ethnicity so athletes and parents can make informed decisions about playing contact sports. Additionally, increased baseline testing and a national database will further research into the natural history of the cognitive side effects from concussion, help determine which assessment tools best detect and monitor concussion-related changes, and help assess the prevalence of phenomena like “doctor shopping.” Baseline testing may also help reduce bias in the interpretation of results based on preinjury intelligence, language, or cultural differences, thus addressing potential disparities in care. Furthermore, longitudinal data from a prospective registry could eventually facilitate a more comprehensive understanding of the neurocognitive, neurobehavioral, and neuroeconomic consequences that athletes (particularly those in high-risk sports or high-risk positions) face from single and repetitive head injuries.

AUTHOR CONTRIBUTIONS Dr. Kirschen: conceptualization of material and drafting and revising the manuscript. Dr. Tsou: conceptualization of material and drafting and revising the manuscript. Ms. Nelson: conceptualization of material and drafting and revising the manuscript. Dr. Russell: conceptualization of material and drafting and revising the manuscript. Dr. Larriviere: conceptualization of material and drafting and revising the manuscript.

ACKNOWLEDGMENT The authors thank Drs. Christopher Giza and Jeffrey Kutcher for critiques of earlier versions of this report. The authors also thank the members of the AAN Ethics, Law, and Humanities Committee and AAN staff who participated in development of this report and guidance.

STUDY FUNDING No targeted funding reported.

DISCLOSURE M. Kirschen received honorarium for authorship in Continuum®. A. Tsou reports no disclosures relevant to the manuscript. S. Nelson provided legal counsel for the AAN. J. Russell received authorship royalties from McGraw-Hill, Continuum, and Lahey Clinic. D. Larriviere was paid as an Associate Editor for Continuum Audio, is an Associate Editor for Continuum and an
The American Academy of Neurology (AAN) and the Child Neurology Society (CNS) have endorsed the paper. Go to Neurology.org for full disclosures.

REFERENCES

37. Collie A, Macnab I, Maruff P, Bennett K, McCreary P. Cognition in the days following concussion: comparison of
Concussion: A History of Science and Medicine, 1870-2005

Stephen T. Casper, PhD

Objective.—To review the intellectual history of concussion from the mid-19th century to the opening decade of the 21st century.

Background.—Head injuries (HI) and their acute and long-term effects have been investigated for centuries, with major reviews of the topic appearing by 1870. Thus, while it has long been acknowledged that chronic traumatic encephalopathy was first described by Harrison Martland in 1928, an examination of the history of concussion research up to Martland’s seminal report places his studies in a deeper historical context. This history makes clear that Martland’s findings were one among many such studies showcasing the lasting dangers of blows to the head. In the years after Martland published his study, his paper was frequently cited in other papers that made clear that blows to the head, of all ranges of severity, were dangerous injuries with potentially life-changing consequences.

Methods.—The author has engaged in an historical analysis of the development and elaboration of concussion research in clinical medicine, neurology, neurosurgery, and those scientific disciplines related to clinical medicine. The author has found numerous primary sources from the history of medicine and science that describe the acute and chronic effects of single and repeated sub-concussive and concussive blows to the head.

Results.—This study makes clear that evidence-based methodologies inevitably short-change the knowledge of past clinicians and scientists by holding these figures to normative standards of recent invention. What criticism of this kind fails to recognize is that past investigators, many of them pioneers in their fields, published their work in ways that matched the highest normative standards of their day for the presentation of evidence.

Conclusions.—It has been recognized for a long time that concussions are dangerous injuries with potentially life-changing consequences, ranging from permanent symptoms to degenerative neurological states. The intellectual history of medicine and science from 1870 to the recent past shows both a continuity of clinical observations about HI and a steady, incremental accumulation of knowledge refining our understanding of those observations from a remarkably wide sphere of scientific disciplines.

Key words: concussion history, head injury, chronic traumatic encephalopathy, brain injury, history of neurology, neurodegenerative disease

(Headache 2018;58:795-810)

INTRODUCTION

In 1933, a slim volume entitled The Injured Workman appeared in print. Like many texts from the history of occupational disease and illness, the volume described with fulsome urgency the various injuries and accidents that plagued working men and women in factory labor and other arenas of professional life. Among the ailments discussed were head injuries (HI), their immediate and remote effects and sequelae. Concussions were common enough for the authors to observe that “mental impairment of post-traumatic origin is surely well-known to every practitioner in industrial
districts. ‘Never the same man since his accident’ is a phrase only too often and too truly heard.” Noting that personality changes and degradation of the whole intellect were often encountered in such cases, the authors observed that the pathogenic mechanisms of HI, while poorly understood, included focal destruction of nerve elements and glial tissues, disintegration and chromatolysis of nerve cells, as well as minute multiple hemorrhages. On concussive injuries, the authors observed:

Concussion usually leaves no after-effects whatever. But frequently, and varying with the severity of the state, sequelae are met with and require clear recognition. The commonest syndrome is that in which the patient complains of headache, often intensified by a sudden change in posture, forgetfulness, change in disposition, irascibility, dizziness, lack of concentration, and poor and disturbed sleep. Such a patient is frequently totally unable to do his ordinary work and may steadily deteriorate mentally. Indeed, mental sloth is commonly very noticeable to friends and family at an early stage. Another syndrome is well-nigh indistinguishable from typical neurasthenia. In still another there is a picture somewhat resembling post-encephalitic Parkinsonism.1

By the time The Injured Workman had been published, research into closed head injuries (CHI) had been ongoing for well over a century, with clinicians and historians in the Western world establishing that injuries could occur in any setting and with a spectrum of severity.2 In reviews, lectures, textbooks, and original research publications, clinicians throughout the late 19th and 20th centuries enjoined each other to warn patients that CHI were dangerous, that repeated concussion should be avoided, and that such injuries brought risks of long-term consequences, including degenerative neurological and psychiatric diseases.

Historical scholarship, thus, produces a sharp and intriguing contrast with evidence-based methodologies like meta-analyses and systematic reviews. Where these new and controversial methodologies end up declaring much significant historical evidence anecdotal, careful historical analysis shows that past investigators brought forward high quality studies and published them in ways that conformed to their past norms. The historical record, furthermore, makes obvious that past authorities never intended to be anecdotal in their writings. They were trying to inform about their clinical experience and scientific research, and they were calling upon their readers, doctors and scientists, to apply reason and inference to information that was emerging from a variety of scientific and clinical arenas, including pathophysiology, at the time for them a gold standard for medicine.

In what follows, this essay surveys the historical primary source literature and offers highlights and touchstones from the long chronology of concussion research. While there were extensive scientific debates on a variety of issues defining CHI across the late 19th and 20th centuries, the published literature makes clear that there was also a remarkable stability in the core definitions, concepts, concerns, and mechanistic understandings that defined the surgical and clinical practices these injuries necessitated. Moreover, there was a strong genealogical relationship across the generations, with findings from investigations in one generation being refined and advanced in the next. Thus, while numerous authorities in the past acknowledged modest differences in meanings and applications of the word concussion, they also routinely cited the work of their predecessors, thereby ensuring a strong historical continuity from the past to the present that is now visible in the historical record.3

SOMATIC VERSUS PSYCHOGENIC SCHOOLS OF THOUGHT

Historians of neurology have long detailed the numerous controversies that sprang up between what the great historian of American psychoanalysis Nathan G. Hale termed the “somatic style” in neurology and the varieties of dynamic psychology and psychiatry that contested somatic claims with a psychogenic account for mental disease.4,5 By the late 19th century, this debate between clinicians and basic scientists studying the central nervous
system (CNS) had developed into the classic tension between organic and functional illnesses that remains, even today, a fixture of debates in neurology, psychiatry, and neuroscience.\textsuperscript{6} The mind, some held, could be functionally diseased even in the context of a seemingly structurally healthy brain. With the rise of Freudian theory after 1909 in the United States, that idea gained great momentum and would not diminish until the mid-1960s, when the rise of molecular biology, neuroscience, and the emergence of psychoactive pharmaceuticals made the position appear increasingly untenable for many.\textsuperscript{4,5}

At the same time, numerous figures in Britain and North America cautioned that there was a borderland between the organic and functional realms, a view with great importance in HI research.\textsuperscript{7} This view suggested that physiological disturbance without apparent structural damage to the tissues was possible. Where the former psychogenic meaning imbued numerous psychiatric and neurological conditions with psychosomatic features, the latter implied that a physical influence had disrupted the behavior of the tissues.\textsuperscript{8} The study of HI throughout the last decades of the 19th and first half of the 20th century often mixed these dual meanings of “function” together, resulting in variegated rhetorical and scientific meanings typical of the controversies that defined concussion in wider society. This was particularly important once the legal system determined that such injuries could be compensable in litigation.\textsuperscript{9} It was courtroom debates, often fought in the public sphere, that generated the perception that HI research in concussion was a controversial matter.\textsuperscript{10} Yet, as the passages from The Injured Workman make clear, even those suspicious of exaggerating individuals (as those authors were) recognized that the effects of blows to the heads, of concussions or worse, could leave permanent or degenerating lesions in the unfortunate victim.

What was the source of such confidence? Clinicians routinely saw and described a common constellation of symptoms that emanated from mild and severe injuries.\textsuperscript{11} Observations were made that in rare instances, single injuries, especially in older individuals, resulted in rapid decline characterized by the onset of dementia and disinhibition. In the 1940s, basic research using animal models found small petechial hemorrhages and other forms of degradation of the brain tissues, showing cumulative deterioration with exposure to blows.\textsuperscript{12}

**THE FACES OF CONCUSSION, 1870–PRESENT**

Numerous social, cultural, political, medical and scientific contexts shaped HI research from 1870 to the present.\textsuperscript{13} It was common for early authors to mention issues of public concern that had drawn attention, whether in the lay press or elsewhere. The industrial world, with its bustling roads and railways, loud factories and enormous construction zones, and new modern understandings of worker protection, provided regular fodder in an epoch that acquired a moniker indicating both the pathology and reality of “The Age of Nerves.”\textsuperscript{14} Early studies in particular focused on railway accidents that resulted in HI as well as spinal injuries.\textsuperscript{15} Where concussion of the spine initiated controversy, most famously between surgeons John Eric Erichsen and Herbert Page, authorities, including the usually taciturn Page, readily admitted that the sequelae following HI could result in a range of temporary and permanent impairments.\textsuperscript{16}

While industrialization signified the transformed nature of risk from HI in labor and leisure, the wars of the 20th century, particularly World War I and World War II, brought an enormous knowledge of pathophysiology into the mechanisms and consequences of HI.\textsuperscript{17} In both wars, thousands of HI patients came to the attention of doctors. Many soldiers had histories of CHI sustained in proximity to blasts or had been buried alive.\textsuperscript{6} The traumas of war were of a dual nature, with physical and psychological components which determined patient experience and presentation.\textsuperscript{18} Thus, one difficulty in clinical medicine that originally emanated out of World War I and continues to the present is the uncertainty of all causes of neurologic and psychiatric presentation.\textsuperscript{19} This discussion, which began in 1915 as cases of shell shock began to appear on the Western and Eastern Front,
continues in publications by those working with veterans.\textsuperscript{17} Experts routinely sought multi-factorial explanations for these presentations, noting the plausibility of premorbid personality or psychological traits as a defense mechanism to the stress of warfare. Although these concerns stimulated numerous investigations, as well as clinical and scientific debates, it was a rare figure who argued wholeheartedly for a Freudian interpretation of such cases.\textsuperscript{20}

Other noteworthy contexts in HI research were sporting injuries and automobile accidents (see Fig. 1). By the late 19th century, authorities in reputable medical journals were raising concerns about HI sustained in contact sports at all skill levels. These concerns would crystallize around boxing in the 1950s,\textsuperscript{21} though extensive debates about the violence of collegiate-level football were noted as early as the 1890s.\textsuperscript{22} All early debates framed those that emerged in the 1980s and afterwards. Motor vehicle accidents also became drivers of HI research in the same period. High profile motorcycle accidents in the interwar period, for example, stimulated helmet research and, by the 1950s authors proclaimed a HI epidemic as a consequence of vehicular collisions. Extensive reports published by the Society for Automotive Engineering appeared, examining the intersection of HI in medicine and engineering. The huge numbers of HI patients would also stimulate research into brain injury. Fred Plum and Jerome Posner, for example, used these populations to characterize stupor and coma.\textsuperscript{23}

Beyond these wider social, cultural, and political contexts, neurology, neurosurgery, and neuroscience professionalized as fields of study (Fig. 2). In the first decades of the 20th century, asylum pathologists, for example, used large HI populations to gather data on the sequelae.\textsuperscript{24} As patterns of institutionalization changed, however, so too did the possibility of conducting studies like these and by the time of the First World War publications by such authors had diminished. The use of EEG in research, as another example, emerged in the 1930s,\textsuperscript{25} and used by the 1940s in HI investigations.\textsuperscript{26} It was a prominent tool in the 1950s and
1960s, but became less popular in subsequent decades. Such trends illustrate ways concussion research gradually evolved across the 20th century.

**CONTROVERSY IN CONCUSSION RESEARCH, 1870–PRESENT**

Numerous authorities across this period repeatedly drew attention to the controversial nature of HI research. Some of this controversy resulted from potential secondary gain from injured patients. Workmen’s compensation cases, insurance claims, and personal and corporate liability suits became a typical feature of modern jurisprudence settings, and with the advent of welfare state policies, were commonplace after 1918. Litigation settings, in other words, dominated the background discussions of HI (Fig. 3). Some physicians participating in medical–legal cases as well, and publications such as those by Byrom Bramwell in 1913 and others, called attention to the pernicious influences a promise of compensation might play in a patient’s ongoing debility and impairment, often suggesting that such patients were little better than malingerers, albeit potentially subconscious ones.

In addition to these litigation controversies, debate between clinicians and scientists included concerns about the extent to which HI resulted in functional rather than structural brain dysfunction. Freudians, from approximately the time of the First World War, saw the sequelae of these
injuries as evidence of unconscious urges and drives, bellying any putative structural injury (although some like De Fursac in 1918 recognized pragmatically the importance of structural lesions in some cases).29 As Freud’s influence diminished in the 1960s,5 concerns about psychogenic etiologies remained. Famously in the 1960s, eminent neurologist Henry Miller argued from clinical experience that many cases of post-concussion syndrome appeared coincidently to follow from the precarious misfortunes of patients he was seeing in litigation settings. He termed such cases “accident neuroses,”30 and the notion stuck. It came, however, to be used more cynically than Miller might have intended. While Miller argued it likely that there was little structurally wrong with the brains of such individuals in instances of a single and minor blow to the head, he also recognized the existence of chronic traumatic encephalopathy (CTE), a condition recognized to occur from intermittent repeated injuries to the brain.31

During these early years, it was impossible to connect objective signs and symptoms with current or delayed-onset subjective symptoms in concussion. There was little problem naming the blow to the head as the ultimate cause because of the close temporal relationship of injury to symptoms, although it was acknowledged that co-morbidity and pre-morbid personalities could be concerns. The question of mechanism of injury, and localization in brain tissue, was an open question driving scientific research, and pathophysiological studies, the gold standard of medicine prior to the advent of the double-blind randomized controlled trial, provided the most significant contributions to the topic.32

**HIGHLIGHTS FROM CONCUSSION AND CONCUSSION SEQUELAE RESEARCH, BEFORE WORLD WAR I**

Many important publications on concussion appeared in the literature before World War I. In 2 essays published in 1871 and 1872, the eminent physician James Crighton Brown (Fig. 4) reviewed the literature on cranial injuries and mental diseases in the context of his clinical experience. His
2 classic studies demonstrated how advanced clinical knowledge was by the mid 19th century. Crichton Brown, among the founders of Britain’s first neurology journal *Brain* and a correspondent of Charles Darwin, described cranial injuries in the *West Riding Lunatic Asylum Medical Reports* (a journal often thought to have been *Brain’s* precursor). Crichton Brown studied a spectrum of cranial injuries, from mild to severe and resulting in death. In 1871, he made a fascinating early observation, given that neuronal theory was not yet fully accepted, and would not be until Cajal’s pioneering work, that:

Concussion is, of course, the most important element in the vast majority of cranial injuries, in relation to subsequent mental infirmity. Not only does it accompany, in greater or less degree, almost all of those other injuries which produce structural lesions, and contribute as much, perhaps, to the consecutive mental changes as the structural lesions themselves; but it is by far the most frequent kind of cranial injury, and the most fruitful source of ulterior misfortune…. Everything points to the conclusion that the evil of concussion really consists on what may be called dynamical changes in the nerve cells and their connecting fibrils.

In his second publication in 1872, Crichton Brown went yet further still. “Great caution should be used ever after by anyone who has experienced such an injury.” In prose thick with the period’s nuances he described the dangers of repeated concussions and noted that personality changes and other mental ailments flowed from these:

Moral delinquency, with its preponderance of the lower feelings and propensities, is also an occasional consequence of cranial injuries; indeed there are grounds for thinking that some who come within the pale of the law as criminals, and who are incorrigible under all correction, have been plunged into vice at first, or have been confirmed in ill-doing, by that cerebral weakness which concussion, and more especially repeated concussion, engenders. A career of dissipation exposes to injuries of the head – these cause a certain amount of weakness and irritability – and these again are enormously aggravated by a continuance in dissipation, so that a total loss of self-control, and an exaggerated activity of all the baser passions is soon reached.

In this period, as Crichton Brown’s essays note, mental disease and HI nomenclature was in development. William Julius Mickel in *Brain* (1893) began modern nomenclature for the mental sequelae following HI. Mickel adopted “traumatic dementia” and “traumatic insanity” as terms for describing the mental illnesses caused by HI. Although he was interested in HI of any severity he made clear his awareness that concussion in rare instances could trigger degenerative conditions. He said of the insanities emerging after brain trauma:

Some become moody, solitary, moping, impatient, bearish, ill-natured, irritable. Then the excitement waxes, is accompanied by threatening and violent language, and may pass into
an acute excitement with suicidal attempts and homicidal assaults, and perhaps convulsions. The acute symptoms, passing off, may leave a bitter, resentful, suspicious, morose, unfriendly, unsociable, taciturn, reserved condition and demeanour; and delusions of conspiracy against the patient.  

Following Mickel’s publication, the nomenclature for mental sequelae following HI became more refined, with many describing traumatic neuroses, traumatic hysteria, and traumatic psychoses in the first 2 decades of the 20th century. In the interwar period, those labels, in turn, would modify further, with traumatic encephalitis, traumatic encephalopathy, and post-concussion syndrome emerging in medical parlance.

It should be noteworthy that Crichton Brown and Mickel both worked in asylum settings. Like many figures in this period, they endeavored to understand the way somatic changes to the brain tissues could result in mental disease. By the beginnings of the 20th century, the question of whether structural changes underpinned mental illness became more urgent. The traumatic factor in mental illness was thus of central concern, because it was evidence that changes to brain tissue from a blow or a fall could lead to mental disturbance. The implication was some patients in asylums were HI victims and thus suffering from a secondary cause of mental disturbance. Many asylum pathologists in Germany and the United States began to study the demography of their own inmate populations to identify cases in which the traumatic factor appeared definitive.

Among those was A.B. Richardson (Fig. 5), then working at the Government Hospital for the Insane in Washington, DC (Fig. 6), who published a review and early compilation of case reports in 1903 (the year of his death) of physical trauma as the cause of mental disease. Richardson described rare but known incidences of concussive trauma resulting in degenerative disease. He added case studies from his own asylum, some of which were concussion without loss of consciousness. Quoting statistics of his contemporaries, Richardson observed:

In 21 [patients] the concussion was followed by immediate loss of consciousness, in 16 by simple mental confusion, in 12 by dull pain in the head. In 19 mental disease began within one year, but in the majority the commencement of the insanity dated from four to ten years after the injury. In 18 cases there was...
dullness of hearing, in 20 great irritability and tendency to violent outbursts. In 14 suicidal tendencies were present. Weakness of memory and confusion of mind were not infrequent.24

Richardson’s essay was buttressed by simultaneous reports from British surgeon T.C. English. English observed in his Hunterian Lecture in 1904 that concussions of all severity could cause irritability, depression, headache, personality changes, and greater susceptibility to alcohol. English’s study drew heavily upon an original prospective analysis of hospital admissions. In his third lecture detailing his major findings he delineated a particular concern that had occurred to him:

I refer to those very mild forms of concussion in which loss of consciousness lasts a few seconds or may be practically absent...such cases are rarely admitted into hospital and the apparently trivial nature of the injury usually leads to entire neglect of treatment or to treatment of an entirely inadequate kind. Thus it comes about that grave consequences are more liable to follow the slighter forms of concussion...38

**TOUCHSTONES FROM CONCUSSION AND CONCUSSION SEQUELAE RESEARCH, 1914-1949**

World War I and World War II stimulated extensive HI research from 1914 to 1949 in the military.17 Both wars had produced extensive psychiatric and neurological casualties, and the wounded routinely had symptoms of both. Indeed, war research, particularly during the war years, would overwhelm published literature.6 European and North American researchers in a range of fields – pathology, neurology, psychiatry, and psychology – published works replete with hypotheses, theories, and clinical observations with management advice for patients suffering from shell shock, blast concussion, psychiatric trauma, and other concomitants of wartime CHI.39

In general, the literature published during World War I focused on distinguishing between psychiatric and neurological conditions. Neurologists were particularly concerned by cases with known injuries to the CNS. The psychiatric and psychological literature, by contrast, sought explanations for the breakdown of soldiers from the horrors of war, and these not infrequently mentioned premorbid characteristics as well as Freudian conceptions of the neuroses and psychoses. Rare was a figure like Frederick Walker Mott (Fig. 7), who sought to bring pathological, neurological, and psychiatric observations together in his research reports. In Mott’s 1916 Lettsomian Lectures, published as a series of articles in The Lancet, the pathologist surveyed multiple exposures soldiers encountered. He observed that concussion, gas poisoning, anoxia, proximity to explosions, and psychiatric stress resulted in similar symptoms. In these lectures, Mott also briefly speculated that repeated concussion, among other factors, could leave a residual weakness in the brain, leaving the organ vulnerable to future HI. He termed such an area of weakness a *locus minoris resistentiae*.40 Thus
chronic HI emerged in Mott’s pathological work as a form of trauma in soldiers liable to give rise to symptoms seemingly similar to those seen in some neurological and psychiatric causalities but undoubtedly the result of structural changes to the brain.

While Mott’s linking of repeated trauma, structural change, and residual weakness was innovative and original, it was in keeping with observations that had been made for decades. By the 1920s, there had been reports of small microscopic hemorrhages in the brain as consequence of concussion. Petechial hemorrhages had been described in experimental animal research and in limited post-mortem study. Pathology reports of concussion patients were hard to procure. Charles Cassasa, an American pathologist building upon the wartime studies by Mott, used patients with more severe injuries, to argue for the existence of concussion hemorrhages, and his paper went on to be cited by other neurologists, including most famously in the work of neurologists Michael Osnato and Vincent Giliberti, and pathologist Harrison Martland.

Osnato and Giliberti’s pivotal 1927 paper brought Cassasa into a wider conversation about the importance of structural lesions in producing mental symptoms. This paper challenged psychoanalytic claims which had begun to take hold particularly in the New York and Boston neurology and psychiatry scene. Osnato and Giliberti argued in their publications that structural changes to the brain were known to result in mental disturbance and should be called “traumatic encephalitis.” They pointed to the recent pandemic of encephalitis as an example justifying deeper inferences.

Osnato and Giliberti’s study was given further support by Harrison Martland’s 1928 paper characterizing a parkinsonian pathology caused by repeated blows to the head, which was well-illustrated by cases of boxers, a medical condition Martland described called, as “punch drunk.” The late stages of the condition, as Martland stated, resulted in a degenerative, progressive dementia with Parkinsonian-like features. It also included subtler impairments, such as personality change. For Martland, it was obvious that injuries could occur “due to single or repeated blows on the head or jaw” which “cause multiple concussion hemorrhages in the deeper portions of the cerebrum.” Martland also suspected that:

“these hemorrhages are later replaced by a gliosis or degenerative progressive lesion in the areas involved. Therefore, in late stages the symptoms often mimic those seen in diseases characterized by parkinsonian syndrome. I realize that this theory, while alluring, is quite insusceptible of proof at the present time, but I am so convinced from my former studies on post-traumatic encephalitis that this is the logical deduction that I feel it my duty to report this condition.”

Martland explicitly connected the pathology of the punch drunk boxer to the many observable varieties of psychic disturbance that occurred in instances of concussion or contusion and had been observed by Cassasa and Osnato and Giliberti:

“I believe that such hemorrhages form the foundation of a replacement gliosis which explains the occurrence of post-traumatic symptoms in many cases of head injury in which recovery occurs. It forms the best possible explanation of the large and important groups of post-concussion neuroses and psychoses and the so-called post-traumatic encephalitis. Even at the present time there is a strong tendency among some writers to demarcate concussion from contusion both clinically and anatomically. This is based usually on the assumption that concussion is unaccompanied by demonstrable morphologic alterations.”

Martland’s paper received widespread recognition, and it would become a classic. Although a seminal description, it was followed by other papers, many of which were highly revealing about the complex intellectual milieu shaping HI research in this period. For example, Isreal Strauss and Nathan Savitisky, both eminent neurologists at Mount Sinai Hospital in New York City, appear, like their New York contemporaries Osnato and
Gilberti, to have been concerned by the supposition of psychoanalytically minded physicians that many of the symptoms following HI could be explained in purely Freudian terms. In their classic study “Head Injury: Neurological and Psychiatric Aspects,” Strauss and Savitisky urged their colleagues to understand that traumatic encephalopathy, in an acute form, was responsible for acute mental disturbances. They extended the insight further, arguing that where a “post-concussion syndrome” could be seen, then it made sense to view this as evidence of structural injury and physical dysfunction in the brain. It was not that they were denying the possibility of psychoneuroses, comorbidity, or pre-morbid personalities; it was that they were urging colleagues to recognize that a history of physical trauma mattered, too.

Retrospective hospital studies conducted later in the 1930s added statistical flesh to Strauss and Savitisky’s observations. Edward Mapother, at the time a prominent psychiatrist in Britain, conducted a retrospective study of hospital admission records in London (1937). Reviewing 30,000 case records, Mapother determined the incidence of psychiatric symptoms following head trauma at a rate of three per thousand patients. In 1932, William Ritchie Russell, Lecturer in Neurology at the Edinburgh Medical School, published a consecutive study of 200 hospital admissions with HI at Edinburgh Hospital, noting a relatively high incidence of psychiatric symptoms following HI in his patient sample.

Many of the lessons of World War I regarding HI had been absorbed by the generation of doctors and surgeons who came of age in the interwar period and were mobilized in the Second World War. In the beligerent nations during World War II, efforts to protect the fighting forces from the effects of HI received renewed attention. So, too, were the nations better adapted to the spinal cord and psychiatric casualties that arose in the context of total war. CHI presented special challenges: A loss of consciousness during the operation of equipment could result in a catastrophic accident, and efforts to prevent HI initiated studies of aircraft cockpits and safety helmet design. Amnesic states frequently followed these injuries, so there was often difficulty in precisely delineating patient histories of exposure. There was also growing evidence from animal experiments that the effects of HI could be cumulative, a view that had already been expressed by Crichton Brown in 1871.

By far, however, the most important work in the study of concussion emerged from the physics laboratory in this period. In 1943, A.H.S. Holbourne, a physicist at Oxford, proposed a biophysical and biomechanical model of acceleration and deceleration injuries of the brain. It was Holbourne’s work that ultimately defined the mechanism of concussion in terms of the biophysical properties of brain tissue. It possessed a deeper practical value as well – it brought together the relationship between environmental design and the nature of HI risk within these environments. From this central physical insight, the problem of cockpit design, as well as the design of motor vehicle interiors, translated brain injury and engineering principles into a common parlance of fluids, statics, materials, and mathematical formula.

It is unsurprising that these deeper contexts should have shaped wartime studies of HI. Britain is highly illustrative of the wide global case. Such figures as Mapother, the neurosurgeon Hugh Cairns, Holbourne, and neurologists W. Ritchie Russell and Charles Symonds were all involved during the war in head and nerve injury research. They often worked collaboratively, and, in some instances, the conditions of total war meant making extremely difficult clinical determinations. Charles Symonds, then Air Commodore, was under perhaps the most extreme pressures and famously so: He had to determine whether pilots were breaking down from psychiatric stress, had experienced CHI, or were suffering what he termed a loss of moral fiber (or all or some of the above). The descriptive and normative consequences of Symonds’ work were enormous for the pilots but also possessed enormous strategic ramifications for Britain’s very survival.

**BRIEF MENTIONS FROM CONCUSSION AND CONCUSSION SEQUELAE RESEARCH, 1950-1980**

By the 1950s, the state of the science was clear regarding risks of repeated concussions. By then,
an historian could write a whole volume surveying the intellectual history of concussion from primitive times to the present. A mature and sophisticated physiological and biomechanical model was evolving from the concept that reductive mechanisms produce both subjective symptoms and organic signs. Even the microscopic hallmarks of the condition had begun to be identified with the observation of tangle pathology in a few cases.

At the same time, there were numerous studies that began to fill in missing physiological, mechanical, and biochemical information. Some of the most important studies were reported by pathologist Sabina Strich, who wrote several seminal papers in the 1950s. Strich hypothesized what many of her contemporaries had observed, that HI were spectrum injuries. Her central claim, which built on Holbourne’s study, was that since shear strain forces caused nerve fiber damage in severe HI, it followed that the signs of concussion reflected similar, albeit less severe events. Many of Strich’s contemporaries appear to have regarded her work as justifying these claims, and her papers would be cited frequently in other work published in the 1960s and later to describe diffuse axonal injuries in severe head trauma and to infer similar stretching injury in more moderate and mild blows to the head or cellular destruction. Indeed, in a review in the 1980s, Thomas Gennarelli would build on the foundations of such work to offer the ingenious hypothesis that the resolution of post-concussion symptoms in some clinical cases reflected the relaxing of strained nerve fibers back to a functional shape.

Strich’s papers in the 1950s were hardly alone among many describing the dangers of “blows to the head,” repeated concussions, and CTE in promoting neurodegeneration pathology. Showcasing further evidence of the sophistication and widespread knowledge of the dangers of concussive and subconcussive blows in this period was a paper by A.G. Gross. It was Gross who pointed out that helmets had to protect against progressive damage from both concussive and subconcussive blows. He also called attention to the spectrum nature of HI through direct reference to the “punch drunk effect”:

“The well-known “punch drunk” effect suffered frequently by boxers who have taken too many hard blows to the head indicates that the damage to the brain from these successive blows is cumulative in nature. The sectioned brain of a punch-drunk fighter shows small areas of damage dispersed throughout the brain. Such progressive damage may well be caused by minute cavities produced by subconcussive blows.”

Ayub Ommaya (Fig. 8) and Thomas Gennarelli used animal models of concussion to further study these issues in the 1960s and 1970s. Ommaya, a neurosurgeon, would go on to be appointed Chief Medical Advisor to the US Department of Transportation, coincidentally highlighting how the automobile industry was shaping HI research. This was a period where motor vehicle accidents increased HI and a time when the Glasgow Coma Scale and the Glasgow Outcome Scale were also pioneered. In Ommaya and Gennarelli’s hands, the conceptualization of concussion applied across a spectrum of severity and, by then, as diagrams in their classic 1974 study showed, investigations of concussion had become significantly scientifically and clinically advanced. Their work, however, was a logical
continuation of the acceleration/deceleration centripetal model that had originated from Holbourne’s conceptualization of linear and rotational forces.

Such studies of physiological and biomechanical mechanisms of concussion and its sequelae were augmented by those of the psychological consequences of concussion. In 1975, New Zealand neurosurgeon Philip Wrightson, and neuropsychiatrist Dorothy Gronwall, published classical studies demonstrating the cumulative psychological effects of concussion with the use of finely designed psychometric tests that could identify the psychological effects of concussion. In this study, Gronwall and Wrightson were profoundly clear that in their opinion medical professionals had a duty to convince sporting bodies that concussions were cumulative and potentially dangerous injuries.59

Perhaps it was this deeper intellectual history that led the producers of the television series MASH to devote a whole episode to concussion. In January of 1976, an episode aired in which the lead protagonist Benjamin Pierce, known as “Hawkeye,” was injured in a jeep accident. As Hawkeye recovers from the immediate acute effects of the concussive injury, he discusses with a Korean family the possible secondary effects that might result if he loses consciousness. The take away message of the whole episode could not have been clearer: Blows to the head were dangerous injuries, too frequently trivialized by the public.60 Such facts do not shine a particularly favorable light on the oft-made claim today that concerns about concussion are the mere result of a media frenzy.

CONCLUSION

In 1999, Geddes et al showed the tangle pathology of CTE to be a taupathy.61 The finding, although of note, in effect merely extended the molecular biology revolution that had taken place after the discovery of the double helix to the world of chronic concussion. Tau had been first characterized in the 1970s, but the tangle pathology of CTE had been observed since the 1950s.62 The year before Geddes et al published their study, Star Trek Voyager had devoted an episode to boxing in which the holographic doctor, a central character in the series, expressed concern about the risks of CTE. By then, newspapers were rife with editorials expressing concern about repeated concussions in professional football and hockey players and the National Football League had begun studying the issue with its mTBI Committee. As is well-known, a few short years later in 2005 pathologist Bennett Omalu et al published a sentinel case of CTE in a football player.63 Although an important observation, as I have endeavored to show in this paper it was an elaboration of published reports since the 1920s. As neurosurgeon Robert C. Cantu commented in an afterward to Omalu et al’s paper, the findings “should come as no surprise.”64 Indeed, Omalu et al’s study had been anticipated as early as 1936 by Edward Carroll who, writing in the American Journal of Medical Sciences, stated, “Punch-drunk is said to occur among professional football players also.”65 Likewise, Augustus Thorn-dike in 1952 was so concerned about the punch drunk condition as a hazard of repeated blows to the head that he recommended college athletes retire from contact sports after three concussions.66

In the 1990s, CTE had also been seen in a case of a victim of serious domestic abuse, a point of grave concern and cultural importance. It must not be forgotten that safety in professional sports is paralleled by safety concerns in other of repeated violence that possesses a kindred resemblance to the recurrent violence of boxing, hockey, and football.

This essay has only sketched a preliminary intellectual history of concussion, offering a short story about the many discoveries and elucidations made by many clinicians from the late 19th century through the entire 20th century and into our own. Figures like James Crichton Brown, Frederick Mott, and Charles Symonds, and others, shaped the field of concussion research in ways that are reflected even now in contemporary science and medicine.

Litigation remains a predominant and significant contextual force structuring the cultural and social landscape of concussive injuries. It is useful to note that litigation around this subject is not so novel, for it has commonly occurred since the turn
of the 20th century. There are, however, significant reasons for concern about the conflicts-of-interest and failed disclosures in a flawed honor system of publication that may well underpin the meta-analyses and systematic reviews that drive such important resources for clinicians as UpToDate™ or equivalents.^6^7

The greatest difference today from the past in medicine is most sharply seen in the decline of Freudianism in understanding the functional disturbances that emanate from concussive injuries. The decline of Freudian theory has not, however, been matched by a decline in dualist thinking in sports medicine, neurology, neuropsychology, or neurosurgery, which exists as veritable rhetorical reaction formation. The organic and functional divide in the mind and brain sciences is as old as modern Western philosophy. A central challenge for the 21st century is to explicate the doctrine of the nerves and the signs and symptoms of nervous disease in such a way as to resolve this particular linguistic conundrum. Doing so will clear up much misunderstanding and misinformation in the study of chronic HI, and will, moreover, curtail the use of rhetoric to manufacture uncertainty about past findings.

For almost a century, single or repetitive HI have been known to result in degenerative processes. By the 1950s, subconcussive blows, second-impact syndrome, tangle pathology, and concerns about cumulative effects of concussion contributed observations that are now key to current understanding of concussion. The science was secure. Many clinicians today, looking forward to new discoveries, may not be as familiar with these achievements of the past, and in consequence they may fall into error, thinking that what is new for them is actually new for our culture, society, and epistemology. The intellectual history of concussion shows that this is simply not the case. Even as novel innovations in medicine – statistics, computers, and controlled studies reshaped medical norms and attitudes – many of the major historical milestones in concussion research had been reached by the 1950s. That much of the evidence of the past was published in ways not matching our contemporary ideals and norms is hardly the fault of our ancestors in clinical medicine. It seems improper to hold past pioneers, many of them founders of neurology and neurosurgery, to standards of recent invention, standards that are themselves fraught with controversy, contradiction, and freighted by the sophistry of manufactured uncertainty. It is prudent to use past science to inform the public. There is, moreover, a duty of care that should require physicians and psychologists to explain and educate a patient that repeated blows to the head are unlikely to be unmitigated good.

Acknowledgment: The author would like to thank Sylvia Lucas, MD, PhD, FAHS, for her careful review of the article.

STATEMENT OF AUTHORSHIP

Category 1
(a) Conception and Design
Stephen T. Casper
(b) Acquisition of Data
Stephen T. Casper
(c) Analysis and Interpretation of Data
Stephen T. Casper

Category 2
(a) Drafting the Manuscript
Stephen T. Casper
(b) Revising It for Intellectual Content
Stephen T. Casper

Category 3
(a) Final Approval of the Completed Manuscript
Stephen T. Casper

REFERENCES
1. Walker GF. The Injured Workman. Bristol: John Wright & Sons Ltd; 1933: quotes on 41-47.
16. Page HW. A clinical lecture on some cases of head-injury, including one in which there was lesion of the occipital lobe. *Lancet.* 1901;157:156-158.
40. Mott FW. The Lettsomian lectures on the effects of high explosives upon the central nervous system: Lecture II. *Lancet.* 1916;441-448.
60. MASH. 13 Jan. 1976; Episode 91.
Confronting the Youth Sports Concussion Crisis: A Central Role for Responsible Local Enforcement of Playing Rules

Douglas E. Abrams

University of Missouri School of Law, abramsD@missouri.edu

Follow this and additional works at: http://scholarship.law.missouri.edu/facpubs

Part of the Entertainment and Sports Law Commons

Recommended Citation

This Article is brought to you for free and open access by University of Missouri School of Law Scholarship Repository. It has been accepted for inclusion in Faculty Publications by an authorized administrator of University of Missouri School of Law Scholarship Repository.
CONFRONTING THE YOUTH SPORTS CONCUSSION CRISIS: A CENTRAL ROLE FOR RESPONSIBLE LOCAL ENFORCEMENT OF PLAYING RULES

By Douglas E. Abrams*

Introduction ................................................................. 75
I. Preventing Youth Sports Concussions ................................. 83
   A. The Contemporary Sports Concussion Crisis ...................... 83
      1. Professional Sports ............................................. 83
      2. Youth Sports ................................................... 88
   B. Meeting the Youth Sports Concussion Crisis .................. 95
      1. Ongoing Review of National Playing Rules ..................... 96
         a. Pop Warner football ......................................... 96
         b. USA Hockey ................................................. 98
      2. Implementation of Playing Rules: “All Safety is Local” 99
         a. Medical Research ............................................. 103
         b. Abuse of Game Officials .................................... 104
II. The Law’s Role in Youth Sports Safety .............................. 106
   A. Recent State Concussion Legislation ............................ 106
   B. Litigation ................................................................... 108
Conclusion ........................................................................... 109

* Associate Professor of Law, University of Missouri. B.A. 1973, Wesleyan University; J.D. 1976, Columbia University School of Law. Professor Abrams played varsity ice hockey at Wesleyan, coached youth hockey at all age levels for 42 years, and now writes and speaks about coaching and player safety. He is the recipient of USA Hockey’s 2013 Excellence in Safety Award.
INTRODUCTION

By late 1905, college football was at a crossroads. Raw violence and unremitting bloodshed had stalked the gridiron for years. In that season alone, eighteen players died and scores more were seriously injured in intercollegiate games.¹ As Americans cringed, calls to abolish the “barbaric” sport grew louder because games and death did not mix on college campuses.²

The specter of death in college football was serious business at the dawn of the 20th century. A national professional league was still a few years away, so the collegiate game was the most prominent form of football played in America. Today, even one on-the-field death among several thousand college football players would attract national attention. Because far fewer collegians played football in 1905, eighteen deaths in a single season comprised an astounding percentage of the players, a grim toll unlikely to abate without meaningful changes to the rules of the game.

Most of the deaths were from what doctors diagnose today as multiple concussions, skull fractures, or other traumatic brain injury.³ At the turn of the century, some intercollegiate football players wore skimpy protective equipment and soft leather helmets without face guards, but helmets did not become mandatory in the National Collegiate Athletic Association (NCAA) until 1939.⁴ Game photos from the period show that most players went helmetless,⁵ even though college football degenerated into “a game of mass interference which leveled the defense. Line play deteriorated to brute force where linemen slugged one another

³ Id.
⁵ See, e.g., BERNSTEIN, supra note 1 (photographs following page 146); IVAN N. KAYE, GOOD CLEAN VIOLENCE: A HISTORY OF COLLEGE FOOTBALL 55 (1973) (photograph of players without helmets); JOHN SAYLE WATTERSON, COLLEGE FOOTBALL: HISTORY, SPECTACLE, CONTROVERSY (2000) (photographs following page 98).
and the ball carrier was pulled and pushed into this mass of humanity."6

Some colleges, notably Columbia University and Northwestern University, reacted to the carnage by eliminating their football programs altogether.7 Disgusted by the unrelenting bloodshed, President Theodore Roosevelt grew worried that more colleges would follow suit, including his alma mater, Harvard.8

Roosevelt was one of the most athletic Presidents in American history, a vigorous sportsman who respected athletic competition.9 He was also a “gridiron enthusiast”10 who closely followed Harvard’s eleven, a team he might have joined as an undergraduate a little more than twenty-five years earlier but for his nearsightedness.11 He embraced football for manifesting rugged Americanism just a few years after the U.S. Census Bureau inspired national soul-searching by announcing the closing of the frontier in 1890.12 When he charged San Juan Hill during the Spanish-American War, his Rough Riders included former college football players who won his respect.13

“To borrow a simile from the football field,” Roosevelt said in 1897, “we believe that men must play fair, but that there must be no shirking, and that the success can only come to the player who ‘hits the line hard.’”14 From the White House, he wrote to his son, Theodore, Jr., who played on Harvard’s freshman team: “I am delighted to have you play football. I believe in rough, manly sports.”15

---

7 WATTERSON, supra note 5, at 73-74, 92.
8 Id. at 64-65.
10 WATTERSON, supra note 5, at 64.
11 BERNSTEIN, supra note 1, at 12; EVAN THOMAS, THE WAR LOVERS: ROOSEVELT, LODGE, HEARST, AND THE RUSH TO EMPIRE, 1898, 56 (2010).
12 BERNSTEIN, supra note 1, at 38; WATTERSON, supra note 5, at 65; THOMAS, supra note 11, at 55-57; FREDERICK JACKSON TURNER, THE FRONTIER IN AMERICAN HISTORY 1-38 (1920).
15 CARROLL & ROSNER, supra note 2, at 50; see also WATTERSON, supra note 5, at 64-65 (quoting Roosevelt’s letter to a friend: “I would rather see my boys play [football] than see them play any other [sport]”).
In October of 1905, with “football staring hard at the prospect of demise,” President Roosevelt summoned the head coach and alumni committee head from each of the “Big Three” collegiate gridiron powers—Harvard, Yale and Princeton—to convene at the White House and explore ways to maintain the game’s distinctiveness as a collision sport, yet stem its unrestrained brutality.

 Barely a month before the college football delegations arrived, Roosevelt mediated an end to the Russo-Japanese War, an effort that earned him the Nobel Peace Prize. With participants considerably less hostile toward one another than warring nations, the White House football summit led to safety-based rule changes that would soon make deaths on the field remnants of the past. The summit also led to the creation of the NCAA, the national governing body that oversees the enforcement of playing rules by member colleges and universities.

Safety-based rule changes did not doom public enthusiasm for football. On the contrary, college and professional football remain the nation’s most popular spectator sports today, and the highest award the NCAA bestows on an individual is the Theodore Roosevelt Award, honoring the man whose presidential initiative saved the game from itself.

Without suggesting intervention by Congress or any state legislature, President Roosevelt confronted college football’s brain injury crisis by advocating national rule changes that conferences, coaches, and referees would administer responsibly in local games.

---

17 Bernstein, supra note 1, at 79-83 (2001); Crowley, supra note 16, at 40-43.
19 Watterson, supra note 5, at 100-10.
20 Crowley, supra note 16, at 43-44.
Injury prevention was central to the President’s formula because mere reaction to serious injury came too late, only after the player and his family suffered irreparable loss.

Today the sports world faces a similar crisis from the epidemic of serious and often permanent brain injury. This crisis—“the predominant youth sports safety issue of the 21st century”—concerns concussions, a form of traumatic brain injury from externally inflicted trauma. “[H]ead trauma in sports is a topic that leads nightly newscasts and is debated at every level of amateur and professional sports.” Concussions produce “contact sports’ nastiest byproducts,” with “long-term effects . . . [that] are proving to be absolutely terrifying.”

Until recently, the national spotlight shined brightest on concussions suffered by professional athletes, particularly football and ice hockey players. As neurosurgeon William P. Meehan reports, we know now that “concussion is a risk in almost any sport.” We also know, as Time reports, that “concussions are an alarmingly commonplace injury, particularly among kids and most particularly among active, athletic ones.” Whether or not the

21 See, e.g., CARROLL & ROSNER, supra note 2.
victim loses consciousness, a concussion at any age “can affect memory, judgment, reflexes, speech, balance, and muscle coordination and can result in serious complications, such as swelling, bruising, or bleeding of the brain, which can cause permanent disability or death.”

Today’s concussion crisis summons a range of preventive strategies, including the one President Roosevelt prescribed for college football in 1905 – public education about safety risks, ongoing review of national playing rules based on new learning, and responsible local implementation of these rules in practice sessions and games. Mere reaction to a player’s brain injury is insufficient to undo prior damage.

This Article concerns the effect of playing rules on efforts to confront today’s concussion crisis in youth sports. The term “youth sports” covers the two primary sources of organized athletics for children: (1) community leagues and teams conducted by parents in private associations or clubs or by public parks and recreation departments, and (2) interscholastic leagues conducted by public and private secondary schools.

I remain awed by the sheer quality and quantity of research and commentary generated in recent years by prominent medical professionals who seek to stimulate public awareness of sports-related brain injuries in children. Without venturing into a profession in which I lack training, I seek to apply this learning from my vantage point both as a lawyer and as a youth hockey coach, concerned for more than 40 years about player safety. For ten of these years, I also served as the president of a youth hockey program and, thus, designed and helped supervise safety measures implemented by other volunteer coaches.

30 CANTU & HYMAN, supra note 26, at 106-07 (stating that 95% of victims who suffer concussions do not lose consciousness); James P. Kelly, Traumatic Brain Injury and Concussion in Sports, 282 J. AM. MED. ASSN 989, 990 (1999) (“Concussion . . . may or may not involve loss of consciousness”).

31 U.S. GOVT ACCOUNTABILITY OFFICE, Concussion in High School Sports, GAO-10-569T (May 20, 2010) (referencing the statement of Linda T. Kohn, Director, Health Care); Brooke de Lench, Concussions Double For Younger Athletes In Team Sports, Study Finds, MOMSTEAM (Sept. 1, 2010), http://www.momsteam.com/health-safety/concussions-double-among-younger-athletes-in-team-sports-study-finds (quoting Dr. Lisa L. Bakhos: “[C]oncussions can happen to anyone. Some [parents] may think, my child is too young to get really hurt in sport, but that is not the case.”).

32 CARROLL & ROSNER, supra note 2.
President Roosevelt sought to save football, not to eradicate it. I recognize that participation in sports inevitably brings risk of injury at any age, and that contact and collision sports depend on a measure of controlled violence within the rules of the game. We can significantly reduce the risk of childhood sports-related concussions and other brain trauma, however, by periodically adjusting safety-based playing rules in light of medical learning, and then by taking meaningful measures to assure their responsible enforcement by coaches, league administrators, game officials and parents who remain committed to sportsmanship and mutual respect in vibrant local games.

Now that children’s spontaneous sandlot play has yielded to organized youth sports programs conducted by adults, injury prevention, grounded in fidelity to the rules of the game, is more than an adult challenge and opportunity. This central injury-prevention strategy is an adult responsibility because “every hit to the head leaves a mark, or a legacy, on a child’s future.”

Part II of this Article discusses rules-based prevention of concussions and other traumatic brain injury in youth sports, a proactive stance that the National Institutes of Health says holds “great promise.” Primary responsibility for the rules rests with national youth sports governing bodies (USA Soccer, USA Hockey, and others), and with the state high school activities associations that oversee the interscholastic sports programs conducted by their member public and private secondary schools. Rule making remains a work in progress, but national and state rule makers have proved increasingly responsive to parents, medical professionals, legislators and similar advocates of periodic review.

National and state rule making, however, does not end the story because children play games from coast to coast on fields and other local venues largely beyond the direct day-to-day supervision of national and state governing bodies. Part II explains why the rules of the game stand the best chance of

---

35 NIH CONSENSUS DEV. PROGRAM, supra note 25, at 9.
protecting players when coaches, league administrators, game officials and parents enforce the rules responsibly.

Part II concludes by discussing how local adult irresponsibility, particularly when passion to win overcomes reason in the heat of competition, can neutralize national and state safety-based playing rules and put young athletes in harm’s way. These rules resemble an impressive building, which may take years to design and construct with care, but which can implode locally in moments.

Part III discusses the role of legal constraints in the quest for greater safety from concussions in youth sports. Most states have taken a giant step forward since 2009 by enacting concussion legislation that, while not displacing safety-based review and local enforcement of playing rules, holds potential to make life better for the nation’s youngest athletes. Parents, coaches and players generally must receive information and education about the dangers of concussions and when to suspect that a player may have suffered one. When someone suspects that a player has suffered possible concussive injury, teams and coaches must immediately remove the player from practice sessions and games until the player secures medical clearance to return to action.

Thus far, private litigation has played comparatively little direct role in preventing youth league concussions. The specter of lawsuits by injured players might influence and accelerate safety initiatives by stimulating the sensibilities of rule makers and other concerned adults, either by jeopardizing the availability of insurance at favorable rates or by leaving individual parents reluctant to enroll their children in a particular sport. These prospects seem to have already moved national and state governing bodies toward greater safety measures, but lawsuits in large numbers remain unreported in youth sports.36

Recovery in an injured player’s tort suit against governing bodies, leagues and coaches helps ease the frequently substantial financial burdens of short-term and long-term care following a concussion or other traumatic brain injury. Recovery, however, comes only after the player suffers immediate and sometimes

36 See infra note 55 and accompanying text (discussing class action lawsuit by more than 2,000 former National Football league players against the NFL arising out of the concussion crisis).
permanent damage. In practice sessions and games, proactive prevention best protects youth leaguers from concussions and other serious injuries, rather than essentially reactive tort law.

I. PREVENTING YOUTH SPORTS CONCUSSIONS

Emphasizing injury prevention initiatives in youth sports plows no new ground. Prevention initiatives in the schools and the greater community already seek to protect children from an array of potential dangers, such as delinquency, bullying, and school violence. Because parents also strive to prevent childhood injuries in their homes (including injuries from sports and games), it seems natural to contemplate injury prevention initiatives in the organized sports their children play in the community.

Prevention initiatives measure success by rates of reduction rather than by total elimination of targeted conduct. The nation cannot eliminate all delinquency, bullying, school violence or youth sports concussions, but parents and safety advocates can strive for significant reduction rates, rather than tolerate the continued high rates of adverse outcomes that are controllable through due care. As Benjamin Franklin said, “an ounce of prevention is worth a pound of cure.”

A. The Contemporary Sports Concussion Crisis

1. Professional Sports

When parents first enroll a child in a youth sports program, their perceptions about sports typically come almost entirely from following professional games. “[T]hrough their pervasive presence in the media,” says the U.S. Court of Appeals for the Sixth Circuit, “sports . . . celebrities have come to symbolize certain ideas and values in our society and have become valuable

---

38 Id. at 410-12.
40 Abrams, supra note 33, at 273.
means of expression in our culture."4 Amid the unprecedented saturation of professional sports in the broadcast and print media and, more recently, on the Internet,42 the impetus toward concussion prevention in youth sports reflects adult reactions to the well-publicized concussion crisis that besets several professional sports.

The Minnesota Twins’ all-star first baseman Justin Morneau, the American League’s Most Valuable Player in 2006, acknowledged these reactions when he returned to the lineup last season after being sidelined with his second concussion. “If anything good comes” from his prolonged recovery, said Morneau, “it’s the fact that if parents see us big guys, professional athletes, missing good chunks of time, they’re going to take it seriously and not rush their high school kids back out there to play a football game.”43

Traumatic brain injury in sports has been called a “silent epidemic,” partly because until recently its potentially devastating effects had received relatively moderate attention from medical researchers amid concern for other neurological conditions that afflict the general population, such as Alzheimer’s disease and stroke.44 In the United States’ “sports-dominated culture,”45 dramatic media accounts broke the silence regarding professional athletes in distress, often years after their retirement. These accounts typically chronicled not the immediate disability and death that stained college football by 1905, but the lingering physical incapacity, dementia and early death attributable to concussions and other brain trauma, particularly in contact and collision sports.

It might seem odd that so much of the nation’s early attention to sports-related traumatic brain injuries focused

---

13 Tyler Kepner, Feeling Right, Finally, N.Y. TIMES, Aug. 5, 2012, at 10 (quoting Morneau).
14 Kelly, supra note 30; see also, Philipp R. Aldana & Mark S. Dias, Are You Ready for the “Silent Epidemic”?’, 32 AAP NEWS 1 (July 1, 2011); Siegel, supra note 27 (attributing silence to the reluctance of many former professional players to acknowledge publicly the likelihood of future deterioration).
primarily on the professional leagues, which included a few thousand of the nation’s elite adult athletes, and not on youth leaguers, the estimated thirty to thirty-five million boys and girls who play each year. Hefty youth sports enrollments comprise nearly half the children in America. Nearly every child has some experience with organized sports, and thus some exposure to serious injury, before turning eighteen.

Odd or not, the headlines first spotlighted the pros. Knowing they suffered multiple concussions in contact or collision sports, some professional athletes or their families have donated their brains to the Sports Legacy Institute in Boston for post-mortem examination. Examinations of a few deceased football and hockey players’ brains reveal that most suffered from chronic traumatic encephalopathy (CTE), a progressive degenerative brain disease caused by repeated blows to the head, including concussions. CTE is linked to behavioral changes, dementia, and premature death. Indeed, football players with CTE may suffer the same type of brain damage as Alzheimer’s disease patients or as combat “veterans who endured bomb blasts in Iraq and Afghanistan.” A September 2012 study of nearly 3,500 retired

---


17 See America’s Children: Key National Indicators of Well-Being, FORUM ON CHILD AND FAMILY STATISTICS, at 3 (2012) (showing that in 2011, there were 73.9 million children under eighteen in the United States).

19 See, e.g., Bari Katz Stryer et al., A Developmental Overview of Child and Youth Sports in Society, 7 CHILD & ADOLESC. PSYCHIATR. CL. N. AM. 697, 697 (1998); Having Fun is a High Priority, USA TODAY, Sept. 10, 1990, at 14C (estimating that only 1 in 20 children has not played an organized sport).


22 CANTU & HYMAN, supra note 26, at 90-104; see also, Mary Pilon, Family of Seau Decides to Give Brain for Study, N.Y. TIMES, May 5, 2012, at 3.

23 CANTU & HYMAN, supra note 26, at 90-104.

52 Id. at 90; Andy Staples, Justified Or Not, Seau’s Death Puts Football Under Question Again, SPORTS ILLUS., May 3, 2012 (recalling that when 44-year-old former NFL player Andre Waters committed suicide in 2006, his brain “resembled what one would expect in an 85-year-old man in the early stages of Alzheimer’s”).

NFL players found that the players die from Alzheimer's, Parkinson's disease, amyotrophic lateral sclerosis ("Lou Gehrig's disease"), and other brain diseases at rates three to four times higher than other Americans.\textsuperscript{54}

More than 2,000 former National Football League (NFL) players also attracted national attention by filing a class action lawsuit alleging that the league knew, or should have known, about the lifelong dangers of concussions and other head trauma.\textsuperscript{55} Some former pros have retired early from collision or contact sports, such as football and hockey, for fear that further concussions would haunt them later in life.\textsuperscript{56} A few former pros have died young from ailments or painkiller overdoses evidently traceable to traumatic brain injury.\textsuperscript{57} Others have committed suicide in suspected attempts to escape progressing debilitation.\textsuperscript{58}

What does the looming concussion crisis bode for the future of professional football and for the future of youth football? Despite persistently high rates of serious injury, writer James A. Michener found in 1976 that “there is no cry to end football, nor will there be, because every society decides what it is willing to pay for its entertainment.”\textsuperscript{59} Michener concluded, “Football is the American

---


\textsuperscript{56} \textit{Carroll \& Rosner, supra note 2, at 17-24}; Lorenzo Arguello, \textit{10 Athletes Whose Careers Came To A Tragic End After Suffering Concussions (Or Kobe's Worst Nightmare)}, \textit{Business Insider}, Feb. 29, 2012.

\textsuperscript{57} See, e.g., John Branch, \textit{In Hockey Enforcer's Descent, a Flood of Prescription Drugs}, N.Y. \textit{Times}, June 4, 2012 (stating that 28-year-old ex-N.Y. Rangers hockey player Derek Boogaard died of drug overdose and was found to have CTE); \textit{Christopher Nowinski, Head Games: Football's Concussion Crisis From the NFL To Youth Leagues} 71-75 (2007) (stating that NFL Hall of Famer Mike Webster died of heart failure at age 50, and post-mortem brain examination found evidence of CTE); Alan Schwartz, \textit{Hockey Brawler Paid Price, With Brain Trauma}, N.Y. \textit{Times}, Mar. 3, 2011, at A1 (stating that NHL "enforcer" Bob Probert died of heart failure at 45 and suffered from CTE).


form of violence . . . because we have given it our moral sanction."*60

Journalist Buzz Bissinger, author of the acclaimed *Friday Night Lights* high school football chronicle,*61* may be right that raw violence defines football’s popularity among Americans. “Take [violence] away,” he writes, “and the game will be nothing.”*62* Columnist George F. Will similarly wrote recently about the “fiction that football can be fixed and still resemble the game fans relish.”*63*

Other commentators suggest that public unease about concussions and other traumatic brain injury may lead many fans to spurn NFL games between players they know are destined for early debilitation. *64* Conjuring images of the crisis that afflicted college football when President Roosevelt interceded in 1905, the *New Yorker’s* Malcolm Gladwell likens football to dog fighting.*65*

---

*60* Id.


*64* See, e.g., Jonathan Tamari, *Concussion Lawsuits Put Spotlight on NFL Policies*, PHILA. INQUIRER, Feb. 12, 2012, at E1 (arguing that lawsuits filed by former NFL players “carry a steep public relations risk” for the league, striking at its “sustainability” over time); Gary Myers, *With the State of Game and Concussions, Jets LB Scott Does Not Want Son to Play Football*, N.Y. DAILY NEWS, May 27, 2012, at 76 (calling concussion crisis “the biggest threat to the future of football”); Ken Belson, *For N.F.L., Concussion Suits May Be Test for Sport Itself*, N.Y. TIMES, Dec. 30, 2011, at A1; Andy Staples, supra note 52 (calling head shots “the biggest problem the sport has right now”).

Accusing the NFL of “chewing up players like a meat grinder,” former New York Times columnist Bob Herbert says that “[w]ith the carnage increasingly emerging from the shadows, there is no guarantee that football’s magical hold on the public will last.”

To promote effective responses to the youth sports concussion crisis, it is not necessary to choose sides in the prognoses over the NFL’s future. If the commentators predicting storm clouds ahead for the pro game prove to be correct, however, any significant loss of popularity would likely affect the youth game’s vitality in many communities.

2. Youth Sports

The American Academy of Pediatrics calls sports-related concussions “a common problem for children and adolescents.” The professional and youth sports concussion crises may share similarities, but tolerance for serious injury should be considerably lower in children’s games than in the pros.

Professional athletes are well-compensated adults, employed by major corporations in billion-dollar businesses. The law’s conception of personal autonomy generally grants competent adults considerable right to decide on their own health care and personal safety in the absence of harm to others. Former

---

66 Bob Herbert, The Sport Needs to Change, N.Y. TIMES, Mar. 15, 2011, at A6; see also, Tim Sullivan, Love of Football Just Might Not Be Enough to Keep It Viable, SAN DIEGO UNION-TRIB., May 28, 2012, at D1 (arguing that unless the NFL meets the concussion crisis with meaningful rules changes, “football will eventually be deemed so dangerous that that its participants will progressively reflect much the same desperate demographic as boxing”); Jake Simpson, Will Concussions Kill Football?, THE ATLANTIC, Sept. 21, 2010 (“If the NFL, NCAA, and other football bodies do not take serious action right now to combat the constant, destructive head trauma that is as much a football staple as the extra point, the sport could face a massive decline in popularity and relevance over the next 20 to 30 years.”).


69 See, e.g., Prince v. Massachusetts, 321 U.S. 158, 170 (1944) (“Parents may be free to become martyrs themselves. But it does not follow they are free, in identical
Confronting the Youth Sports Concussion Crisis

National Hockey League Hall of Fame goalie Ken Dryden observes correctly that “[f]or players or former players, owners, managers, coaches, doctors and team doctors, league executives, lawyers, agents, the media, players’ wives, partners and families, it’s no longer possible not to know and not to be afraid, unless we willfully close our eyes.” The pros bargain collectively with team owners about safety measures and other terms of employment, and thus, may determine for themselves how much risk of injury they wish to tolerate.

Children, however, play sports without lucrative contracts and nationwide audiences of millions because they seek to have fun, win games and develop their skills. Christopher Nowinski, co-director of the Sports Legacy Institute, puts it well: “What’s good television is not necessarily good for kids. They’re not little men. They’re children.” Few youth leaguers progress to the Division I collegiate ranks, and fewer still progress to the pros and receive a single paycheck for their play. For most parents, youth sports are an opportunity to provide children with memories, during a lifetime of good health, as free as possible from the chronic effects of childhood injury.

---

70 Ken Dryden, Head Shots Should Be History, GLOBE & MAIL (Canada), Mar. 12, 2011, at F5.
71 See, e.g., MICHENER, supra note 58, at 10 (“If the game isn’t fun, it has lost at least half its justification’’); Ron Borges, Counting Cost to Children, BOSTON HERALD, Feb. 4, 2012, at 42 (quoting Christopher Nowinski, co-founder of the Sports Legacy Institute).
74 See, e.g., Jonathan Tamari, Young Athletes Growing Mindful of Concussion Danger, Philly.com (Feb. 12, 2012) http://articles.philly.com/2012-02-12/sports/31052461_l_concussion-awareness-traumatic-encephalopathy (quoting neurosurgeon Robert Cantu who wrote, “[i]ndividuals who aren’t being paid need to be informed of the risk they’re taking and then decide whether they want to take those risks.”).
The numbers define the imposing contours of the youth sports crisis, with “[c]oncussions representing an estimated 8.9% of all high school athletic injuries.” It is commonly reported that 300,000 sport-related concussions occur each year, although it was estimated in a recent review that up to 3.8 million recreation- and sport-related concussions occur annually in the United States. . . . Because of the large numbers of participants in youth and high school sports, concussions in the pediatric and adolescent age groups account for the majority of sport-related concussions.

The pediatric concussion crisis affects more sports than traditionally imagined. As Dr. Stanley Herring told a congressional committee, the crisis “is not a football issue. It’s not a boy sport issue.” The American Academy of Pediatrics finds that “[a]mong the more commonly played high school sports, football and ice hockey have the highest incidence of concussion, followed by soccer, wrestling, basketball, field hockey, baseball, softball, and volleyball.” The concussion rate in girls’ soccer is almost as high as it is in boys’ football, and girls have higher rates of reported concussions than boys in similar sports and may experience more difficulty than boys in recovering from concussions.

---

76 Id. at 598-99; see also, Meehan & Bachur, supra note 66, at 114 (“the majority of at-risk athletes are children,” and “children are particularly susceptible to” sport-related concussions).
77 Protecting Student Athletes from Concussions: Hearing on H.R. 6172 before the Comm. on Educ. and Labor, 111th CONG. 27 (2010) (referencing the statement of Dr. Stanley Herring, clinical professor, Dept of Rehabilitative Medicine, Orthopedics and Sports Medicine and Neurological Surgery, Univ. of Wash.).
78 Kirkwood et al., supra note 28, at 1359, 1360; see also MEEHAN III, supra note 28, at 29-37 (discussing concussions in various sports); The Impact of Concussions on High School Athletes: Hearing before the H. Educ. and Labor Comm., 111th Cong. 7 (2010) (referencing the statement of Dr. Gerard Gioia, director of neurophysiology, Children's Nat'l Med. Center, Washington, D.C.) (showing there is a possibility that children can suffer concussions in any sport that has high risk of direct contact, including wrestling, cheerleading and gymnastics); GAY CULVERHOUSE, THROWAWAY PLAYERS: THE CONCUSSION CRISIS FROM PEE WEE FOOTBALL TO THE NFL 77-78 (2012) (discussing concussions in sports other than football).
79 Halstead & Walter, supra note 75 at 599 ; Chris G. Koutures & Andrew J. M. Gregory, Injuries in Youth Soccer, 125 PEDIATRICS 410, 412 (2010); Randall W. Dick, Is
The hefty numbers and broad reach likely shroud an even more profound crisis because “underreporting of concussions exists in all sports and is a special challenge in a few sports such as football and ice hockey.”80 Not only do national and state injury databases provide inexact measures of concussive injuries,81 but players, parents and coaches also often do not recognize concussive symptoms.82

Many youth leaguers, particularly boys, also remain reluctant to report head injuries to their elders.83 The “shake it off and tough it out” ethic, a manifestation of children’s notions that they are invincible,84 encourages a “code of silence” among young athletes who fear that reporting may cause them to lose playing time, lose their position to a teammate, lose permission to play at all, incur disfavor from coaches, or let their team down.85

“Sometimes we have ignored concussions in younger athletes, and we now realize those athletes are most significantly affected,” says Dr. Daniel Kraft, director of Riley Hospital for Children’s Sports Medicine at Indiana University Health.86 “Young athletes pose a unique challenge,” add two other researchers, “because

---

80 CANTU & HYMAN, supra note 26, at 14; see also Schwartz, supra note 24 (stating that concussions in high school football are “drastically underreported”).
81 U.S. GOVT ACCOUNTABILITY OFFICE, supra note 31, at n.3.
82 See, e.g., Halstead & Walter, supra note 75, at 605-06; Jack Kelly, What Dangers Await the Young Athlete?, PITTSBURGH POST-GAZETTE, June 4, 2012, at C1.
their brains are still developing and may be more susceptible to the effects of a concussion.”87

Children also appear particularly susceptible to repeated sub-concussive blows to the head that occur over the span of one or more seasons.88 “[S]econd-impact syndrome, a rapid and often fatal condition associated with a second head injury while the person is still symptomatic from a first, has been described mainly in adolescent athletes.”89 Because concussed children seem to require longer recovery periods than concussed adults, continued hits can produce devastating consequences even if none of the hits by itself would cause serious injury.90

Some voices have suggested that greater public awareness of the particularly high concussion rates in contact and collision youth sports may jeopardize the ability of leagues and high school programs to maintain insurance at rates affordable to many families.91 Other voices speculate that heightened danger of traumatic brain injury may cause more manufacturers of protective equipment to turn away from the prospect of impending legal liability.92 The San Jose Mercury News anticipates an even

87 Halstead & Walter, supra note 75, at 597; see also, Kirkwood et al., supra note 28, at 1359, 1367 ("younger athletes may respond more poorly" than adults to brain injuries); Paul McCrory et al., Can We Manage Sport Related Concussion in Children the Same as in Adults?, 38 BRIT. J. SPORTS MED. 516, 517-18 (2004).
90 See, e.g., Gladwell, supra note 65 (quoting Dr. Robert Cantu); Alice Park, Kids’ Concussion Symptoms May Persist for a Year, TIME, Mar. 6, 2012.
91 See, e.g., Bonnie Cavanaugh, Concussions, Sexual Abuse The Latest Hot-Button Issues for Youth-Sports Insurers, PROP. AND CAS. 360 (Apr. 23, 2012) (“While serious coverage implications due to concussions have yet to emerge, insurers, coaches and league officials are looking at prevention, testing and return-to-play guidelines”); Seau, Football: Game of Death, supra note 58, (“it’s reasonable to ask what entity will insure a sport such as football someday”).
Wider net: “[J]unior high and high school principals, athletic directors and coaches are soon going to have to start worrying about their liability” unless they take meaningful preventive measures in the face of known dangers.\(^9\)

Perhaps even more ominous for the fates of some youth collision and contact sports, the specter of concussions may depress enrollment by leaving some parents reluctant to register their children to play in the first place.\(^9\) Emile Therien, former president of the Canada Safety Council, spoke recently about safety-based rule changes that USA Hockey has made over the past few decades. His son Chris played twelve years in the National Hockey League, but the elder Therien says that, “If we hadn’t made changes to the equipment back then . . . the game wouldn’t exist today. Parents just wouldn’t enroll their kids. It would be child abuse.”\(^9\)

Because parents ultimately decide with their children what level of risk remains tolerable, parental reluctance amid the well-publicized concussion crisis may help explain the recent national declines in the numbers of youngsters who play youth league and

---

\(^9\) Nowinski, supra note 57, at 116 (discussing helmet manufacturers that have left the industry because of litigation losses).

\(^9\) California Parents Ignoring Risks of High School Football, (SAN JOSE, CAL.) MERCURY NEWS, Aug. 29, 2011 (editorial); see also, Tyler Cowen & Kevin Greer, What Would the End of Football Look Like?, GRANTLAND (Feb. 9, 2012), http://www.grantland.com/story/_/id/7539458/cte-concussion-crisis-economic-look-end-football (“The most plausible route to the death of football starts with liability suits. . . . If you are coaching a high school football team, or refereeing a game as a volunteer, it is sobering to think that you could be hit with a $2 million lawsuit at any point in time.”).

\(^9\) See, e.g., Eric Sondheimer, Sports Doctor Answers: “Would I Let My Son Play Football?”, L.A. TIMES (Varsity Times Insider), July 1, 2012 (quoting Andrew Blecher, M.D., who would give his son a “qualified yes,” but would hope that he would not play particularly dangerous positions); see also, William C. Rhoden, Football’s Future Rests on Parents as Much as Players, N.Y. TIMES, Sept. 3, 2012, at D2 (“The more options a family has, the less attractive football may become, except where college scholarships are involved. Then there are parental ego and male vanity.”); Jonathan Anker, Why My Son Will Never Play Football, HLN (May 22, 2012), http://www.hlntv.com/article/2012/05/04/why-i-will-not-let-my-son-play-football (“[T]here are other sports out there. The world needs teachers and doctors. It does not need football players.”) (emphasis in original).

Columnist George F. Will speculates that “in this age of bubble-wrapped children, when parents put helmets on wee tricycle riders, many children are going to be steered away from youth football, diverting the flow of talent to the benefit of other sports.”

Emerging parental reluctance actually extends well beyond the bubble-wrap set. Even some professional football players have stated publicly that they do not want their own sons to play the sport under present rules, or that they would hesitate to permit them to play. Former quarterback and two-time NFL Most Valuable Player Kurt Warner, for example, openly discusses his “fear of placing any of [his] kids in an environment where brain trauma is a possible byproduct of the competition.”

Former Pittsburgh Steelers Hall of Fame quarterback Terry Bradshaw, who still suffers headaches from the hits he absorbed during his fourteen-year NFL career, states unequivocally “If I had a son today . . . I would not let him play football.” After ten NFL seasons, New York Jets linebacker Bart Scott says, “I don’t want my [seven-year-old] son to play football. I play football so he won’t have to. . . . I don’t want to have him deal with getting a concussion and what it would be like later in life.”

Derek Brown, who played eight seasons in the NFL, says “a lot of guys in

---

96 Mike Kaszuba, *End of the Innocence*, STAR TRIBUNE (Minneapolis, Minn.), Aug. 5, 2012, at 3C (discussing falling youth football enrollments in five Minneapolis-area communities); Bob Holmes, *Fewer Played Football in 2011*, BOSTON GLOBE, June 5, 2012, at C7 (“For the fifth straight year, participation in football across the state has dropped.”).

97 Will, supra note 63 (emphasis in original).


99 Culverhouse, supra note 78, at 66.


101 Myers, supra note 64; see also, Outside the Lines, Future of Football, ESPN (Feb. 4, 2011, 5:35 PM), http://espn.go.com/video/clip?id=6091106; Student Athlete Concussions, supra note 76 (statement of Sean Morey, retired NFL player) (“Football is the profession I have chosen. I choose to risk my health to financially provide for my family. . . . However, our children’s developing brain is far more sensitive to chemical and metabolic changes of concussion.”).
Neurosurgeons report that some parents still push their children to return to the lineup too soon after a concussion, but Kurt Warner expresses the attitude of parents who refuse to dismiss the prospect of brain injury as “part of the game.” Warner claims, “We fall short as guardians if we don’t try to reduce traumatic injuries such as concussions, especially with the information we now have.”

**B. Meeting the Youth Sports Concussion Crisis**

Millions of children play organized sports each year, a number much larger than the number of collegians who played football when Theodore Roosevelt intervened in 1905. With these imposing numbers, injury prevention today does not depend on White House summits or other intercessions by the President or any other national political leader (though the President’s Council on Fitness, Sports and Nutrition partners with the Centers for Disease Control and Prevention to promote “Heads Up: Concussions in Youth Sports,” the Centers’ educational campaign for coaches, parents and athletes).

Injury prevention in youth sports depends instead largely on parents, medical professionals, legislators, journalists and other

--


103 Some Hockey Parents Take Risks With Young Brains, Expert Says, TORONTO STAR, Sept. 18, 2011, at S4 (quoting Dr. Michael Cusimano of St. Michael’s Hospital, Toronto).

104 Warner, supra note 98.

105 See supra notes 46-47 and accompanying text.

voices who spur national youth sports governing bodies and state
high school activities associations toward ongoing rule changes in
the name of greater safety. Concerned about the prospects of
diminishing enrollments and perhaps difficulties maintaining
insurance, governing bodies seem to be listening.

For example, neurosurgeon Julian Bailes, chair of Pop
Warner Football's Medical Advisory Board, says that the
organization's recently announced rule changes, discussed below,
"can eliminate 60-plus percent of the brain impacts or
concussions." We're not trying to fundamentally change the
game," he explained,

We're trying to ensure its survival by reducing the potential
for injury in practice.... For the future of the sport, we need to
morph it now and take the unnecessary head contact out of
the game. If parents were considering allowing their child to
play football, [the new rules changes] should assure them.

1. Ongoing Review of National Playing Rules

Two recent actions suggest the influence of parents and other
advocates for greater safety in youth sports. As part of their
continuing efforts to enhance player safety, Pop Warner Football
and USA Hockey have adopted rule changes that retain the
essential character of their respective sports, but postpone or
reduce contact or collision until the age levels when medical
experts conclude that players are developmentally ready.

a. Pop Warner football

A 2012 Virginia Tech study, which gathered data from
sensors placed inside helmets, showed that some head hits
suffered by seven- and eight-year-old football players resemble the

107 Te-Nehisi Coates, Youth Football Starts to Change, THE ATLANTIC, June 14,
2012 (quoting Dr. Bailes).
108 Tom Farrey, Pop Warner to Limit Practice Contact, ESPN (June 15, 2012, 2:27
PM), http://espn.go.com/espn/story/_/id/8046203/pop-warner-toughens-safety-measures-
limiting-contact-practice; Jamie McCracken, Ahead of Season, Pop Warner Renews
Safety Emphasis, USA TODAY, June 13, 2012, at 9C.
harder hits taken by college football players.\textsuperscript{109} The cumulative effects of sub-concussive hits can also exact a toll, even when none by itself rises to the level of a concussion.\textsuperscript{110}

Reflecting a “new focus on brain injuries in [the] youngest athletes,”\textsuperscript{111} Pop Warner instituted new national rule changes recommended by its medical advisory board in 2012. The organization, which enrolls players between the ages of five and sixteen,\textsuperscript{112} now limits body contact to a third of a practice session (or a maximum of forty minutes), and prohibits full speed head-on blocking or tackling drills where players line up more than three yards from each other.\textsuperscript{113}

ESPN’s Tom Farrey reports that with these rule changes, Pop Warner “challenges the longtime culture of America’s most popular game” by becoming “the first nationwide league at any level of football to restrict the amount of contact players experience.”\textsuperscript{114} The Bergen Record also reports that even before the national organization acted, some local youth football associations already instituted safety measures of their own.\textsuperscript{115}

Pop Warner’s executive director confidently claims that “[football . . . is very capable of evolving and changing appropriately. If new research comes out, we will continue to change our rules to keep our kids as safe as we can.”\textsuperscript{116} Controversy remains, however, because American Youth Football says that Pop Warner has gone “overboard” and argues that health risks to young players can be better managed through sportsmanship and proper coaching.\textsuperscript{117}

\begin{flushleft}
\textsuperscript{110} See supra notes 88-89 and accompanying text.
\textsuperscript{112} About Us, POP WARNER LITTLE SCHOLARS, http://www.popwarner.com/About_Us.htm.
\textsuperscript{113} Farrey, supra note 108; McCracken, supra note 108.
\textsuperscript{114} Farrey, supra note 108.
\textsuperscript{116} McCracken, supra note 108.
\textsuperscript{117} Id.
\end{flushleft}
Several years ago, USA Hockey banned body checking in the mite and squirt age levels, which enroll players under the age of eleven. In June of 2011, the organization extended the ban to the pee wee (ages eleven to twelve), and thus postponed checking until the bantams (ages thirteen to fourteen). The organization’s Progressive Checking Skill Development Program tightens standards of play for intimidation checks beginning in the bantams. The bans affect only boys’ hockey because checking is already banned in girls’ hockey.

USA Hockey acted after most medical studies found that body checking dramatically increases risks of concussion and other serious injury in particularly young hockey players. The Journal of the American Medical Association, for example, published a 2010 University of Calgary study that found that body checking at the pee wee level tripled concussion rates.

Dr. Robert Cantu and Mark Hyman are right that “[y]outh hockey is a safer sport for the checking restrictions – that’s beyond dispute.” USA Hockey’s decision to postpone checking is the latest step in a march toward greater player safety that began decades ago. Much of what passed for protective equipment when I first laced up my skates in the mid-1960s (including soft leather helmets that left the ears and much of the head exposed) would appear laughable today to anyone who peruses family snapshots in an old scrapbook. Concussions and other head

---

120 See, e.g., Roman Augustoviz, Checking Ban Has Governing Bodies at Odds, STAR TRIBUNE (Minneapolis, Minn.), June 8, 2012, at 1C.
121 Carolyn A. Emery, Risk of Injury Associated with Body Checking Among Youth Ice Hockey Players, 303 J. AM. MED. ASS’N 2265 (2010); see also, Augustoviz, supra note 119 (quoting Dr. Michael Stuart, USA Hockey chief medical officer and Mayo Clinic Sports Medicine Center co-director: “numerous studies document significant risks of injuries, including concussions, in leagues that allow body checking at the pee wee level”).
122 CANTU & HYMAN, supra note 26, at 22.
injuries must have been common, if often undiagnosed, ignored or misunderstood, in those days.

After some initial resistance to periodic rule changes that appeared odd or unusual, parents, coaches and players adapted each time. They seem also to have adapted to the latest postponement of body checking. “I have eleven- and twelve-year-old boys,” concludes parent, Hockey Night in Canada analyst, and former NHL star Mike Milbury, who was known for his physical play during his career.124 “At that age, their heads and necks are not developed. They’re more susceptible to concussions and the after-effects. . . . They should take hitting out until kids are in bantam.”125

2. Implementation of Playing Rules: “All Safety is Local”

Thomas P. (Tip) O’Neill, former Speaker of the U.S. House of Representatives, famously said, “all politics is local.”126 Decision-making in Washington, D.C., surely influences voters, but the former Speaker recognized that local happenings could influence voters even more by affecting their daily lives directly. O’Neill’s explanation holds relevance in youth sports, where ultimately “all safety is local” because protocols and playing rules are enforced, or not enforced, in practice sessions and games in towns and cities largely beyond the direct day-to-day supervision of national and state governing bodies.

“The life of the law,” explained former Harvard Law School Dean Roscoe Pound, “is in its enforcement.”127 Pound meant that achieving a statute’s protective purpose depends on responsible enforcement because words on paper protect no one, and statutes do not apply themselves. A youth sport’s playing rules — the “statutes of the game” — similarly are merely words on paper, and they achieve their protective purpose only with responsible local enforcement by coaches, league administrators, game officials and parents.

125 Id.
127 Roscoe Pound, Mechanical Jurisprudence, 8 COLUM. L. REV. 605, 619 (1908).
Youth sports playing rules can lose much of their protective force when adults intimidate referees, skirt the rules, or incite the players in local games. For nearly fifteen years, sports safety advocates have been haunted by an overheated Chicago-area youth hockey game in which these three manifestations of local irresponsibility led to a fifteen-year-old player’s catastrophic injury. The player suffered quadriplegia, not a concussion, but the story provides harsh lessons about the tenuous role of safety-based playing rules in youth sports generally.

On the night of November 3, 1999, New Trier High School’s junior varsity hockey team faced off against bitter rival Glenbrook North High School in the Chicago suburb of Gurnee. With only a few seconds remaining in the game, New Trier led, 7-4, in the teams’ first meeting since Glenbrook North had edged them, 3-2, for the Illinois state junior varsity title a season earlier.\(^{128}\)

The November rematch was out of control from the opening faceoff. “[V]iolence flared repeatedly as the mood grew ugly,”\(^ {129}\) and eyewitnesses later described “an intense battle”\(^ {130}\) as each team’s parents and students taunted rival fans and players.\(^ {131}\) The players trash talked to one another and squared off in confrontations unrestrained by their coaches,\(^ {132}\) the leaders recognized by pediatric professionals as “the most important individual[s] for maintaining safety” in youth sports.\(^ {133}\) The referees called sixteen penalties, an especially high number for a junior varsity hockey game.

At the final buzzer or within a second or two afterwards, a fifteen-year-old Glenbrook North player sped across the ice, blind-sided New Trier sophomore co-captain Neil Goss, and body


\(^{130}\) Debbie Howlett, Teen May Face Trial In Sports Injury, USA TODAY, May 5, 2000, at 3A.

\(^{131}\) Assoc. Press, supra note 129; see also, Smith, supra note 128.


checked him head-first into the boards.134 “This is what you get for messing,” the player said as Goss lay prone on the ice, permanently paralyzed from the neck down.135

USA Hockey’s national playing rules did not fail Neal Goss.136 He wore a helmet, face cage and other protective equipment that met safety specifications. No report indicated that any coach or referee had evaded or failed USA Hockey’s nationally mandated criminal or child abuse background checks or lacked the classroom training required of coaches and officials. The Glenbrook North attacker received a penalty for crosschecking and a thirty-day suspension pending a hearing before state amateur hockey officials.137

Instead, players on both teams were left vulnerable by rabid adults who let their emotions get the better of them. As the game spiraled out of control for an hour or more, no coach, referee, league administrator or parent had the common sense to stop the game, deliver a public address announcement requesting respect for the rules, or otherwise move the teams from the brink before it was too late.

We cannot prove that adult irresponsibility caused the cheap shot that left Neal Goss a quadriplegic, but adults concerned about player safety do not need any such proof. Parents seek to protect their children every day based not on demonstrable proof, but on their own intuition and common sense.

Intuition and common sense suggest that, particularly in contact and collision sports, adults heighten the risk of concussion or other avoidable injury when they tolerate or encourage dirty play and other violence outside the rules of the game. Adult irresponsibility may not render serious injury inevitable, but adult


134 Tony Gordon, Plea Deal Ends Emotional Hockey Case, CHI. DAILY HERALD, Aug. 8, 2000, at 1; Howlett, supra note 130, at 3A.
136 See Megan O’Matz, supra note 135 (discussing the Goss family’s lawsuit, which did not name USA Hockey as a defendant).
irresponsibility creates a toxic local atmosphere that can make serious injury more likely.

Nearly 15 years after the Chicago junior varsity hockey tragedy, too many parents and coaches continue moving in the wrong direction. In 2010, Reuters News and the market research company Ipsos jointly conducted a survey in twenty-two nations. The survey ranked parents in the United States as the world’s worst behaved parents at children’s sports events. Sixty percent of U.S. adults who had attended youth sports contests reported they saw parents become verbally or physically abusive toward coaches or officials; runners-up were parents in India (59%), Italy (55%), Argentina (54%), Canada (53%) and Australia (50%).

“It’s ironic that the United States, which prides itself in being the most civilized country in the world, has the largest group of adults having witnessed abusive behavior at children’s sporting events,” said an Ipsos senior vice president.

The Reuters/Ipsos survey confirmed earlier surveys that uniformly found significant rates of adult violence, vulgarity and abuse at children’s games in the United States. Observers report “innumerable cases . . . throughout the country every month . . . of games turning tragic at the hands of enraged parents.” “Waves of head-butting, elbowing and fighting have been reported at youth sporting events across the country.”

These reports and the consistent survey numbers suggest that when ill-tempered adults tolerate or incite local rules violations, the adults risk neutralizing national safety standards that seek to protect youth leaguers from concussions and other preventable injury. Dr. Michael Stuart, professor of orthopedic

---

139 Id.
141 Abrams, supra note 137, at 15-16.
surgery at the Mayo Clinic and USA Hockey's chief medical officer, helped design the organization's recent ban on peewee body checking, but he recognizes that rule changes are not enough: "The hardest thing of all is trying to instill sportsmanship and mutual respect."144

On the first anniversary of the fateful New Trier-Glenbrook North junior varsity game, a veteran local referee said that "nothing" had changed in Chicago-area high school hockey.145 "It's just as bad as it ever was," he concluded. "There's kids being carried off the ice every night. You have parents acting like animals in the stands, coaches acting like animals on the bench.... But when their kid gets hurt, they can't figure out why."146

a. Medical Research

The link among adult irresponsibility, local rules breakdowns, increased risk of concussions and other serious sports-related injuries finds support in medical research. Researchers have intimated that the United States should perceive "foul play" in youth sports as a "public health concern" for the risk of serious injuries that persistent rules violations pose in games played by millions of children each year.147

A recent study by the Center for Injury Research and Policy at Nationwide Children's Hospital, one of the nation’s most comprehensive pediatric research institutes, demonstrates not only how clean play enhances player safety, but also how dirty play enhances preventable risk.148 The study concerned nine high school sports: boys' football, soccer, basketball, wrestling and baseball; and girls' soccer, volleyball, basketball and softball.149

144 Lisa Kocian, Checking Head Injuries in Winter Sports, BOSTON GLOBE, May 24, 2012 (quoting Dr. Stuart).
145 Barry Rozner, One Year After a Hockey Tragedy, What Has Changed?, CHI. DAILY HERALD, Nov, 3, 2000, at 1.
146 Id.
147 S. K. Fields et al., Violence in Youth Sports: Hazing, Brawling and Foul Play, 44 BRIT. J. SPORTS MED. 32 (2010).
149 Id. at 35.
The Children’s Hospital researchers estimated that between 2005 and 2007, more than 98,000 injuries in these nine sports were directly related to an act that a referee or disciplinary committee ruled illegal. In four of the nine sports that were studied, illegal acts were responsible for more than ten percent of injuries: boys’ soccer (11.4%), girls’ soccer (11.9%), boys’ basketball (10.3%) and girls’ basketball (14.0%). Thirty-two percent of these injuries were to the head or face, and twenty-five percent were concussions.

The Children’s Hospital study was unequivocal: “Reducing the number of injuries attributable to illegal activity in general among United States high school athletes can specifically reduce the number of injuries to the head/face and concussions.”

To spur injury reduction, the Children’s Hospital researchers urged better local rules enforcement through “targeted education about the dangers of illegal activity for players, coaches and referees.” “Each sport has . . . rules developed to promote fair competition and protect participants from injury,” the researchers explained. “[E]nforcing rules and punishing illegal activity is a risk control measure that may reduce injury rates by modifying players’ behavior.”

b. Abuse of Game Officials

The American Academy of Pediatrics reports agreement among sports medicine professionals that “[o]fficials controlling the physicality of the game . . . can . . . play significant roles in reducing contact injuries.” Another recent medical study concurs that “[t]o be effective for promoting safety,” a youth sport’s

150 Id. at 34.
151 Id. at 35-6.
152 Id. at 36.
153 Id.
154 Id. at 34.
155 Id.
156 Id.; see also, U.S. CENTERS FOR DISEASE CONTROL AND PREV., Nonfatal Traumatic Brain Injuries Related to Sports and Recreation Activities Among Persons Ages Under 19 Years—United States, 2001-2009, 60 MORBIDITY AND MORTALITY WEEKLY REP. 1337, 1340 (2011) (advising that to help prevent concussions and other traumatic brain injury, the agency urges “adhering to rules of play with good sportsmanship and strict officiating”).
157 Koutures & Gregory, supra note 79, at 410.
rules “must be enforced rigorously and consistently by referees and leagues.”

In many communities, however, parents and coaches thwart rigorous, consistent rule enforcement by creating directly or indirectly a chronic shortage of referees and other game officials. A primary reason for the chronic shortage is the steady exodus of experienced officials who grow disgusted with the verbal, and sometimes physical, abuse inflicted on them by adults on the benches and in the stands. Efforts to recruit replacement officials may not keep pace with attrition because, according to the Deseret Morning News, “[b]rand-new officials often suffer through their first season of abuse before deciding that refereeing just isn’t worth it.”

“Officiating a youth sports game is becoming an increasingly risky job,” explains Positive Coaching Alliance executive director Jim Thompson, who says, “[y]outh sports officials are under attack – literally.” The risk has increased so much that the National Association of Sports Officials offers youth sports officials insurance for “injuries suffered when an official is the victim of an assault and/or battery by a spectator, fan or participant.”

Particularly in contact or collision youth sports at older age levels, player safety suffers when veteran officials hang up their whistles each year. Many replacement officials are inexperienced and unprepared for responsibilities thrust on them, and frequently unable to keep up with fast-paced games. But for the veteran officials’ departures, many replacements would not be on the field.

158 Tator et al., supra note 133, at 455.
159 Abrams, supra note 33, at 260-61.
160 CANTU & HYMAN, supra note 26, at 153.
161 Dan Rasmussen, Referee Shortage Hurting Soccer, Deseret Morning News (Utah), Apr. 26, 2005.
II. THE LAW’S ROLE IN YOUTH SPORTS SAFETY

A. Recent State Concussion Legislation

“Between 2009 and July 2012, at least thirty-four states have enacted statutes concerning traumatic brain injury. In 2012, at least fourteen states have introduced some type of traumatic brain injury legislation.”164 By targeting concussions in youth sports in such unison,165 this flurry of nationwide legislative activity demonstrates the persuasive force of both emerging medical research and commentary and the responses and expectations of parents and sports safety advocates.

Nearly all the new statutes require that before each season, state education departments or local boards of education provide parents, coaches, administrators, and players with information and education about the nature and dangers of concussions, how to recognize symptoms of potential brain trauma, and how to help insure healthy recovery.166 Some of the statutes contemplate provision of written materials, and others specify face-to-face group presentations.167

Most of the new statutes also require that coaches immediately remove from a practice session or game any player suspected to have suffered a concussion.168 Most also specify that the player may not return to action until a physician or other licensed medical professional clears the player and affirms that return is medically appropriate.169

The new concussion statutes take giant steps in the right direction, but they do not displace safety-based review and responsible enforcement of playing rules. The statutes merely

165 Id. (presenting state-by-state summary).
167 See, e.g., CONN. ACTS, P.S. 1062 (Reg. Sess.) (requiring that coaches complete annual training and review, and complete refresher courses once every five years); 2011 IND. ACTS, P.L. 144 (Dep’t of Educ. must develop and disseminate guidelines, information sheets and forms).
168 See, e.g., TRAUMATIC BRAIN INJURY LEGISLATION, supra note 164 (presenting state-by-state summary).
169 Id.
establish prudent protocols for preventing and reacting to actual and suspected concussions that players suffer in practice sessions and games.

Nor do the statutes’ protocols appear to protect all young athletes who need the law’s protection. For example, many of the statutes do not appear to reach private youth sports associations, even ones that enroll millions of children and use public fields and other facilities under permits or licenses granted by local government bodies.\textsuperscript{170} The legislature surely “may take one step at a time, addressing itself to the phase of the problem which seems most acute to the legislative mind,”\textsuperscript{171} but child safety advises extending the statutory mandates to these associations. Government agencies have long held discretionary authority to regulate private use of public property that charters, statutes, or ordinances commit to agency management.\textsuperscript{172}

The new statutes’ implementation remains challenging because most coaches and game officials, who are not medical professionals, may lack first-aid training and typically must make immediate on-the-spot decisions without medical advice.\textsuperscript{173} Less than half of high schools have certified athletic trainers on staff, and many high schools do not enlist local volunteer physicians to play formal roles at practices and games.\textsuperscript{174} In community youth leagues, certified trainers are rare indeed.

\begin{footnotesize}
\footnotesize
\begin{enumerate}
\item See, e.g., 2011 Ariz. Sess. L., ch. 167 (school boards); 2011 Colo. Sess. L., ch. 67 (youth athletic interscholastic activity in public and private middle, junior and high schools); 2011 Minn. L., ch. 90 (organizations that charge a fee for a youth athletic activity).
\item See, e.g., Shubha Singh et al., Gymnastics-Related Injuries to Children Treated in Emergency Departments in the United States, 1990-2005, 121 Pediatrics e954, e958-59 (2008) (“Prevention of gymnastics-related injuries depends on the establishment and universal enforcement of uniform rules and regulations for gymnasts, coaches, and spotters. . . . [A] set of uniform rules and regulations has not been developed or implemented. Whereas some high school gymnastics programs and private gyms require safety training for their gymnasts and coaches, many fail to implement such training programs”).
\item See, e.g., Cantú & Hyman, supra note 26, at 125 (“Every high school in America should have a full-time athletic trainer”); Brooke de Lench, Athletic Trainers: Every High School Should Have One, MOMSTEAM (May 23, 2012),
\end{enumerate}
\end{footnotesize}
Youth sports programs should perceive the new statutes as invitations to take proactive measures not explicitly mandated in the legislation, including the hiring of certified trainers. In the absence of certified trainers, youth leagues and high school teams alike should enlist medically trained volunteers to serve on the staff at practices and games, with the authority to overrule the coaches' decision not to remove an apparently injured player from the lineup. When I was president, our youth hockey program had a medical committee of parents, who were physicians, nurses, or emergency medical technicians. At least one such volunteer was assigned to each practice and game, frequently when their own children were playing so that the volunteer would be on the premises anyway.

The youth hockey program instructed coaches to err on the side of caution when a player took a hit and came to the bench disoriented. “You can play with a big bruise or hip flexor,” explains Dr. Cantu, but “[t]here is never a scenario in which playing with a head or spinal injury, or a suspicion of such an injury, should be condoned.” Our hockey program’s bywords were, “When in doubt, sit them out.” Feelings of disorientation can be “after-shocks of brain trauma” and, as the National Institutes of Health recognizes, children “have many decades of life ahead.”

B. Litigation

The law’s prescriptions frequently help shape personal behavior, but we should not exaggerate the current role of tort litigation in preventing concussions and other avoidable youth sports injuries. The specter of lawsuits by injured players might

http://www.momsteam.com/team-of-experts/athletic-trainer-AT-every-school-should-have-one.

175 CANTU & HYMAN, supra note 26.
176 Brooke de Lench, Coaches: Part of Concussion Solution or Problem?, MOMSTEAM (May 21, 2012), http://www.momsteam.com/team-of-experts/coaches-part-of-concussion-problem-or-solution (reporting 2012 survey in which “fully half of parents with children age 12 to 17 playing school sports admitted knowing of a coach who would have a player return to sports too soon after a concussion”) (emphasis in original).
177 CANTU & HYMAN, supra note 26, at 146.
178 CULVERHOUSE, supra note 78, at 62.
179 NIH CONSENSUS DEV. PROGRAM, supra note 25, at 9.
accelerate safety initiatives by stimulating the sensibilities of rule makers and other concerned adults, by jeopardizing the availability of insurance at favorable rates, or by leaving individual parents reluctant to enroll their children. Any such potential long-term influence on prevention efforts has only residual effects on a player injured today.

Regardless of whether lax rules enforcement may have contributed to the underlying injury, a negligence suit against governing bodies, leagues, or coaches can only compensate a youth leaguer for injuries that have already occurred. A third or more of the recovery after settlement or trial may go to the plaintiff’s lawyer under the contingent-fee retainers common in personal injury suits. Compensation can react to damage and is no small matter to a family facing medical expenses, but compensation does nothing to reverse the player’s immediate and sometimes permanent injury.

With the sufficiency of USA Hockey’s national safety standards not in issue, tort law reacted to Chicago-area hockey player’s Neal Goss’ quadriplegia as best it could. Facing lifetime costs for medical bills and around-the-clock personal care, the Goss family filed a multimillion-dollar civil damage action alleging that five defendants negligently failed to control the game—the Glenbrook North opponent; the Glenbrook North coach; the Illinois Hockey Officials Association; the Northbrook Hockey League, which sponsored the Glenbrook North team; and the Amateur Hockey Association of Illinois. The parties reached private settlements in some of the civil suits, and USA Hockey’s insurance helped meet the bedridden Neal Goss’ expenses for lifelong care.

CONCLUSION

Discussion about the serious consequences of sports-related concussions “can no longer really be called a debate,” because

---

180 See ABA MODEL RULES OF PROF. CONDUCT 1.5(c), (d) (2011).
181 Abrams, supra note 137, at 10.
182 O'Matz, supra note 135.
seriousness has become “a widely accepted fact.” Former Montreal Canadiens’ hockey goaltender Ken Dryden writes, “[h]ead injuries have become an overwhelming fact of life in sports” because of “[t]he immensity of the number, the prominence of the names, the life-altering impact on their lives, and, more disturbingly, if that’s possible, the now sheer routineness of their occurrence.” Evidently, from swelling youth sports enrollments and greater willingness to report traumatic brain injury, reported concussions in high school sports have been rising at a fifteen percent annual rate. Experts predict even higher pediatric sports-related concussion rates in the foreseeable future.

“[T]he concussion problem in football and other contact sports is far more serious than any of us want to believe, and it is time to do something about it,” says former football player, professional wrestler and Minnesota Governor Jesse Ventura. Two researchers report that, “[e]ven 10 years ago, a young athlete with a ‘ding’ or low-grade concussion would have been allowed to return to sports as soon as 15 minutes after his or her symptoms had cleared.” Former Tampa Bay Buccaneers president Gay Culverhouse reports that as late as 2006, rushing a player back from a concussion was “standard operating procedure in the NFL. Concussions were not taken seriously. . . . This was the culture of

---

184 Simpson, supra note 65.
185 Ken Dryden, Time for the NHL to Get Head Smart, GRANTLAND (Sept 30, 2011), http://www.grantland.com/story/_/id/7036426/time-nhl-get-head-smart (emphasis in original); see also, Rosemarie S. Moser et al., Neuropsychological Evaluation in the Diagnosis and Management of Sports-Related Concussions, 22 ARCHS. CLIN. NEUROPSYCHOLOGY 909, 910 (2007) (“Concussions are common injuries in athletics” at the professional and amateur levels).
187 Halstead & Walter, supra note 75, at 599.
188 Jesse Ventura, Introduction, in NOWINSKI, supra note 57, at ix.
189 Halstead & Walter, supra note 75, at 597; see also DAVE MEGGESY, OUT OF THEIR LEAGUE 125 (1970) (writing that a former NFL outside linebacker; “Getting ‘dinged’ means getting hit in the head so hard that your memory is affected, although you can still walk around, and sometimes even continue playing. You don’t feel pain, and the only way other players or the coaches know you’ve been ‘dinged’ is when they realize you can’t remember plays.”).
the time. Your teammates expected you to play, and your coaches expected you on the field on game day.”

Today, more adults and children are coming to respect concussions for what they are — traumatic brain injuries that can leave their young victims less able to learn in school, perform functions of everyday life, and perhaps enjoy adulthood free from chronic pain, cognitive dysfunction and possible mental deterioration.

“Unlike other anatomical areas such as our bones, muscles, ligaments, and tendons, our brain tissue has relatively little ability to heal and repair itself.” “While today many parts of the body can be replaced either by artificial hardware or transplantation, the brain cannot be replaced.” With the stakes so high, says CNN chief medical correspondent and neurosurgeon Sanjay Gupta, “we owe it to our . . . kids . . . to make them as safe as we know how to do, and we can do a lot better than we have been doing.”

The primary focus belongs on prevention, which begins with parents, medical professionals, journalists, and legislators who influence national youth sports governing bodies and state high school activities associations to continue evaluating playing rules to maintain the essence of particular sports while also making play as safe as possible. Proposals for further safety-based rules changes warrant careful attention. Reacting favorably to Pop Warner’s recent changes, for example, the Boston Globe urged the organization to “consider further limits, including those that affect

---

190 Culverhouse, supra note 78, at 64.
193 Lyle J. Micheli, Foreword, in Meehan III, supra note 24, at xi.
196 Nowinski, supra note 57, at 168-69 (“change will be difficult without pressure from the grassroots level”).
197 See, e.g., Policy Statement: Baseball and Softball, 129 PEDIATRICS e842, e852-53 (2012) (making recommendations for further safety measures); Charles Randazzo et al., Basketball-Related Injuries in School-Aged Children and Adolescents in 1997-2007, 126 PEDIATRICS 727, 732 (2010) (“For young children, age-appropriate basketballs should be used, which may decrease the rates of concussions . . . , and rough play should be discouraged, to minimize collisions.”).
games, not just practices. Wisely, the organization hasn't ruled out a ban on the three-point stance, which puts linemen in the position of starting plays with heads out front.”

Prominent neurosurgeon Robert Cantu would go even further. He recommends postponement of tackling in football, body checking in hockey, and heading the ball in soccer until players have turned fourteen. Other voices support Dr. Cantu's well-articulated position.

"Consistent and diligent enforcement of the rules and regulations of the game," says Dr. William P. Meehan, "may be one of the most effective ways of reducing the risk of sport-related concussions." Ultimate responsibility for enforcement resides at the local level with coaches, league administrators, game officials and parents, even ones whose children play clean and cause no trouble. The player lying prone on the ice at the end of the 1999 Chicago junior varsity hockey game could have been any parent's child. Neal Goss happened to be in the wrong place at the wrong time, the victim of impulsive violence outside the rules of the game. If the adults had maintained their self-control from the start, he would likely have walked out of the rink because players trained and supervised by responsible adults do not race several yards to drive opponents' faces into the ground at the end of a game.

As our nation confronts an epidemic of pediatric obesity, we serve children best when we encourage participation in sports by reassuring them and their families that they can play vigorously yet safely. As the law continues responding to the youth sports concussion crisis, the response does not displace the need for ongoing review and responsible local enforcement of

199 CANTU & HYMAN, supra note 26, at 144-49, 152-53.
200 See, e.g., Joe Nocera, supra note 102, at A21 (quoting former Dallas Cowboy tight end Jean Fugett, now a Baltimore lawyer living in constant pain from his playing days, who says that youngsters should not play tackle football before high school because their bodies are not ready).
201 MEEHAN III, supra note 28, at 121.
playing rules. The recent preventive rule changes made by USA Hockey and Pop Warner football demonstrate how medical research and advocacy for greater safety can prevail over charges that rule changes seek to “sissify” collision and contact sports. Speaking in support of Pop Warner’s rules changes, University of Alabama football coach Nick Saban explained, “Anytime you change something, people will say no, they’ve done it this way for a long time. But there’s always a better way.”

Two years after the 1905 White House intercollegiate football summit that opened this Article, President Theodore Roosevelt addressed youth sports in a message to the Washington Playground Association:

City streets are unsatisfactory playgrounds for children because of the danger, because most good games are against the law, because they are too hot in summer, and because in crowded sections of the city they are apt to be schools of crime. Neither do small back yards nor ornamental grass plots meet the needs of any but the very small children. Older children who would play vigorous games must have places especially set aside for them; and, since play is a fundamental need, playgrounds should be provided for every child as much as schools. This means that they must be distributed over the cities in such a way as to be within walking distance of every boy and girl, as most children can not afford to pay carfare.

The face of youth sports has changed dramatically since Roosevelt’s time. Until a few decades ago, American children generally conducted many of their own games on local playgrounds or sandlots without adult involvement. Today adults conduct most youth sports in private associations, public agencies such as parks and recreation departments and high school activities associations. Roosevelt’s message to the Washington Playground Association suggests that he would

---

2013 | Confronting the Youth Sports Concussion Crisis

203 Farrey, supra note 108 (quoting Saban).
205 Abrams, supra note 33, at 264.
applaud efforts to provide children the safe competition and personal growth that remain the promises of youth sports.