30th ANNUAL CONFERENCE

Forging New Frontiers:

Injury Prevention in Evolving Environments

December 5-7, 2025

Embassy Suites by Hilton
Ft. Lauderdale, Florida

Injury Free Coalition for Kids®

COLUMBIA | MAILMAN SCHOOL OF PUBLIC HEALTH
CENTER FOR INJURY SCIENCE AND PREVENTION

UAB THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

This event is jointly provided by the University of Alabama Heersink School of Medicine and the Injury Free Coalition for Kids at the Columbia Center for Injury Science and Prevention (CCISP), Mailman School of Public Health, Columbia University. The University of Alabama School of Medicine is an equal opportunity/affirmative action institution.

Forging New Frontiers 2025
Injury Prevention in Evolving Environments

The 30th Annual Injury Free Coalition for Kids® Conference
December 5-7, 2025, Embassy Suites Ft. Lauderdale

CONFERENCE OBJECTIVES

Forging New Frontiers, the annual conference of the Injury Free Coalition for Kids®, is the premier injury prevention meeting to foster collaborative research, develop best practices and address challenges in the field of pediatric injury prevention. The objectives of the December 2025 conference are to provide participants with an opportunity to:

- Expand knowledge in the field of Injury Prevention.
- Encourage and disseminate injury prevention research.
- Learn about designing, planning and building healthy communities.
- Share and explore challenges and successes in community-based injury prevention programming with a goal of helping trauma centers develop and improve injury prevention programs.
- Share information about innovative injury prevention best practices.
- Describe how trauma centers can develop and evaluate community-based injury prevention programs.
- Identify opportunities for multi-city projects and research as well as opportunities to learn more about translating research into practice in minority and resource-limited communities.
- Provide attendees with the opportunity to revitalize their creative energies in order to continue to innovate and sustain healthy communities.

ACCREDITATION

CME Credits: This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of the University of Alabama Heersink School of Medicine and the Injury Free Coalition for Kids at the Columbia Center for Injury Science and Prevention (CCISP), Mailman School of Public Health, Columbia University. The University of Alabama Heersink School of Medicine is accredited by the ACCME to provide continuing medical education for physicians. The University of Alabama Heersink School of Medicine designates this activity for *AMA PRA Category 1 Credit(s)™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity. The University of Alabama School of Medicine is an equal opportunity/affirmative action institution.

CHES/MCHES Professional Development: Forging New Frontiers 2025 is sponsored by Injury Free Coalition for Kids, a designated provider of continuing education contact hours (CECH) in health education by the National Commission for Health Education Credentialing, Inc. Application has been made for accreditation to offer Certified Health Education Specialists (CHES) and/or Master Certified Health Education Specialists (MCHES) Category I contact education contact hours. More information will be provided in an insert to this book.

National Child Passenger Safety Certification Continuing Education: This program has been approved by National Child Passenger Safety Certification, a program of Safe Kids Worldwide, to offer CPS technical continuing education units. Individual sessions that qualify for CPS CEUs are indicated on the agenda. CPS technicians will self-claim up to 4 CEUs and 1 Community Education Credit for the conference and will have to maintain documentation of attendance for each claimed session. (A certificate will be provided through the online Injury Free evaluations system that will satisfy this requirement.) This event's pre-approval number is 8235.

celebrating 30 years

Injury Free Coalition for Kids®

A Surgeon and Her Community

Dr. Barbara Barlow '60 wants to keep kids out of her medical wards, so she brings them into the hospital for art lessons, arranges for the rebuilding of neighborhood playgrounds, and lobbies for gun control.

by Amy Arner Sgarro '83

DR. BARBARA BARLOW '60, chief of pediatric surgery at New York's Harlem Hospital Center, was having a typical workday. Three children were admitted to the hospital for surgery; another, having fallen out of a window, required immediate attention in the hospital's pediatric trauma center; some snags had arisen regarding the Japanese garden she was having built for a local public school; arrangements needed to be finalized for an art show featuring many of the neighborhood children; and plans for a conflict resolution program for children and their parents still needed fine-tuning.

Hardly the typical responsibilities of a surgeon, but commonplace for Dr. Barlow, founder of Harlem Hospital's Injury Prevention Program (IPP), a diverse, community-oriented program that pushes medicine beyond its traditional limits.

In a neighborhood of 80,000 children, most of them poor, alarming numbers of children were sustaining preventable injuries. Since arriving at Harlem Hospital Center in 1975, Dr. Barlow has been treating children for falls from windows lacking gates, who are hit by cars as they play on streets, and children who are the victims of violence. Frustrated and demoralized, Dr. Barlow confronted the fact that if she and her staff continued to work within the bounds of the hospital—as surgeons traditionally do—they would most likely continue to see the endless parade of injured kids.

"To see children who get shot while they're playing basketball, or sitting on their stoop, or at the breakfast table; to see kids assaulted for their lunch money, stabbed for their coat—it's just awful," Dr. Barlow says. "It's very traumatic, and while I accepted this in choosing my career, it never has become easy to deal with. Every injury I see hurts me. I feel enraged and devastated when I see children die of injuries that needn't have happened to begin with."

In the face of this devastation, and attempting to prevent it, Dr. Barlow initiated the Injury Prevention Program in 1988. Funded by a grant from the Robert Wood Johnson Foundation, Dr. Barlow hired a staff of three and started with the seemingly simple goal of rebuilding Harlem's playgrounds.

"We patterned our whole program on the premise that children in the community didn't have anything to do after school," says Dr. Barlow. "There were no safe places to play because junkies and homeless people had taken over the parks." Short of funds, the neighborhood's public schools had abolished extracurricular activities and sports, and few families could afford to pay for after-school programs. With no place else to go, kids were hanging out in the streets—and getting run over by cars, caught in the crossfire of drug-related shootouts, hurt in abandoned buildings.

At the beginning of the project, Dr. Barlow and her staff photographed all the city parks and school playgrounds in Harlem. Armed with a damning photo essay, they approached the city's Department of Parks and the Board of Education, as well as the local school board. The parks department responded with a large-scale effort to renovate Harlem's public parks; to date, nearly all the parks in the community have been made safer.

Fixing the public school playgrounds was another matter. Certainly the schools wanted safer playgrounds for Harlem's children, but they were constrained by severely limited budgets. The only solution seemed to lie in securing private funding. That Dr. Barlow has done through endless hours of fundraising, and since 1988, the Injury Prevention Program has helped build two new school playgrounds; six more are in the works.

And what playgrounds they've built. No mundane collection of monkey bars and swing sets are these. Dr. Barlow works with a playground architect, who designs creative spaces that reflect the ideas of each school's kids and their teachers. Their first playground was a fanciful model of Harlem, replete with a miniature Apollo Theater stage, a scaled-down version of the Harlem River Bridge, a model of the

This chief of pediatric surgery at a New York City hospital leads her staff to unconventional prescriptions as they combat an epidemic of preventable injuries to children.

Dr. Barbara A. Barlow in the playground at Public School 197

Amy Arner Sgarro is a frequent contributor to the Quarterly.

Welcome from Our Founder

Barbara Barlow, MD, FAAP, FACS

Professor of Surgery in Epidemiology
Associate Director, Center for Injury Science and Prevention
Executive Director, Injury Free Coalition for Kids
Mailman School of Public Health
Columbia University in the City of New York

Dear Injury Free,

Welcome to the 2025 Injury Free Coalition for Kids Annual Conference, Forging New Frontiers: Injury Prevention in Evolving Environments.

It is an immense privilege to welcome you to this year's conference — a gathering that, for the past 30 years, has united injury prevention professionals, public health innovators, clinicians, researchers, community leaders, educators, and many others dedicated to building safer communities, and healthier futures for children and their families.

Over these three decades, our world has changed in profound ways. Technological and digital advancements, urbanization, and climate change — among many other shifts — have transformed the environments in which injuries occur. As a result, the strategies we use to prevent them must evolve as well.

At this year's conference, our focus is on meeting those challenges head-on: exploring how to design, implement, and sustain injury prevention efforts in evolving environments — and doing so with equity, resilience, and innovation at the forefront.

We encourage you to take full advantage of the robust program we have planned: impactful keynote presentations, interactive workshops, multiple learning sessions, dynamic lightning rounds and plenty of networking opportunities. This conference is designed to serve you, inspire you, and connect you.

On behalf of our Program Committee, I extend my thanks for your dedication, passion, and the vital work you do every day to protect lives, build resilience, and create safer environments.

Welcome to Fort Lauderdale, to forging new frontiers together, and to advancing the next generation of injury prevention strategies in our evolving world. Here's to another 30 years of injury prevention leadership and impact!

Warm regards,

Dr. Barlow
Founder & Executive Director

Welcome from Our President-Elect

Michael N. Levas, MD, MS

President-Elect, Injury Free Coalition for Kids
Professor of Pediatrics, Emergency Medicine
Medical College of Wisconsin
mnlevas@mcw.edu

It is a pleasure to welcome you to the 30th Injury Free Coalition for Kids® Annual Conference, *Forging New Frontiers: Injury Prevention in Evolving Environments*. This year's theme reflects our commitment to adapting and innovating in response to the ever-changing landscapes where children live, learn, and grow. Whether through technology, policy, or community engagement, we continue to forge new paths to protect children from preventable harm.

The Injury Free Coalition for Kids remains a national leader in pediatric injury prevention. With over 42 hospital-based sites across the country, our coalition transforms data into action—developing evidence-based interventions that respond to local needs and national trends. Our work spans critical areas such as firearm safety, child passenger protection, fall prevention, and safe sleep initiatives. Through the publication of our annual meeting supplement in *Injury Epidemiology*, we share these innovations with the broader public health community.

This year's keynote session features **Brent Kaziny, MD**, whose leadership in pediatric emergency medicine and disaster preparedness exemplifies our theme. Dr. Kaziny's work at Texas Children's Hospital and Baylor College of Medicine has advanced pediatric readiness in emergency departments and shaped national strategies for disaster response involving children. His insights will help us navigate evolving environments with resilience and foresight.

We are honored to present the **Pioneer Award** to **Judy Schaechter, MD, MBA**, in recognition of her extraordinary career in injury prevention. Dr. Schaechter currently serves as Director of the CDC's Division of Violence Prevention at the National Center for Injury Prevention and Control. Her work focuses on translating science into action and supporting communities to stop violence before it happens. She brings decades of experience in pediatrics, public health, and policy—including leadership roles at the American Board of Pediatrics and the University of Miami. Her keynote will reflect on the evolving challenges and opportunities in injury prevention, aligning perfectly with our conference theme.

Injury Free's leadership extends beyond this conference. Each year, we spearhead **National Injury Prevention Day** on November 18, joining forces with partners nationwide to raise awareness and empower communities. Through coordinated events, media campaigns, and advocacy, we shine a light on the leading causes of injury and promote proven strategies to prevent them.

We are excited to offer new workshops and panels this year, including sessions on social media presence, equity in injury prevention, and community-based innovations. The abstracts submitted by our members showcase the breadth and depth of work being done across the country to make children safer.

A heartfelt thank you to the Program Committee, Scientific Publications Committee, presenters, panelists, keynote speakers, and moderators. Special thanks to Walter Rice and DiLenny Roca-Dominguez for their leadership and dedication.

We also honor the memory of **Lenita Johnson**, whose service to our organization for over two decades left an indelible mark. This year, we present the inaugural **Lenita Johnson Award** in her name.

Finally, we thank our founder and fearless leader, **Dr. Barbara Barlow**, whose vision and passion continue to inspire us all.

Thank you for attending YOUR conference. Please take advantage of the many opportunities to connect, collaborate, and celebrate our shared mission. Together, we are forging new frontiers in injury prevention—creating safer, healthier environments for every child.

Sincerely,
Mike Levas

Keynote Speaker

Brent D. Kaziny, MD, MA

Associate Professor
Department of Pediatrics, Section of Emergency Medicine
Baylor College of Medicine
Attending Physician, Emergency Center
Medical Director of Emergency Management
Texas Children's Hospital
bxkaziny@texaschildrens.org

Dr. Brent D. Kaziny completed his medical degree at the University of Texas–Houston, School of Medicine. He started his pediatric intern year at the Tulane-Ochsner Pediatric Residency Program, where he received the Hurricane Katrina Code Grey Hero Award for his efforts caring for patients and assisting with the evacuation of Tulane Hospital during the aftermath of Hurricane Katrina. After completing his intern year, he transferred to Baylor College of Medicine, where he completed his residency training in general pediatrics. He completed his fellowship in Pediatric Emergency Medicine at the University of Utah in Salt Lake City. Upon completing fellowship, Dr. Kaziny took a position at Baylor College of Medicine and Texas Children's Hospital. On a national level he serves as the Co-Director of the Disaster Domain for the Emergency Medical Services for Children–Innovations and Improvement Center, the Co-Lead of the Disaster Management Domain of the Pediatric Pandemic Network, the Vice-Chair of the AAP's Council on Children and Disaster, and a voting member of the National Advisory Committee on Children and Disasters. At Texas Children's Hospital he works in the Emergency Center and serves as the Medical Director of Emergency Management. Dr. Kaziny is the Principal Investigator for the third pediatric disaster care center of excellence, the Gulf 7 Pediatric Disaster Network, funded by the Administration for Strategic Preparedness and Response.

2025 Pioneer Award

Judy Schaechter, MD, MBA

Director of the Division of Violence Prevention
U.S. Centers for Disease Control and Prevention (CDC) Injury Center
Former President and CEO, American Board of Pediatrics
Former Chair of Pediatrics, University of Miami
Former President and Current Board Member
Injury Free Coalition for Kids

The Injury Free Coalition for Kids Pioneer Award is given to an individual who has demonstrated dedication throughout their career to the mission of preventing injuries to children and their families. The award recognizes a forerunner in the field of Injury Prevention, an innovator and calculated risk-taker who blazes new trails and speaks out when needs are unmet. Injury Free Coalition for Kids is pleased to award the 2025 Pioneer Award to Judy Schaechter, MD, MBA.

Judy currently serves as Director of the Division of Violence Prevention at the CDC's Injury Center, where she leads efforts to bridge science and practice to stop violence before it starts. The Division of Violence Prevention monitors violence-related injuries, conducts research on risk factors and prevention strategies, and supports state and local partners in adopting and disseminating effective programs.

Dr. Schaechter has an impressive background in public health, policy development, and coalition building. She led the American Board of Pediatrics as President and CEO, spearheading strategic planning and initiatives on mental health, workforce, and belonging. She previously served as Chair of Pediatrics at the University of Miami and Chief of Child Health at Jackson Memorial, one of the nation's largest public health systems. She also was a Robert Wood Johnson Foundation/National Academy of Medicine Health Policy Fellow, working with the Senate Health, Education, Labor and Pensions Committee.

Committed to advancing progress on challenging issues of public health and community wellbeing, Dr. Schaechter has addressed issues including violence and injury, climate concerns, disaster preparedness, and access to quality education and health care. She earned a Certificate in Public Policy from Harvard Kennedy School, an executive MBA from the University of Miami, a Medical Doctorate from Stanford and a BA in Religious Studies and Ethics from Brown University. A long-time leader within the Injury Free family, she is a former president of the organization and currently serves as a member of the Injury Free Board.

We are proud to present the 2025 Injury Free Coalition for Kids Pioneer Award to Dr. Judy Schaechter, in recognition of her many years of service and her bold advocacy for improving the lives of children through injury prevention.

2025 Principal Investigator of the Year

Steven C. Rogers, MD, MS

Attending Physician, Division of Emergency Medicine
Medical Director, Emergency Behavioral Health Services
Connecticut Children's
Research Scientist, Connecticut Children's Injury Prevention Center
Associate Professor, University of Connecticut School of Medicine

This year we recognize Steven C. Rogers, MD, MS, CPST as the 2025 Principal Investigator of the Year for his exemplary leadership, groundbreaking research, and unwavering dedication to protecting children and families from preventable injuries.

Dr. Rogers serves as the Medical Director of Emergency Behavioral Health Services at Connecticut Children's, an Associate Professor of Pediatrics at the University of Connecticut School of Medicine, and a Research Scientist at the Connecticut Children's Injury Prevention Center. As Co–PI for Injury Free Coalition for Kids – Hartford, CT and a member of the Injury Free Board of Directors he has been instrumental in advancing the Coalition's mission to prevent injuries to children and building safer, healthier communities for all children.

Steve takes an innovative and multidisciplinary approach to injury science and prevention. He has combined clinical care, research, and advocacy. He is a pediatric emergency physician, a car passenger safety technician who also focuses on youth behavioral health which uniquely positions him to understand and address the complex intersections of physical and behavioral health injury risks.

Dr. Rogers' research portfolio reflects a deep and sustained commitment to understanding and preventing youth suicide and behavioral health crises in the emergency care setting. His recent publications, such as *"Screening and Risk Algorithms for Detecting Pediatric Suicide Risk in the Emergency Department"* (2025), *"Feasibility and Importance of Universal Suicide Screening in a Pediatric Emergency Department"* (2025), and *"Using Transfer Learning to Improve Prediction of Suicide Risk in Acute Care Hospitals"* (2025)—have contributed significantly to the national dialogue on suicide prevention in children and adolescents. Dr. Rogers has also made major contributions to injury prevention research more broadly, co-authoring studies such as *"A Multicenter Evaluation of Pediatric Emergency Department Injury Visits During the COVID-19 Pandemic"* (2023) and *"Violence Prevention Emergency Tool (VPET) Screening of Youth in the Pediatric ED"* (2020), which have provided key insights into how environmental, social, and systemic factors affect injury trends and risk patterns in children and adolescents.

Dr. Kevin Borrup, Executive Director of the Connecticut Children's Injury Prevention Center, writes that Dr. Rogers is "a constant champion of children and the Injury Free Coalition for Kids since he joined Connecticut Children's. He has worked to completely change how we approach the mental health wellness of children internally at the hospital and in the community, over a period of time that has been typified by a swelling public health crisis related to suicide."

Throughout his career, Dr. Rogers has exemplified excellence in research and advocacy. His work continues to influence policy, improve practice, and inspires collaboration across clinical, academic, and community settings. His leadership embodies the mission and values of the Injury Free Coalition for Kids, and his contributions have had a profound and lasting impact on child health and safety.

The Injury Free Coalition for Kids proudly honors Dr. Steven C. Rogers as the 2025 Principal Investigator of the Year, in recognition of his outstanding research and commitment to improving the lives of children and families through evidence-based prevention.

2025 Program Coordinator of the Year

Mary Beth Vassy, MPH, CPST-I

Pediatric Trauma Injury Prevention Coordinator
Safe Kids South Carolina Charleston Area Coalition Coordinator
Medical University of South Carolina (MUSC) Children's Health

Mary Beth Vassy, MPH, CPST-I, has emerged as a dynamic and influential leader within the Injury Free Coalition for Kids, bringing energy, innovation, and collaboration to every initiative she touches. Since joining the coalition just a few years ago, she has made a profound impact by chairing multiple committees, actively participating in national conferences, and fostering engagement among fellow Program Coordinators to elevate the coalition's collective work.

As the leader of the Safe Sleep Sub-committee, Mary Beth has championed efforts to reduce infant sleep-related deaths through education and outreach. She also founded the Young PCs Subcommittee, creating a space for emerging professionals to connect, share strategies, and grow within the injury prevention field. Her involvement in the Child Passenger Safety Sub-committee reflects her commitment to keeping children safe in vehicles through evidence-based practices and community engagement.

Mary Beth serves as the Pediatric Trauma Injury Prevention Coordinator for MUSC Children's Health and leads the Safe Kids Charleston Area Coalition, where she implements programs like car seat checkups, safety workshops, and drowning prevention campaigns tailored to local needs. Her leadership was especially visible during a recent surge in child drownings in the Lowcountry, where she used her platform to educate families on water safety and advocate for proactive measures.

A skilled communicator, Mary Beth leverages Instagram as an educational tool, sharing practical safety tips and engaging content that resonates with families. Her expertise has also made her a trusted voice on local television, where she delivers clear, actionable guidance on injury prevention topics ranging from golf cart safety to safe sleep practices.

Her background in public health and biostatistics, combined with her hands-on experience in trauma prevention, makes her a go-to resource in both clinical and community settings. Whether she's coordinating a coalition event, mentoring young professionals, or speaking to the media, Mary Beth Vassy exemplifies the spirit of Injury Free. She is collaborative, evidence-driven, and deeply committed to protecting children.

It is for these reasons that we are excited to award Mary Beth Vassy as the 2025 Program Coordinator of the Year, in recognition of her exceptional leadership, innovative approach to injury prevention, and unwavering dedication to protecting children and families in her community and beyond.

celebrating 30 years

Injury Free Coalition for Kids®

Schedule-at-a-Glance

Friday, December 5

7:00 am	Registration
8:00 am	Welcome & Logistics
8:15 am	**Keynote: Brent Kaziny, Disaster Preparedness**
9:15 am	Platform Presentations: Drowning Prevention/Child Passenger Safety
10:30 am	Coffee Break
10:45 am	Platform Presentations: Firearm Injury Prevention
12:00 pm	Lunch
1:00 pm	Friday Lightning Round & Poster Session
2:00 pm	Workshop Sessions ★1A, 1B, 1C, 1D
3:00 pm	Workshop Sessions ★2A, 2B, 2C, 2D
4:00-5:00 pm	PI and PC Meetings
6:00-7:00 pm	Reception
7:00 pm	Board of Directors Meeting

Saturday, December 6

7:00 am	Registration
8:00 am	**Keynote Panel Discussion: "From Reels to Real Safety"**
9:00 am	Platform Presentations: Community Focus
10:00 am	Coffee Break
10:30 am	Saturday Lightning Round & Poster Session
11:30 am	**Pioneer Award Presentation and Keynote: Judy Schaechter**
12:30 pm	Lunch
1:30 pm	Platform Presentations: Safe Sleep/SUID/Mental Health
2:45 pm	Break
3:00 pm	Workshop Sessions ★3A, 3B, 3C, 3D
4:00 pm	Bonus Workshops: Program Funding, ★CPS Group Meetings: Safe Sleep, NIPD
5:00 pm	Group Meetings: ★CPS, ECIP, Firearm
6:30 pm	Reception/Cocktail Hour
7:30 pm	Banquet Dinner and Awards Presentation Drum Karaoke featuring the *Lapido Sound Machine!*

Sunday, December 7

8:15 am	Group Meeting: Social Media
8:30 am	Business Meeting
9:00 am	Platform Presentations: Special Populations/Education
10:00 am	Break
10:30 am	Sunday Lightning Round & Poster Session
12:00 pm	Adjournment

All sessions are generally eligible for CME and CHES credits.
★ Sessions eligible for CPS CEUs are marked with a star.

Support for this event has been provided by:

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Conference Exhibitors

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Special Thanks for Ongoing Support

Bloomberg Philanthropies

Please make sure to stop by the exhibition booths during the conference!

Conference Agenda

Friday, December 5, 2025

7:00 am

SALON E/F

Registration

8:00 am

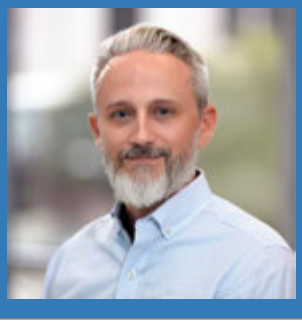
SALON A/B/C/D

Welcome & Logistics

8:15 am

KEYNOTE — SALON A/B/C/D

From Go Bags to Grand Plans: Protecting Children Through All Levels of Disaster Preparedness



Brent D. Kaziny, MD, MA
Associate Professor
Department of Pediatrics, Section of Emergency Medicine
Baylor College of Medicine
Attending Physician, Emergency Center
Medical Director of Emergency Management
Texas Children's Hospital
bxkaziny@texaschildrens.org

9:15 am

PLATFORM PRESENTATIONS — SALON A/B/C/D

Drowning Prevention/Child Passenger Safety

Moderators:
Nikita Patil, DO
Jamie Holland, MD

Ethnic and Racial Disparities in Pediatric Swimming Activities
Rohit P. Shenoi, MD
Haley Romine

Cost Savings Analysis of Universal Swimming Pool Fencing in Texas
James "Trey" Rhodes, MD

Making School Bus Transport Safer For Our Students
Barbara DiGirolamo, M.Ed., CPSTI

Federally Mandated Car Safety Features Decrease the Rate and Severity of Pediatric Backover Trauma
Jeannette M. Joly, MD

Making a Splash with Drowning Prevention Education in a Large Metropolitan Area
Melissa H. Kwan, MD, FAAP

Share the excitement!

Tag **@InjuryFreeKids** and use **#BeInjuryFree** and **#InjuryFree2025** in your social media posts.

@InjuryFreeKids
InjuryFreeCoalitionForKids
linkedin.com/company/injuryfreekids/

Friday, December 5, 2025

10:30 am

SALON E/F

Coffee Break

10:45 am

PLATFORM PRESENTATIONS — SALON A/B/C/D

Firearm Injury Prevention

Moderators:
Narmeen Khan, MD
Rohan Akhouri, MD, MPH

Improving Firearm Injury Prevention Anticipatory Guidance in the Pediatrician's Office – A Quality Improvement Initiative
Shreya Gautam, BA

Guardian Receptivity to Physician-Led Firearm-safety Education in a Pediatric Emergency Department (ED): Psychometric Evaluation of a New Measure
Lindsay D. Clukies, MD, FAAP

Who are the Firearm Owners in Youth Firearm Suicide?
Sofia Chaudhary, MD, FAAP

Lock It Up: A Safe Gun and Medication Storage Program for Safer Homes and Communities
Ashley Mahnke, MBA, CHES, CPST-I
Mackenzie Rose, CHES, CPST

12:00 pm

Lunch

1:00 pm

LIGHTNING ROUND PRESENTATIONS — SALON A/B/C/D

Friday Lightning Round: Firearm Safety and Ingestion Prevention

Moderators:
Maneesha Agarwal, MD, FAAP
Mary Beth Vassy, MPH, CPST-I

Trends in Pediatric Marijuana Ingestions Before and During the COVID-19 Pandemic: A Retrospective Analysis from a Tertiary Children's Hospital
Brittain Robinson, MD
Nick Watkins, MD

Health Equity and Unintentional Pediatric Cannabis Ingestion
Melissa Blumberg, MD, MPH

Caregiver Perceptions of Firearm Education
Steven C. Rogers, MD, MS

Beyond Locks and Lectures: What Rural Parents Really Think About Firearm Safety Messaging
Victor A. Soupene, PhD, MS

Pediatric Exposures Associated with Caffeine Energy Products Reported to United States Poison Centers, 2011-2023
Timothy Ross Thompson, BA

You Want to Know What?!—Farmer Parents' Attitudes Regarding Healthcare Providers Discussing Firearm Storage and the Asking Saves Kids Program
Pam Hoogerwerf, BA

Assessing Pediatric Resident Comfort and Preparedness in Firearm-Injury Prevention Education: A Foundation for Curriculum Development
Lindsay D Clukies MD FAAP

All sessions are generally eligible for CME and CHES credits.
Sessions eligible for CPS CEUs are marked with ★CPS .

2:00 pm

WORKSHOP SESSION 1A — GULFSTREAM A ★ CPS

Is It Legit: Counterfeit, Noncompliant and Unregulated Child Restraint Devices

Joseph M Colella, CPST-I

WORKSHOP SESSION 1B — GULFSTREAM B

Training Tomorrow's Prevention Leaders: Insights from the Black Boys Better Youth Ambassador Program

Chris James, CPS-MH, CAMS
Kristi James, DrPHc, MPH, CHES

WORKSHOP SESSION 1C — SALON A/B

How to Develop a Youth Suicide Prevention Center

Steven C. Rogers, MD, MS
Kristen Volz-Spessard, MS

WORKSHOP SESSION 1D — SALON C/D

Overcoming barriers to healthcare led firearm injury prevention strategies

Emma Cornell, MPH
Sofia Chaudhary, MD, FAAP
Olivia Frank, MPH
Ashley Blanchard, MD, MS
Lindsay D. Clukies, MD, FAAP

3:00 pm

WORKSHOP SESSION 2A — GULFSTREAM A ★ CPS

When Kids Outsmart Car Seats: Addressing challenging behaviors in motor vehicles

Shea Buckley, MEd, BCBA, CPST
Dex Tuttle, MEd, CPST-I

WORKSHOP SESSION 2B — GULFSTREAM B

Planting Rays of Unity, Beauty, and Pride: Examining the Intersectionality of Climate Change Advocacy, Youth Violence, and Adolescent Health

Felicia Scott-Wellington, MD
Sadhana Dharmapuri, MD

WORKSHOP SESSION 2C — SALON A/B

Empowering Pediatric Trainees as Advocates: Building a Longitudinal Injury Prevention and Media Communication Curriculum

Hailey D. Nelson, MD, FAAP, IBCLC
Enjuli Chhaniara, DO, PGY-3

WORKSHOP SESSION 2D — SALON C/D

From Prevention to Promotion: Advancing Your Academic Career Through Your Injury Prevention Efforts

Maneesha Agarwal, MD, FAAP
Lindsay D. Clukies, MD, FAAP
Michael N. Levas, MD, MS
Kathy W. Monroe, MD, MSQI

Friday, December 5, 2025

4:00 pm

SALON A/B
PI Meeting

SALON C/D
PC Meeting

6:00 pm

Reception

7:00 pm

Board of Directors Meeting

Saturday, December 6, 2025

7:00 am

SALON E/F
Registration

8:00 am

PANEL DISCUSSION — SALON A/B/C/D

From Reels to Real Safety: Pediatric Injury Prevention in the Digital Space

Maneesha Agarwal, MD, FAAP
Associate Professor of Pediatrics and Emergency Medicine
Emory University School of Medicine
Pediatric Emergency Medicine Physician
Children's Healthcare of Atlanta
Co-PI/Atlanta IFCK Chapter
maneesha.agarwal@emory.edu
Twitter: @tarhealer

Darria Long Gillespie, MD, MBA
Clinical Assistant Professor of Emergency Medicine
University of Tennessee
Founder, No-Panic Parenting
drdarria@nopanicparenting.com
IG @DrDarria
(www.instagram.com/drdarria)

Tracy Mehan, MA
Director of Research Translation and Communication
Co-host of the Communications Breakdown podcast
Center for Injury Research and Policy
Nationwide Children's Hospital
Tracy.Mehan@NationwideChildrens.org
Linktr.ee/tracymehan

Nkeiruka Orajiaka, MD, MPH
Attending Pediatrician, Assistant Professor
Division of Pediatric Emergency Medicine
Department of Pediatrics
University of Texas Southwestern Medical Center
Children's Medical Center of Dallas

9:00 am

PLATFORM PRESENTATIONS — SALON A/B/C/D

Community Focus

Moderators:
Sofia Chaudhary, MD, FAAP
Ashley Mahnke, MBA, CHES, CPST-I

Pop-Up Safety Town Evaluation
Jamie Holland, MD

Charlie's House Virtual Safety Experience: Exploring Interactive Strategies to Broaden Reach of Household Safety Education
Laura A. Kemerling, MSN, RN, C-NPT, CPST
Richard Gist, PhD
Shenoah Miller

Scaling Pediatric Injury Prevention Education in NYC: A Collaborative Hospital-Based Model Using Safe Sitter® Programs
Gia Ramsey, MBA, ADN, LPN, CPST-I
Julia Glauboch, BSN, RN, CPST

Improving Checkpoints, an online teen driver safety program, to increase reach and accessibility
Jill Solomon, MPH, CHES

Integrating Injury Prevention into Community Health Needs Assessments
Taylor Hautala, MPH

10:00 am

Coffee Break

10:30 am

LIGHTNING ROUND PRESENTATIONS — SALON A/B/C/D

Saturday Lightning Round: ATVs and Other Vehicles

Moderators:
Brent M. Troy, MD, MPH, FAAP
Lorrie Lynn, MA, CPSTI

Off-Road Vehicle-Related Eye Injuries in the U.S.
Charles Jennissen, MD

ATV Safety Initiative: Providing safety education in rural communities with effective outcomes
Kristyn Jeffries, MD, MPH

Lawnmower-Related Eye Injuries in the U.S.
Nicholas Stange, MD, MPH

On-line Marketing of Chinese Youth ATVs: Are Dealers Following Mandatory Federal Standards?
Jens Strand, High School Student

Rural Iowa Adolescents' Use, Knowledge and Attitudes Regarding UTVs on Public Roads
Parker Sternhagen, Undergraduate

Pediatric ATV related injuries in Arkansas by region
Nikita Patil, DO

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Saturday, December 6, 2025

11:30 am

KEYNOTE — SALON A/B/C/D

Pioneer Award Keynote: A Perspective from Someone in the Caravan

Judy Schaechter, MD, MBA
Professor Emerita of Pediatrics
University of Miami
jschaechter@miami.edu

12:30 pm

Lunch

1:30 pm

PLATFORM PRESENTATIONS — SALON A/B/C/D

Safe Sleep/SUID/Mental Health

Moderators:
Victor A. Soupene, PhD, MS
Laura A. Kemerling, MSN, RN, C-NPT, CPST

Layered risk: Sudden Unexpected Infant Death in the 2nd Largest US County
Gina S. Lowell, MD, MPH

The utility of a modified Kendi-Macy framework for SUID prevention
Kyran Quinlan, MD, MPH

Strange Bedfellows: A Non-Traditional Safe Sleep Program in Oregon
Kathleen McDonough, MPA
Adrienne Gallardo, MA, CPST-I

Addressing College Mental Health with the Fresh Check Day Program
Kristen Volz-Spessard, MS

Infant Safe Sleep Practices of Rural Iowa Adolescents
Ky Renshaw, Undergraduate

Starting with "Why:" Setting a course for the future of injury prevention
Lorrie Lynn, MA, CPSTI

2:45 pm

Break

3:00 pm

WORKSHOP SESSION 3A — GULFSTREAM A ★ CPS

Establishing and maintaining a successful Adaptive Needs Seating Clinic

Michelle Nichols, CPST-I
Larisa Nefedov, MA, CPST-I
Blanca Villaseñor, CPST-I

All sessions are generally eligible for CME and CHES credits.
Sessions eligible for CPS CEUs are marked with ★CPS .

WORKSHOP SESSION 3B — GULFSTREAM B

Way Beyond the ABC's: Tailoring Safe Sleep Training for Community Health Agencies

Gina S. Lowell, MD, MPH
Felicia A. Clark, D-ABMDI
Christie Lawrence, DNP, RNC-NIC, APN/CNS

WORKSHOP SESSION 3C — SALON A/B

Question, Persuade, and Refer Gatekeeper Training

Steven C. Rogers, MD, MS
Kristen Volz-Spessard, MS

WORKSHOP SESSION 3D — SALON C/D

AI in Action: Leveraging AI for Injury Prevention Campaigns

Tracy Mehan, MA

4:00 pm

CPS BONUS WORKSHOP — ★ CPS

Learning With The LATCH Manual: 2025 and Onward

Denise Donaldson, MBA, CPST-I

BONUS WORKSHOP

Making your Dollar Stretch in Injury Prevention Programming

Melissa H. Kwan, MD, FAAP
Sandra McKay, MD, FAAP
Sarah Beth Abbott, BS, EMT-LP
Marisol Nieves, LMSW, CPST

Social Media Short Videos

Safe Sleep Group Meeting

NIPD Group Meeting

5:00 pm

CHILD PASSENGER SAFETY GROUP MEETING — ★ CPS

Deciphering CPST Lingo: Challenges faced by non-English speakers

Dex Tuttle, MEd, CPST-I

Firearm Group Meeting

Early Career Physicians Group Meeting

6:30 pm

Reception/Cocktail Hour

7:30 pm

Banquet Dinner and Awards Presentation

Featuring Drum Karaoke with the famous ***Lapido Sound Machine***!

Sunday, December 7, 2025

8:15 am **Social Media Group Meeting**

8:30 am **Business Meeting**

9:00 am

PLATFORM PRESENTATIONS

Special Populations/Education

Moderators:
Dex Tuttle, MEd, CPST-I
Charles Jennissen, MD

Social Media Posts by Children's Hospitals and Injury Prevention Content - A Missed Opportunity for Education & Advocacy
Maneesha Agarwal, MD, FAAP

Assessing Feasibility of Providing Injury Prevention Counseling for Caregivers of Children with Autism in the Outpatient Setting
Caroline Chivily, MD, MPH

Association of Autism Spectrum Disorder and Common Co-Occurring Conditions with Suffocation
Ashley Blanchard, MD, MS

Developing a Longitudinal Advocacy and Injury Prevention Curriculum for Pediatric Residents
Hailey D. Nelson, MD, FAAP, IBCLC
Enjuli Chhaniara, DO, PGY-3

From Triage to Treatment: Enhancing Mental Health Screening Compliance in Pediatric Trauma Patients
Kendall Snellgrove, MD

10:00 am **Break**

10:30 am

LIGHTNING ROUND PRESENTATIONS

Sunday Lightning Round

Moderators:
Alicia Webb, MD
Adrienne Gallardo, MA, CPST-I

A novel data warehouse for injury-related research
Michael J. Mello, MD, MPH

An Analysis of a System Change: Implementing Trauma-Informed and Evidenced-Based Practices in Injury Prevention
Michael N. Levas, MD, MS

Locked and Loaded: Attitudes Regarding Firearm Storage Among Farming Parents in Iowa
Marc Doobay, MPAS, PA-C, DFAAPA

Partnerships Expanding Child Passenger Safety Efforts
Iris Garcia, MPH, CHES, CPSTI

Injury Prevention on the Road Home: A Hospital-Based Car Seat Loaner Program Evaluation
Amy Watkins, MPH, CPST

Updated injury trends in the Child Injury Database (CID)
Emma Sartin, PhD, MPH

When the Dog Bites: A 5-Year Retrospective on Canine Bite Encounters in Pediatrics
Sara Beth Rowell, BS

Correlation Between Various Systemic Factors and Pediatric Traumatic Brain Injury (TBI) Follow-up Rates after the implementation of the Visio-Vestibular Exam
Alise Haddad, BS

Wheels of Misfortune: A Tale of Two Rides
Laurel Barker, BS

Utilization of the Emergency Department for Mental Health by Pediatric Survivors of Firearm Injuries
Lauren Bozarth, BS

12:00 pm

Boxed Lunch

Adjournment

30 Injury Free Coalition for Kids®

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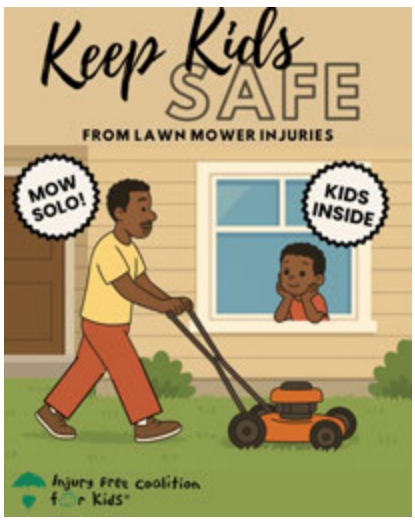

Thank you **Social Media Committee** for your great content and dedication to increase the visibility of Injury Free and injury prevention to professionals and parents across the country. Interested in supporting this important work through social media or in another way? Scan the QR code to sign up! **#BeInjuryFree**

Session and Presentation Abstracts

KEYNOTE

From Go Bags to Grand Plans: Protecting Children Through All Levels of Disaster Preparedness

Friday, December 5, 2025, 8:15 AM to 9:15 AM

Brent D. Kaziny, MD, MA
Associate Professor
Department of Pediatrics, Section of Emergency Medicine
Baylor College of Medicine
Attending Physician, Emergency Center
Medical Director of Emergency Management
Texas Children's Hospital
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In this presentation, Dr. Kaziny will draw on his firsthand experience preparing for and responding to various types of disasters from hurricanes and winter storms, to pandemics and surge events. This talk will explore the critical intersection of disaster preparedness and injury prevention with a focus on both the practical and the strategic. The talk will take the audience on a journey from individual and family preparedness – think "go bags," family reunification plans, and evacuation plans- to system-level initiatives related to maintaining healthcare delivery, communication, and response. Participants will walk away with a deeper understanding of the cascading impacts disasters have on child safety and well-being, along with concrete ideas for how we can prepare, prevent, and respond with purpose.

Objectives:
1. Describe the continuum of disaster preparedness strategies spanning from personal, community, and institutional levels.
2. Identify common gaps in barriers to pediatric disaster planning and response across healthcare systems and public health.
3. Apply key principles of disaster preparedness to injury prevention efforts.

PLATFORM PRESENTATIONS

Drowning Prevention/Child Passenger Safety

Friday, December 5, 2025, 9:15 AM to 10:30 AM

This session explores innovative strategies to reduce preventable childhood injuries through drowning prevention, pedestrian safety, and vehicle safety initiatives. Presentations examine disparities in swimming access, the economic benefits of universal pool fencing, the use of bus-mounted cameras to drive pedestrian safety legislation, and the positive impact of federal backup-camera mandates on reducing pediatric backover injuries. Collectively, these studies demonstrate how data, policy, and community engagement can work together to create safer environments for children.

Learning Objectives:
1. Identify social and environmental factors contributing to disparities in swimming access and safety.
2. Evaluate the cost-effectiveness of environmental interventions such as pool fencing.
3. Apply data-informed advocacy strategies to improve pedestrian safety near school zones.
4. Assess the influence of vehicle safety mandates on reducing backover-related injuries in children.
5. Develop community-based approaches to promote and expand drowning prevention initiatives.

Moderators:

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Ethnic and Racial Disparities in Pediatric Swimming Activities

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Authors: *Haley Romine; Aleena Joseph; Vinh Diep; Nouran Farag; Elizabeth A. Camp, PhD; Rohit P. Shenoi, MD*

Background: Drowning is a public health problem. Recreational water access and swim lesson participation among children are factors that can influence pediatric drowning rates. We aimed to determine factors associated with swimming lesson participation and swimming ability among children.

Methods: Parents of children aged 0-19 years who visited an urban children's hospital emergency department between 2022-2025 completed a survey after providing informed consent. Covariates included demographics, maternal education, parental swimming ability, child's participation in food assistance program, Head Start, or daycare, and swimming pool access. Outcomes included child swimming class participation and swimming ability (based on child's comfort with playing in water over their head). Descriptive statistics and group comparisons by chi-squared test and logistic regression were performed.

Results: There were 485 children selected. The median age was 6.5 years (IQR: 3,11). Subject demographics were males (54%), Hispanic (53%), non-Hispanic White (21%), Black (20%) and Asian/Other (7%). Among preschool children (?5 years old), participation in food assistance program was 35%, Head Start (19%) and daycare (31%). Forty-eight percent of school-aged children participated in a school food assistance program.

Overall, 64% of children had swimming pool access year-round or during summer. Seventy-three percent of parents could swim. Among children, 29% attended swimming classes and 38% were very comfortable playing in water over their head. Parents of Hispanic ethnicity and Black race had lower odds of swimming ability when compared to White parents. Children of Hispanic ethnicity and Black race were significantly less likely to have attended swimming classes or be comfortable when playing in water over their head compared to children of White race.

Among preschool children, significant factors associated with swimming lesson attendance were age [OR:1.8 (95%CI:1.2,2.5)], and year-round or summer pool access [OR:20 (95%CI:4,100)]. Significant factors associated with swimming lesson non-attendance were Hispanic ethnicity [OR:0.3 (95%CI:0.1,0.9)], and Black race [OR:0.1 (95%CI:0.01,0.4)]. Similarly, among preschool children, those with year-round or summer swimming pool access were >3 times more likely to be comfortable playing with water over their head compared to children without pool access after adjustment [OR:3.4 (95%CI: 1.3,8.9)].

Among school-aged children, significant factors associated with swimming lesson participation were maternal education [OR:4.7 (95%CI:2.4,9.5)], and recreation-center pool access [OR:3.0 (95%CI:1.4,6.5)]. Significant factors associated with swimming lesson non-participation were Hispanic ethnicity [OR:0.3 (95%CI:0.2,0.6)], Black race [OR:0.3 (95%CI:0.2,0.8)] or in a school food assistance program [OR:0.3 (95%CI:0.2,0.5)]. White race and parental ability to swim were factors significantly associated with a child being comfortable playing in water over the head compared to other groups.

Conclusions: Significant racial and ethnic disparities in parents' swimming ability and their child's swimming class participation and swimming ability exist. In preschool children, swimming class participation and swimming ability are significantly associated with older age, swimming pool access and non-minority race. Among school-aged children, swimming class participation and swimming ability are significantly associated with maternal education, parent's swimming ability, swimming pool access, non-minority status, and non-participation in food assistance program.

Objectives:
1. Explain factors associated with swim lesson attendance in children by age group
2. Discuss reasons for disparities in swimming ability in children by age group
3. Summarize methods to improve swim lesson attendance among high drowning risk subpopulations.

Cost Savings Analysis of Universal Swimming Pool Fencing in Texas

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Authors: *James "Trey" Rhodes, MD; Linh Nguyen, PhD; Rohit P. Shenoi, MD*

Background: Texas ranks among the highest in pediatric drowning fatalities in the United States. Functional pool fencing reduces drowning risk in children, yet its economic benefit in preventing pediatric drowning is unknown.

Methods: We estimated the cost savings from instituting a universal fencing program in Texas among children 1-9 years old. The mean annual number of drowning fatalities in children aged 1-9 in Texas was obtained through CDC Wonder. The number of nonfatal drownings were estimated based on a drowning case-fatality rate of 1:6. Drowning burden included fatal and nonfatal drownings. The total cost of drowning was estimated using the Texas Health Care Information Collection data (2016-2022), including medical costs and indirect costs incurred by a pediatric patient and caregiver due to drowning. The average cost for a medium-sized swimming pool fence

was obtained from pool companies. We assumed zero fence maintenance costs for a 10-year period since this is the average fence lifespan and time for an infant to grow into an older child not needing supervision.

Based on the literature, we estimated a fence to be 76% effective in preventing drowning. Using information on pediatric drownings in Harris County, Texas, we assumed current functional pool fencing coverage to be 38%. We also assumed each drowning case corresponds to one home, and risk reduction applies uniformly.

The number of prevented drownings was calculated by multiplying the annual number of drownings by the effectiveness rate of pool fencing and (1-coverage rate). Total cost savings were estimated by multiplying the number of prevented drownings due to pool fencing by the average cost per case. The net benefit of instituting pool fencing was estimated by subtracting the cost savings from the cost of universal pool fence installation. Cost savings per case prevented were calculated as the cost savings divided by prevented cases.

Results: From 2018-2023, there were 264 (44/year) fatal swimming pool drownings in Texas among children 1-9 years old. Using a pediatric drowning case-fatality rate of 1:6, the annual burden of fatal and nonfatal drowning in Texas children aged 1-9 is 264 cases.

Based on the 76% effectiveness of pool fencing in preventing drowning and 38% of homes with functional fences, the annual number of prevented drownings is 124 cases. The total costs incurred by a patient and caregiver per pediatric drowning patient in Texas are $337,435 (medical costs: $60,860; lifetime indirect costs: $276,575). The annual cost savings from 124 prevented cases by instituting universal pool fencing in Texas is $41,841,940. With the average cost for a medium-sized swimming pool fence of $3,343, the total cost of installing a functional fence for the remaining 62% of homes is $548,252.

The annual net benefit of instituting universal pool fencing is $41,293,688. The cost savings per case prevented is $333,014.

Conclusions: Drowning-associated lifetime costs are enormous in Texas. Instituting a statewide universal pool fencing program will result in significant long-term savings.

Objectives:
1. Discuss the characteristics of functional swimming pool fencing.
2. Identify barriers to instituting functional swimming pool fencing in Texas.
3. Compute the economic benefit of a universal swimming pool fencing program in Texas.

Making School Bus Transport Safer for Our Students

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Background: Pedestrian injuries, including by children going to school, are an important national safety issue. For children getting off a school bus, Massachusetts state law mandates cars must stop and can't pass a school bus when it is stopped with the stop sign out as it is dropping children off. In one Massachusetts city, multiple cars were observed violating this law. However, the current Massachusetts law requires police to physically see each driver who is passing the bus to issue a citation for this offense. As a result, incidents have occurred where siblings were hit by a car, a crossing guard and student on bike were hit while on the crosswalk during a red light, as well as multiple daily "near misses." The objective of this program description is to describe an advocacy program, which advanced passage of a law to improve the safety of children walking from school buses with the installation of cameras on buses to record motor vehicles violating the law mandating them to stop when a school bus is stopped for student drop-off.

Methods: This child pedestrian safety program was focused on gathering data on motor vehicle violations related to school buses and on advancing legislation to install cameras on school buses to decrease the risk of child pedestrian injury when leaving the school bus. A Safety Task Force in the city was convened, which was overseen by the Mayor and included parents, school staff, local police, injury prevention experts, and the health board. Activities of the Safety Task Force included: 1) speaking to students in local schools about pedestrian safety; 2) distributing an informational newsletter for parents; 3) attending local events and fairs to get signatures in support of the law change; and 4) obtaining broad media coverage from local news channels. The Safety Task Force also obtained a grant to install bus cameras to record motor vehicles passing stopped buses to obtain data and evidence about these violations.

Results: In September 2024, there were 10 cameras added to the city's 33 bus fleet. From September 2024- May 2025, over 3,000 cars were recorded passing stopped school buses dropping off children for school, for an estimated 10,000 violations. Since the law stated police have to witness these violations in person, these individuals couldn't be ticketed. However, this evidence was then used with legislators to advocate for changes in the state law. In January 2025 the Massachusetts Governor signed into law, legislation allowing any city or town to install cameras on school buses, and use these video recordings to mail citations directly to the vehicle owners driving past stopped school buses.

Conclusions: Passing a new child safety law in a state is challenging, and often, takes years of work. Partnering with allied organizations, including AAA, Safe Routes to School,

Injury Free, Safe Kids, and ThinkFirst are great ways to leverage your argument. Partnerships, evidence, and advocacy are essential for policy changes to improve child pedestrian safety.

Objectives:
1. Describe strategies for working with your government to pass better laws protecting our youth.
2. Analyze approached to obtain data and evidence to support your proposed law changes
3. Examine how to build partnerships with other community organizations, police and elected officials to gain support in your proposed initiatives

Federally Mandated Car Safety Features Decrease the Rate and Severity of Pediatric Backover Trauma

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Background: Pedestrian collision with a motorized vehicle-in-reverse is referred to as backover trauma. Resulting injuries carry significant morbidity and mortality, and they disproportionally occur in small children due to challenging visualization. For prevention, a federal mandate was passed on May 1, 2018 requiring all new vehicles to be equipped with a backup camera; however, older vehicles may still lack this safety feature. This study aims to characterize the impact of this mandate by evaluating the rate and severity of pediatric backover trauma before and after its enactment.

Methods: A retrospective pre-post observational study was conducted of patients less than 5 years of age with backover trauma between January 2011 and November 2024. Two sets of data were compared: electronic medical records of patients treated at a level one pediatric trauma center as identified by the institutional trauma registry, and data curated by Kids and Car Safety from publicly available injury records of the surrounding metropolitan counties to externally validate institutional trends. Trauma registry abstraction included demographics, injury severity score (ISS), hospital course, and disposition. Severe injury in pediatric trauma was defined as ISS >25. Backover trauma rates and severity were compared pre-mandate (01/2011-04/2018) versus post-mandate (05/2018-11/2024). Descriptive statistics, univariate analyses, and Poisson rate tests were utilized.

Results: From trauma center data, 71 patients were identified: 53 (75%) pre-mandate, 18 (25%) post-mandate. Patients were a median age of 2 years (IQR: 1.6-2.8), 61% male, and 68% with governmental insurance. Overall median ISS was 10 (IQR: 5-19): no difference between groups (p=0.83). There were 10 cases of severe trauma pre-mandate (19%) versus 2 cases post-mandate (11%) (p=0.72), with one pre-mandate, in-hospital death. The trauma rate pre-mandate was significantly higher at approximately 7.2 backovers/year compared to 2.7 backovers/year post-mandate: a rate ratio of 0.38 (95% CI: 0.21-0.66; p<0.01). In public injury records, 23 victims were identified: 17 (74%) pre-mandate, 6 (26%) post-mandate. Injuries were reported fatal on scene or shortly after emergency medical service transport in 13 pre-mandate cases (76%) and 4 post-mandate cases (67%) (p=0.63). The trauma rate pre-mandate was higher at approximately 2.3 backovers/year compared to 0.9 backovers/year post-mandate: a rate ratio of 0.39 (95% CI: 0.13-1.05; p=0.06).

Conclusions: A decrease in the rate of backover trauma was observed following the 2018 federal mandate requiring backup cameras in all new vehicles. Severe injuries decreased by half, and the absolute number of publicly reported fatal cases decreased by 69%. Reduction in rate and severity of backover trauma justify public health-driven regulatory requirements. Post-manufacturing installation of backup cameras should be prioritized and subsidized for all vehicles manufactured prior to the 2018 federal mandate.

Objectives:
1. Define backover trauma in pediatric patients
2. Describe the impact of federally mandated backup cameras on pediatric backover injuries
3. Summarize next steps for prevention, which include supporting a subsidized program to install backup cameras in cars without them

Making a Splash with Drowning Prevention Education in a Large Metropolitan Area

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Background: Drowning is the second leading cause of death for children ages 1-4 years old and the second leading cause of unintentional death for children ages 5-14 years old. To address this, we partnered with the local community hospital, medical school, and community organizations to develop an interactive drowning prevention program for caregivers and children in a suburb of a large metropolitan area.

Methods: Planning meetings started 12 months prior to this event. A grant from the state AAP chapter foundation provided the initial funding. We worked with our local community hospital, the YMCA, and two local drowning prevention foundations for initial planning and coordination. Other community partners were also invited to provide their expertise the day of the event.

Activity stations were designed so volunteers could set up with a prepackaged kit. A passport was developed to encourage families to stop at each booth.

Volunteers were recruited through the medical school and community hospital. Advertising was managed by the hospital's marketing department.

The day opened with the local drowning prevention foundation sharing their stories about how drowning has affected their lives and education. Families then went to activity stations staffed by our volunteers with a focus on safe rescue and personalized education.

Results: 100 individuals registered, 53 participants attended, and there were 41 volunteers. Pre- and post-surveys showed 90% of respondents reported having an open body of water within 10 minutes walking distance from their home. After the event, all respondents reported feeling confident that they could identify things in their home or nearby that might be dangerous for their child around water. Prior to the event, only 55% could report this. After this event 75% reported knowing where to find help to make their home safer and prevent drowning. Overall, 55% reported not having enough money to pay for changes at home to keep their children safe from drowning. Most respondents reported that their income was over $75k annually. A three-month post-event survey is pending.

Conclusions: Developing a successful community event is a collaborative effort. Verbal feedback revealed that caretakers think their children are getting drowning prevention education in swim lessons, but the adults were not. While this is a gap that we can fill with similar events, this is also an opportunity for swim instructors and schools.

90% of respondents lived within 10 minutes walking distance of a body of water that they did not have the ability to change or implement safety measures. This is a gap that can be filled through working with our communities who manage these bodies of water.

For future events, we plan to extend the invitation to more community partners. The activity stations were created with the intention to be reused with instructions so volunteers could set up with minimal interventions, so this initial investment can be used again.

Objectives:
1. Describe how to develop and fund a successful educational program within a larger community event.
2. Examine funding sources and partnerships to help make an event successful.
3. Identify how a program like this can be replicated in other arenas.

PLATFORM PRESENTATIONS

Firearm Injury Prevention

Friday, December 5, 2025, 10:45 AM to 12:00 PM

This session presents four complementary approaches to preventing pediatric firearm injuries. A quality-improvement project in Georgia pediatric offices increased anticipatory guidance and storage-device distribution at well-child visits. A validated survey measured guardian receptivity to firearm-safety education in an emergency department, finding generally positive attitudes influenced by prior education and demographics. A national review of youth firearm suicides revealed that most firearms used were owned by the victim or a parent and commonly stored unlocked and loaded. A hospital-based "Lock It Up" program demonstrated how integrating firearm and medication-safety initiatives into clinical workflows can broaden community outreach. Together, these studies show practical, evidence-based strategies spanning primary care, emergency medicine, and hospital systems.

Learning Objectives:
1. Identify effective methods to deliver firearm-safety guidance in clinical and community settings.
2. Interpret patterns of firearm ownership and storage in youth suicides to inform prevention efforts.
3. Assess guardian receptivity to physician-led firearm-safety discussions.
4. Apply lessons from multidisciplinary safe-storage initiatives to strengthen hospital and community programs.

Moderators:

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Improving Firearm Injury Prevention Anticipatory Guidance in the Pediatrician's Office – A Quality Improvement Initiative

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Authors: *Kiesha Fraser Doh, MD; Sofia Chaudhary, MD; Claudia Fruin, MD; Shreya Gautam, BA; Fozia Eskew, BS; Bolanle Akinsola, MD*

Background: 80% of unintentional pediatric firearm-related deaths in the US occur in the home often while playing with an unsecured firearm. A survey of Georgia pediatricians indicates that anticipatory guidance (AG) around prevention of firearm injury and deaths within pediatric well child care visits (WCC) is very limited. Although physician counseling can lead to safer firearm storage behaviors, only 40% of previously surveyed Georgia pediatricians feel equipped to provide this guidance. Thus, our primary objective aimed to increase the delivery and documentation of firearm safety anticipatory guidance, along with distribution of firearm storage devices, to 75% from baseline within a 6-month period for families who present for their 3-year-old WCC.

Methods: Setting: 6 primary care pediatric practices (PCPP) across rural and urban Georgia participated in this QI project between July 2023 and February 2024.

Interventions included (1) participation in monthly webinars including sessions on general guidance on how to provide firearm secure storage education, types of firearms and secure storage devices; educational sessions on QI methodologies; sessions to address concerns, and a final session to review outcomes and plan future efforts. (2) Appointing practice champions, one physician and one office staff manager to drive improvement. (3) Tracking distribution of gun locks and safes with chart audits for the first 10 days of each month for 6 months. (4) Group practice review and feedback.

QI tools used included a firearm injury prevention algorithm, risk assessments, key driver diagrams, PDSA worksheets, and run charts. Key measures aimed to 1) increase firearm safe storage counseling at 3-year WCC, 2) provide secure storage devices to families with firearms, and 3) complete follow-up calls to confirm use of these devices. We used run charts to track our data.

Results: Three practices increased their AG documentation on 3 y/o WCC from 0% to 33%-50%. Two practices were able to maintain a minimum of 10% improvement throughout the study period. All practices had challenges with distribution of secure storage devices and with follow-up phone calls on utilization of devices distributed. Both firearm secure storage device distribution and follow-up phone call were less than predicted with only 4 families receiving a device and 3 families receiving a follow up phone call at one practice. One practice screened 21% of 3-year-old WCC which was a 19% increase from their baseline

Conclusions: This QI initiative showed that AG on firearm safety can be increased through targeted education, practice support, and use of QI tools. Although the 75% goal was not met, important progress was made in initiating firearm safety discussions that were previously absent. Barriers such as differences in resources, staffing, and administrative support likely contributed to limited overall change. Future efforts should include ongoing training, especially in culturally sensitive counseling, structural racism, and firearm-related equity issues to enhance pediatricians' comfort and effectiveness in discussing firearm safety.

Objectives:
1. Identify the prevalence and contributing factors of unintentional firearm injuries occurring in the home environment.
2. Explore strategies to establish a structured framework for implementing a firearm safety counseling and storage program within their own community or clinical setting.
3. Evaluate the challenges and benefits of integrating firearm safety screening and secure storage device distribution into pediatric practice policies

Guardian Receptivity to Physician-Led Firearm-safety Education in a Pediatric Emergency Department (ED): Psychometric Evaluation of a New Measure

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Background: Firearm injuries are the leading cause of death among U.S. children and adolescents, yet little is known about guardians' receipt of physician-led firearm-safety education. We aimed to assess guardians' exposure to and attitudes toward firearm-safety education and evaluate the underlying structure of a brief attitudinal questionnaire to guide development of a physician-led educational initiative.

Methods: An anonymous electronic survey was administered to guardians of patients being treated in the ED of a Level 1 pediatric trauma center. The survey assessed firearm ownership, prior education about and attitudes toward receiving physician-led firearm-safety education. Ten items measured respondents' attitudes regarding the importance of and receptivity to such education using a 5-point Likert scale from Strongly Disagree (1) to Strongly Agree (5). Principal component analysis (PCA) was conducted for data reduction and to examine the underlying structure of these items.

Cronbach's alpha measured the internal-consistency reliability of items loading on resulting components. Analyses of variance (ANOVA) tested between-groups differences in receptivity to physician-led firearm-safety education. Chi-square tests examined associations among guardian characteristics and exposure to firearm-safety education.

Results: Of 591/765 (77%) guardians who completed the 10 items assessing receptivity to physician-led firearm-safety education, PCA yielded a single-component solution. All items loaded highly on the component (range: .74-.93), and internal-consistency reliability was high (Cronbach's ? =.96). Mean (SD) receptivity scores were higher among guardians with (vs. without) a 4-yr college degree (3.5 [1.0] vs. 3.2 [1.0]; p <.001) and who never (vs. ever) received firearm-safety education (3.5 [1.0] vs. 3.1 [1.0]; p < .001), but scores did not differ significantly by firearm ownership (p =.18). A lower percentage of guardians with a 4-yr college degree knew someone injured or killed by a firearm (33.2% vs. 53.5%; p <.001); but a higher percentage reported firearm ownership (45.4% vs. 35.6%; p <.02) and no prior firearm-safety education (57.2% vs. 47.6%; p =.02).

Conclusions: Guardians receptivity to physician-led firearm-safety education differed by educational attainment and exposure to firearm-safety education, but not by firearm ownership. The receptivity measure demonstrated strong internal-consistency reliability, supporting its use in future interventions. These findings can inform development of tailored educational initiatives aimed at reducing pediatric firearm injuries.

Objectives:
1. Describe guardian attitudes toward physician-led firearm-safety education in a pediatric emergency department setting, including how these attitudes vary by education level and prior exposure to firearm-safety education.
2. Interpret the psychometric properties of a newly developed receptivity scale, including its internal-consistency reliability and results of principal component analysis.
3. Apply findings to inform the design of targeted physician-led firearm-safety education initiatives aimed at reducing pediatric firearm injuries.

Who are the Firearm Owners in Youth Firearm Suicide?

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Background: Firearms are the most common and lethal means of suicide for youth ages 10-24 years. To inform youth suicide prevention efforts, it is crucial to understand ownership and storage patterns of these firearms. To address this knowledge gap, we describe ownership and storage patterns of firearms used in youth suicide and examine the sociodemographic and clinical characteristics of decedents associated with firearm ownership by the decedent or the parent.

Methods: We conducted a retrospective cohort study of firearm suicides by youth aged 10-24 years from 2018-2021 using the CDC National Violent Death Reporting System. We included data from states that report firearm ownership for ?70% of cases (AZ, CT, DE, KS, ME, MT, NH, ND, HI). We described firearm ownership by age group (10-17, 18-24 years) and among decedents with known mental health (MH) problems. We used multivariable logistic regression to estimate the association of age group and firearm ownership by (1) the decedent and (2) the parent, adjusted for sex, race, ethnicity, rural/urban location, and clinical characteristics. Among cases with non-missing firearm storage data, we described whether firearm was locked and/or loaded by age group.

Results: Of 1,021 youth firearm suicide decedents, most were White (82%), non-Hispanic (80%), ages 20-24 years (63%), and male (89%). Firearm ownership was missing for 23% of decedents. Of the remaining cases (n=788/1021 (77%)), firearms were most often owned by the decedent (56%) or a parent (27%). Among 10-17-year-old decedents (n=166/788 (21%)), 5% owned the firearm and 72% used a firearm owned by a parent. Among 18-24-year-olds (n=622/788 (79%)), 69% owned the firearm and 14% used a firearm owned by a parent. Of decedents with known MH problems (n=307/788 (39%)), 60% owned the firearm and 25% used a firearm owned by a parent. There were lower adjusted odds of firearm ownership by the decedent for 10-17-year-olds compared to 18-24-year-olds (aOR 0.03, 95% CI 0.02, 0.07). There were higher adjusted odds of firearm ownership by the parent for 10-17-year-olds compared to 18-24-year-olds (aOR 10.99, 95% CI 7.50, 16.10). Among decedents 10-17 years of age with known locked (n=135) and loaded (n=105) status, 60% were stored unlocked and 70% were stored loaded. Among decedents 18-24 years of age with known locked (n=327) and loaded (n=350) status, 69% were stored unlocked and 81% were stored loaded.

Conclusions: Approximately three-quarters of 10-17-year-old suicide decedents used a parent's firearm, while two-thirds of 18–24-year-olds used their own. Although storage data are limited, among decedents with known firearm storage practices, most firearms were stored unlocked and loaded, regardless of age group. Suicide prevention strategies should focus on reducing access to firearms owned by youth, in addition to caregivers.

Objectives:
1. Learn ownership patterns of firearms used in youth suicide in the United States.
2. Understand firearm storage patterns for firearms used in youth suicide by age group.
3. Recognize the need for suicide prevention interventions that are directed towards youth in addition to their parents.

Lock It Up: A Safe Gun and Medication Storage Program for Safer Homes and Communities

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Background: Rising unintentional firearm injuries, ingestions, and suicides in our community have prompted a long-standing hospital-based home safety program to evolve and address these concerns. Enhancing our focus on general home safety, the program now includes safe gun and medication storage solutions to prevent injuries. Each year, the hospital's emergency department and mental health services care for a high rate of children and teens presenting with unintentional firearm injuries and suicide ideation. The purpose of this program is to enhance education and provide safe storage devices to these patient's families, reducing access to lethal means. Proper storage of firearms and medications is a critical strategy in preventing unintentional injury, suicides, and death.

Methods: Beginning in 2022, the program initiated the distribution of gun locks (trigger and cable locks) and medication lock bags through collaborations with social work and mental behavioral health teams. In 2024, a multidisciplinary workgroup was formed to integrate these efforts for a cohesive approach to firearm and medication safety. Program optimization involved: 1) identifying families of at-risk patients in the emergency department and trauma center for participation; 2) integrating documentation into the electronic health record with updated flowsheets and a bilingual liability agreement; 3) developing a data report to track product distribution; 4) creating and implementing a digital gun safety teaching sheet; 5) expanding the range of available safe storage products (lockboxes with key and biometric lockboxes) sourced from approved vendors and managed through a centralized warehouse; and 6) launching a two-part staff training program, including evidence-based Counseling on Access to Lethal Means (CALM) training. In 2025, the team plans to create a standardized screening practice integrated into the hospital's social determinants of health assessment to further identify eligible families. Data analysis for this program evaluation included descriptive statistics on product distribution.

Results: In 2024, 70 safety products were distributed to families across 10 counties, including 45 lock boxes, 2 cable locks, 2 trigger locks, and 21 medication lock bags. Ingestions and suicide were the leading complaint with 64% being female. So far in 2025, 46 safety products have been given to 32 children, and 43 staff participated in the CALM training. Program educators noted positive feedback from families receiving education and safety products.

Conclusions: Initial data indicates a significant need for continued expansion of this safe gun and medication storage program across the health system. The program's development highlights the value of clinical integration and multidisciplinary collaboration. This has been well-received by staff, leadership, and families. Future efforts will focus on quality improvement and further program expansion.

Objectives:
1. Participants will understand the key components of a successful safe storage program and be able to implement a similar program.
2. Participants will learn how to integrate a safety program into the electronic health record to facilitate system-wide implementation.
3. Participants will learn about clinical integration in establishing a safe storage program.

LIGHTNING ROUND PRESENTATIONS

Friday Lightning Round: Firearm Safety and Ingestion Prevention

Friday, December 5, 2025, 1:00 PM to 2:00 PM

This lightning session brings together brief presentations on two fast-changing pediatric injury threats: unintentional ingestions of cannabis and caffeine-energy products, and firearm-related harm. The ingestion studies describe sharp increases in young children's exposures to marijuana edibles and caffeine products, highlight shifting product formulations and age patterns, and show heavy use of hospital and social-service resources, with attention to equity and CPS/SW involvement. The firearm studies examine how caregivers and rural/farming parents perceive firearm-safety counseling and the ASK campaign, which messengers they trust, and how programs and messages should be tailored for rural contexts. They also assess pediatric residents' low comfort but strong interest in training around firearm-injury prevention. Together, the work underscores the need for targeted counseling, culturally attuned messaging, and better clinician preparation to address these evolving risks.

Learning Objectives:
1. Describe current trends in pediatric cannabis and caffeine-energy product exposures.
2. Recognize how unintentional pediatric cannabis ingestions intersect with health equity, social work and CPS involvement.
3. Summarize caregivers', rural parents', and farm families' attitudes toward firearm-safety counseling, the ASK campaign, and preferred messengers and settings.
4. Identify gaps in pediatric residents' training and comfort with firearm-injury prevention counseling and how these findings can guide curriculum development.
5. Gain insights into ingestion- and firearm-injury prevention strategies for ED, primary care, and community environments.

Moderators:

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Trends in Pediatric Marijuana Ingestions Before and During the COVID-19 Pandemic: A Retrospective Analysis from a Tertiary Children's Hospital

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Background: The legalization and commercialization of cannabis products, particularly in edible forms such as gummies and cookies, have contributed to a rise in pediatric marijuana ingestions. These products are often indistinguishable from non-THC-containing snacks, making them especially hazardous for young children. The COVID-19 pandemic introduced additional risk factors including increased time spent at home, limited supervision, and elevated caregiver stress. This study aimed to examine changes in ingestion trends before and during the pandemic, and to assess demographic characteristics and clinical outcomes among affected pediatric populations.

Methods: We conducted a retrospective observational study of pediatric emergency department (ED) visits for marijuana ingestion between January 1, 2016, and December 31, 2023, at a tertiary children's hospital in the United States. Cases were included if marijuana ingestion was documented in ICD-10 codes, toxicology reports, or discharge diagnoses. The cohort was divided into pre-COVID and COVID-era groups using March 11, 2020, as the point of data inflection. Trends over time were assessed using linear regression; group comparisons used chi-square testing and one-way ANOVA.

Results: A total of 2,304 cases were identified, with 1,423 (61.7%) occurring during the COVID era. The proportion of ED visits attributed to marijuana ingestion rose from 0.20% in 2016 to 0.70% in 2023 ($p = 0.0019$). The 0–5-year age group experienced the sharpest increase, from 3.6% of cases pre-pandemic to 10% during the pandemic—representing a 1466% rise with a P value of <0.001. Floor admissions ($p = 0.0037$) and discharges ($p = 0.0016$) significantly increased, while ICU

admissions remained stable. Disparities were evident: African American children and those covered by Medicaid were disproportionately represented among the cases.

Conclusions: Pediatric marijuana ingestions have increased substantially in recent years, particularly among young children during the COVID-19 era. While most exposures resulted in floor admission or discharge, the rising frequency highlights a growing burden on emergency and inpatient services. Public health interventions—including caregiver education, safer product packaging, and clear labeling—are essential. Addressing racial and financial disparities is also critical to ensure equitable prevention efforts.

Objectives:
1. Analyze trends in pediatric marijuana ingestion before and during the COVID-19 pandemic.
2. Identify demographic disparities associated with these ingestions.
3. Discuss implications for public health interventions aimed at reducing pediatric marijuana exposures.

Health Equity and Unintentional Pediatric Cannabis Ingestion

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Background: With cannabis legalization, concentrated and edible forms have become widely available, leading to increased unintentional ingestions in children. These toxic ingestions raise concerns for neglect and often prompt social service involvement, yet data on health equity in managing such cases is limited. This study examined sociodemographic factors and the incidence of social work (SW) consultation, child protective services (CPS) reporting, and safe disposition planning (SDP) among young children with unintentional cannabis ingestions.

Methods: A retrospective cohort study at two level 1 trauma centers analyzed pediatric emergency department (PED) records of children aged 0-6 who tested positive for THC from June 2016 to September 2024

Results: Among 266 cases, most children were under age 2 (58.3%), male (52.3%), white (47.0%), English-speaking (98.9%), non-Hispanic (91.7%), and publicly insured (71.4%). Ingestions increased over time, with 51.8% occurring in the last two years (2023-2024). Edibles (51.1%) from a primary guardian (40.2%) were the most common source. Most cases (83.5%) were triaged as high-risk, with 41.7% evaluated in a trauma bay. Hospital admission was common (82.0%), with 25.2% of admitted children requiring critical care. SW (95.5%) and CPS (80.1%) were involved in most cases. No significant relationship was found between deprivation index and SW (p=0.520), CPS (p=0.405), or discharge disposition (p=0.144–0.256).

Conclusions: The rising incidence of pediatric cannabis ingestion highlights significant toxicity risks to young children and an increasing burden on pediatric healthcare systems, with high utilization of social service evaluation regardless of socioeconomic status.

Objectives:
1. Cannabis ingestions in young children are rising post legalization.
2. Cannabis ingestions in young children are highly toxic and require high resource utilization.
3. Cannabis ingestions in young children commonly prompt social work consultation and child protective service reporting, regardless of socioeconomic status.

Caregiver Perceptions of Firearm Education

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Background: Firearm related injuries are the leading cause of death in children older than one year of age. Safety counseling and prevention are cornerstones of injury prevention. Little is known about caregivers' perceptions regarding safety counseling in the ED (emergency department) setting. This survey study sought to assess caregivers' recollection of firearm safety counseling and who provided that counseling in the past two years. It further sought to determine whom they entrusted to provide this information, and their preferred modalities for future counseling. Secondary objectives included assessing the relationship between parental perspectives on who provided this counseling and how this counseling was provided based on presence of a firearm in the home.

Methods: A prospective cross-sectional survey was implemented at a single institution's emergency department. Parents of children birth-18 years of age were recruited between November 2020 through May 2022, in a private ED treatment room and the survey was administered using a handheld tablet. Excluded were parents of critically ill/injured children (ESI level 1) or those presenting with a primary psychiatric complaint such as suicidal ideation.

Results: A total of 820 of 1,181 of eligible caregivers were recruited (response rate of eligible caregivers: 69.4%). 24.1% of respondents recall receiving counseling on firearm safety within the last two years. 56.1% responded affirmatively that pediatricians ought to counsel parents/guardians on firearm safety. 17.4% reported having a firearm in their home, and these respondents were more likely to have received recent

safety counseling. Police departments and pediatricians were the most trusted sources for information; with 58.3% and 55.5% of caregivers identifying them as a highly reputable source of such counseling respectively.

Conclusions: Just over half of caregivers in our convenience sample are following AAP firearm recommendations regarding safe storage of guns and ammunition. Caretakers who own a firearm are more likely to recall counseling on safety measures, equally as likely to believe their pediatrician should offer such counseling, and less likely to entrust their pediatrician to provide them with high-quality information when compared to caretakers who do not own a firearm. Pediatricians and police were viewed as trusted sources of information on firearm safety. In-person counseling was preferred while social media and online resources were not.

Objectives:
1. Review compliance of AAP firearm recommendations among firearm owners.
2. List trusted sources of firearm safety information among caregivers.
3. Compare and contrast differences between caregivers who possess a firearm and those who do not with regards to firearm safety counseling preferences.

Beyond Locks and Lectures: What Rural Parents Really Think About Firearm Safety Messaging

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Background: Firearm-related suicide and unintentional firearm injury rates are higher in the rural US compared to the urban US. While firearm safe storage programs and safety messaging have the potential to reduce such injuries, little is known about how to effectively engage rural populations with these interventions. The objective of this study was to identify factors related to firearm safety programming and messaging among parents in rural US households.

Methods: Rural parents participated in focus group sessions conducted in-person or online during 2024. Participants were recruited through emails to Iowa FFA club advisors who informed member parents, a mass email distributed to University of Iowa faculty/staff, and invitations distributed to 2024 Farm Progress Show attendees. Inclusion criteria were: (1) (1) residence in Iowa with active farming or ranching operations, (2) at least one child aged 10-19 years living in the home, and (3) at least one firearm in the household. The focus group moderator guide was used to identify primary themes, while sub-themes emerged organically during group discussions. Transcripts were analyzed using Dedoose qualitative analysis software. Three research team members independently coded the data; discrepancies were resolved through consensus in iterative review meetings.

Results: A total of 32 participants took part in the focus groups, with most participants being female, holding at least a college degree, and identifying as non-Hispanic White. Trusted messengers for firearm safety messaging included law enforcement officers, Department of Natural Resources personnel, community members, and individuals directly impacted by firearm-related violence. Conversely, teachers, healthcare professionals, and celebrities were generally not perceived as effective messengers. Participants strongly advocated for age-specific messaging, recommending the use of realistic examples and impactful visualizations while avoiding redundant messaging. They proposed integrating new firearm safety messaging within existing community initiatives, such as school curricula, 4-H and FFA programs, and local firearm safety courses. Opinions on distributing firearm safety devices like locks and safes were mixed: some participants considered these practical tools for injury prevention, whereas others anticipated underutilization and thus perceived such efforts as potentially wasteful.

Conclusions: Effective firearm safety programming and messaging should account for the distinct preferences and values of rural populations. Tailoring interventions to reflect these nuances can enhance their relevance and impact. Strategies led by law enforcement—such as the distribution of firearm safety locks—may be particularly effective in these settings. Future research and program development should incorporate these findings to design firearm safety initiatives that resonate with rural communities and potentially reduce firearm-related injuries.

Objectives:
1. Describe the burden of firearm-related injuries in rural US populations.
2. Identify factors contributing to effective programming and messaging among rural US populations.
3. Discuss how these findings may inform future firearm safety interventions in the rural US.

Pediatric Exposures Associated with Caffeine Energy Products Reported to United States Poison Centers, 2011-2023

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Background: Children under six years represent the highest percentage of caffeine-related exposures reported to US poison centers (PCs), and youth under 20 years account for

more than two-thirds of exposures. Previous studies on this topic are limited to data before 2015 and do not exclusively focus on the pediatric population, despite a growing popularity of these products among youth. This study investigated the characteristics and trends of pediatric exposures to caffeine energy products reported to US PCs.

Methods: This is an observational study of single-substance exposures involving caffeine energy products among individuals <20 years old reported to US PCs from January 1, 2011, to December 31, 2023. Cases were identified using the National Poison Data System generic codes for caffeine and caffeine-containing energy drinks. Exposures involving coffee, tea, and caffeinated conventional soft drinks were not included because these are not considered energy products. Analyses included descriptive statistics, population-based rates, and odds ratios (ORs) with 95% confidence intervals (CIs).

Results: There were 32,482 caffeine energy product exposures reported to US PCs, representing a 17.3% increase in the exposure rate during 2011-2023. Most exposures were among <6-year-olds (69.6%), males (56.7%), and involved liquid formulations (57.5%). Most (80.7%) were not treated in a healthcare facility; however, 1.6% were medically admitted. Teenagers 13-19 years old were more likely to be admitted (OR=12.74, 95% CI: 10.40-15.60) or have a serious medical outcome (OR=18.83, 95% CI: 16.88-21.01) than children <13 years old. Solid energy product formulations were more likely to be associated with a serious medical outcome (OR=1.98, 95% CI: 1.81-2.17) or medical admission (OR=5.23, 95% CI: 4.31-6.36) than other types of formulations. During the study period, exposure rates increased for liquid (34.5%) and powder/granules (632.9%) product formulations but decreased for solids (-51.5%). Among liquid formulation subcategories, the exposure rate for beverages increased by 46.5% and that for shots decreased by 86.1%.

Conclusions: Although most pediatric exposures to caffeine energy products reported to US PCs were associated with no or minimal clinical effects, serious medical outcomes and medical admissions occurred. The product formulations that drove the 17% increase in the exposure rate changed during the study period. Opportunities exist to reduce the adverse effects of caffeine energy products among the pediatric population.

Objectives:
1. Understand the major trends in single-substance exposures involving caffeine energy products in the <20 years old population.
2. Compare product types associated with exposures in the <6 years old, 6-12 years old, and 13-19 years old populations.
3. Differentiate product types associated with more serious medical outcomes and medical admissions.

You Want to Know What?!—Farmer Parents' Attitudes Regarding Healthcare Providers Discussing Firearm Storage and the Asking Saves Kids Program

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Background: Firearm-related deaths and injuries can often be prevented with safe firearm storage. The American Academy of Pediatrics (AAP) recommends clinicians discuss firearm storage with families as part of their injury prevention routine. The AAP also advocates through their Asking Saves Kids (ASK) campaign for parents/caregivers to ask about firearms and their storage in the homes where their children visit. Our study objective was to evaluate the attitudes held by Iowa parents on farms regarding healthcare providers asking about and discussing firearm storage and also about the ASK campaign.

Methods: Focus group sessions (in-person and on-line) were performed in 2024. Participants were recruited through emails to Iowa FFA club advisors who informed member parents, a mass email distributed to University of Iowa faculty/staff, and personal distribution of invites to 2024 Farm Progress Show attendees. Requirements included: (1) Must live on and actively farm/ranch in Iowa, (2) Must have at least one child between 10-19 years old, and (3) Must have at least one firearm in the home. Major themes were identified from the focus group moderator guide. Sub-themes were based on the conversations of subjects. Dedoose, a software package that facilitates qualitative analysis, was utilized to analyze transcript content. Additional coding was conducted by three research members, and coding discrepancies were discussed with a consensus achieved via an iterative process.

Results: Thirty-two parents participated. Some deemed it appropriate for clinicians to discuss firearm storage to help ensure children's safety and to identify families needing safety information. However, others felt it only appropriate to ask about firearms if there were mental health concerns. A few stated providers were a trusted source and that it would be easier to have firearm safety conversations with them than others, and recognized firearms were another safety issue to be addressed. The majority had negative opinions regarding clinicians discussing firearms. Many would be surprised, offended, defensive, and even stop going to the provider if asked. Specific reasons included that it was an invasion of privacy and none of their business, it was not healthcare provider's job/responsibility, being asked was threatening and made them feel targeted, and it would not be helpful for providers to ask. Regarding the ASK campaign, many stated they would be annoyed, that asking them was offensive like they didn't trust them or were judging them as bad parents, and asking would not change their storage behaviors.

Conclusions: Most study participants were not comfortable with clinicians asking about firearm storage, and in many cases, felt it had nothing to do with their family's health. Similarly, they had negative attitudes regarding being asked about their firearm storage by other children's parents. Healthcare providers may encounter unique barriers when addressing safe firearm and ammunition storage with rural families.

Objectives:
1. State at least three positive things that some farm parents relayed to focus group moderators regarding healthcare providers discussing firearm storage with them.
2. Identify at least three negative things that some farm parents discussed said to focus group moderators regarding healthcare providers discussing firearm storage with them.
3. Discuss at least three opinions shared by some farm parents to focus group moderators about parents of their children's friends asking them about their firearm storage.

Assessing Pediatric Resident Comfort and Preparedness in Firearm-Injury Prevention Education: A Foundation for Curriculum Development

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Background: Firearm injuries are the leading cause of death among children and adolescents in the U.S. Despite this public health crisis, firearm-injury prevention education remains infrequent in pediatric care. Pediatric residents are uniquely positioned to provide such education to families but may lack the training, confidence, or comfort to do so. This study aimed to assess pediatric resident comfort discussing firearm safety and evaluate the underlying structure of a brief attitudinal questionnaire to guide development of a physician-led curriculum.

Methods: An anonymous electronic survey was administered to 112 pediatric residents at an urban, Level 1 trauma center in January 2024. The survey included six items about residents' comfort discussing firearm access, secure storage, local resources, and firearm laws with families as well as interest in further training on these topics. Responses were scored on a 5-point scale from "Not at all" (1) to "Very much" (5); higher scores indicate greater comfort and greater interest. Principal component analysis (PCA) was conducted for data reduction and to examine the underlying structure of these items. Cronbach's ? measured the internal-consistency reliability of items loading on resulting components.

Results: Sixty-three (56% of 112) residents completed the survey, 58 (92.1%) of whom reported having cared for a patient with a firearm injury; yet only 31 (49.2%) reported being trained to discuss secure firearm storage. PCA yielded a 2-component solution, with five items each loading >.600 on the first component; the item about interest in further training loaded on its own component and was analyzed separately. The 5-item component measuring residents' comfort discussing firearm-safety/injury-prevention had high internal-consistency reliability (Cronbach's ? = 0.845), with a mean (SD) score of 2.4 (0.8) indicating low levels of comfort. Notably, residents' mean interest in firearm-safety/injury-prevention training was 4.1 (0.9). Barriers to discussing firearm safety with families included having little comfort with the topic (25 [35.7%]) and knowledge about available resources (24 [38.1%]).

Conclusions: Despite extensive clinical exposure to firearm-related injuries, pediatric residents reported low levels of comfort discussing firearm-injury prevention with families. The strong internal-consistency reliability of the 5-item scale measuring comfort discussing firearm-safety with families and the barriers to having such family discussions provide preliminary evidence of the validity of this measure. Findings underscore the need for a structured curriculum to build residents' competence and confidence in initiating firearm-safety discussions with families.

Objectives:
1. Describe the current comfort levels and training gaps among pediatric residents in discussing firearm-injury prevention with families.
2. Interpret the findings of a principal component analysis (PCA) used to evaluate a 6-item attitudinal survey measuring residents' comfort and training interest in firearm safety counseling.
3. Identify key barriers to firearm safety counseling in pediatric care and explain how these findings can inform the development of a structured, physician-led curriculum.

WORKSHOP SESSION 1A

Is It Legit: Counterfeit, Noncompliant and Unregulated Child Restraint Devices

Friday, December 5, 2025, 2:00 PM to 3:00 PM

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An increasing frequency of child restraint devices purchased through e-commerce do not comply with current Federal Motor Vehicle Safety Standards (FMVSS), so they cannot be legally used to meet state legislative requirements and may be unsafe. Other devices are counterfeit, meaning they use stolen intellectual property, may be misrepresented as the original item, and may also be unsafe. Still others may be completely unregulated, so they do not fulfill minimum safety performance standards to assure safety. Attendees will have an increased ability to identify compliant, noncompliant, counterfeit and unregulated devices in the field, the ability to differentiate between categories of questionable products, and familiarity with appropriate reporting processes and field education.

Objectives:
1. Ability to differentiate between compliant, noncompliant, counterfeit and unregulated devices
2. Potential to identify questionable devices in the field
3. Familiarity with reporting processes and field education

WORKSHOP SESSION 1B

Training Tomorrow's Prevention Leaders: Insights from the Black Boys Better Youth Ambassador Program

Friday, December 5, 2025, 2:00 PM to 3:00 PM

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The workshop will highlight the Black Boys Better Youth Ambassador Program, an innovative, culturally responsive initiative designed to engage and empower Black boys through mentorship, mental health awareness, and leadership development. Centered in Georgia, this program equips middle and high school students with knowledge and tools to navigate life challenges, including opioid misuse and suicide prevention, while promoting community resilience and identity pride. The Black Boys Better Youth Ambassador program has leveraged the knowledge and access of Black boys to receive mental health education and support their peers. Through this approach, the program's goal is for youth to be trained on opioid and substance use prevention strategies, to then teach and inspire their peers and the communities that they're a part of. Long-term goals include educating the Ambassadors on career opportunities that are within their reach, such as social workers, licensed professional counselors, therapists, and peer specialists. Career education and workshops are led by Black licensed psychologists and mental health practitioners who work with Black and Brown communities, uniquely positioning the Ambassadors to learn from those with lived experience. Through the ambassador program, peer-led activities are created to encourage Black students to enter and stay in the mental health field, addressing workforce disparities.

Participants will explore the program’s framework, including strategies used to successfully recruit youth participants and community partners. Presenters will share tangible program successes such as school-based partnerships, development of a youth-led curriculum, and the implementation of peer ambassador models. The session will also address challenges faced during implementation, such as maintaining consistent engagement, navigating school system constraints, and ensuring culturally safe spaces for honest conversation.

Objectives:
1. Addressing practical strategies for recruiting and retaining Black male youth in leadership-based prevention programs
2. Identifying lessons learned in building trust with schools, caregivers, and community partners
3. Providing examples of youth-driven solutions and programming that promote protective factors
4. Developing tools for sustaining momentum and youth voice in community health efforts

WORKSHOP SESSION 1C

How to Develop a Youth Suicide Prevention Center

Friday, December 5, 2025, 2:00 PM to 3:00 PM

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Suicide has become the second leading cause of death among children greater than 10 years of age, and continues to remain a leading cause of death throughout most of our lifetime. Suicide rates in youth have only continued to climb over the last decade, therefore prevention measures are crucial. To address this epidemic, Connecticut Children's recently established a comprehensive Youth Suicide Prevention Center to reduce the occurrence of youth suicide deaths and those youth suffering with suicidal thoughts through identification, education/training, research, and advocacy. Aiming to implement validated and evidence-based programs to create safer and healthier communities. Suicide is preventable, and implementation of suicide prevention efforts including universal screening may save lives of youth in crisis.

During this workshop we will provide you with the basic knowledge and background you need to understand suicide specifically in your state or region. We will review and highlight reliable suicide prevention resources including the Suicide Prevention Resource Center, CDC, NIMH/NIH and the American Foundation for Suicide Prevention. Additionally, discuss suicide screening measures which can be implemented within your community.

You will learn how to build an evidence-based foundation for suicide prevention. There are many interventions and proven prevention strategies that can be easily adopted by you, your injury prevention center and your institution including the following, which we will highlight during this workshop:

Outline:
1. Youth Risk Behavior Survey and WISQARS
2. Suicide Screening Workflows – Emergency Department and Inpatient
    a. Ask Suicide Screening Questions (ASQ)
    b. Columbia- Suicide Severity Rating Scale (C-SSRS)
3. Lethal Means Restriction Counseling
4. Zero Suicide Programs
5. Staff education opportunities
    a. Annual suicide prevention trainings
    b. Question Persuade Refer Training (QPR)
6. Funding Opportunities

Objectives:
1. Appreciate the growing epidemic of youth suicide and need for prevention programs
2. Identify reliable sources of information about suicide and prevention programs
3. Develop a familiarity with some of the basic prevention strategies and explore how they can be implemented
4. Recognize potential funding sources for your suicide prevention work

WORKSHOP SESSION 1D

Overcoming Barriers to Healthcare-led Firearm Injury Prevention Strategies

Friday, December 5, 2025, 2:00 PM to 3:00 PM

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Due to recent increased awareness and advocacy, healthcare-led efforts to advance firearm injury prevention have increased in recent years. From lethal means counseling to hospital-based violence intervention programs (HVIPs), pediatric healthcare providers have embraced efforts to reframe firearm injury prevention as a public health issue. Despite this progress, current changes in funding availability and political climate threaten many programs engaged in this important work. This session aims to equip attendees with creative strategies and solutions to navigate current challenges in funding and political climate, to sustain this life-saving work. Attendees will be asked to share common barriers they have experienced in their own practice, and workshop presenters will facilitate a dynamic, solutions-oriented dialogue, drawing on their combined experiences operating HVIPs, lethal means counseling and secure firearm storage programs across the country. Workshop leaders will highlight innovative strategies for program continuity and empower attendees to apply these strategies in their own practice to address various types of firearm injury, including suicide, homicide, and unintentional injury. In this interactive session, participants will first hear from workshop leaders, followed by brief peer-to-peer conversations on individual challenges and solutions. Through these conversations, attendees will network and meet participants at varied levels of institutional engagement in firearm injury prevention efforts offering a broad spectrum of perspectives and possible future collaborations.

Objectives:
1. Describe common barriers among existing clinical programs for firearm injury prevention
2. Identify unique stakeholders to partner with to continue firearm injury prevention initiatives
3. Recognize institutional and community facilitators to strengthen and sustain firearm injury prevention programs

WORKSHOP SESSION 2A

When Kids Outsmart Car Seats: Addressing challenging behaviors in motor vehicles

Friday, December 5, 2025, 3:00 PM to 4:00 PM

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Approximately 10–15% of people with developmental disabilities engage in challenging behavior such as aggression, property destruction, self-injury, and elopement (Emerson, et al., 2001), with some studies suggesting that number increases to more than 50% in individuals with a diagnosis of autism (Mazurek, et al., 2013). Further, 74% of children with autism, or other developmental disabilities, were found to escape from their child safety restraint (Yonkerman et al., 2013). This behavior may continue as the child transitions from a child safety restraint to a seat belt. Escape from the child safety restraint or seat belt is especially dangerous for children who engage in challenging behavior as it may lead to distracted driving by the caregiver, which has been observed to increase the likelihood of becoming involved in a motor vehicle crash by as much as two times that of model driving (Dingus et al, 2016). Interventions are available that are shown to decrease the likelihood of escape from motor vehicles or vehicle restraint systems, as well as aggressive and disruptive behavior by children in the vehicle. These interventions include the antecedent procedure of adaptive car seats and restraints, which can be applied when a conventional car seat is determined to no longer be appropriate. However, it can be difficult to conduct an assessment to determine the appropriate car seat or restraint device for children who exhibit these behaviors.

Phone and video evaluations as well as in-person car seat checks were conducted with a number of families indicating escaping behavior while travelling in vehicles. CPSTs evaluated families' specific concerns and conducted informal interviews on sensory triggers and observed behaviors. Recommendations for interventions included distraction aids, use of items that trigger sensory deficits and/or reduced sensory overload, and DME and other physical interventions.

In many cases, families did not respond to follow-up messages after discussing new intervention ideas with CPSTs. Given indications of feeling overwhelmed during in-person evaluations, we suspect that suggested interventions were moderately helpful, at minimum, though we can't be certain. When available, successes and additional challenges were shared. In some cases, car seat misuse was discovered, such as improper harness tightening or improper leg buckle location. Upon correcting misuse, escaping behavior was reduced. It has been noted repeatedly that "best practice" scenarios aren't always met and occasionally families will need to make choices they feel appropriate for their families that may not align with CPST recommendations.

Taking an individualized approach to car seat evaluations with families reporting escaping behaviors can help CPSTs support families in making safer decisions while travelling. This includes taking time to get to know observed behaviors in broader scenarios and understanding how actions in the vehicles may be similar or different. Suggestions of sensory interventions and distractions that may address a child's particular hyper- or hypo-sensitives and reduce escaping behaviors. Other more restrictive interventions may be needed when distraction aids are ineffective.

Objectives:
1. Identify common behaviors that may create barriers to assessing a child’s safety needs while riding in a vehicle.
2. Provide recommendations and resources to help reduce the likelihood of these behaviors occurring during car seat assessment appointments.
3. Be able to identify resources, including DME products and other behavior interventions, that can help a family create a safer travel scenario.

WORKSHOP SESSION 2B

Planting Rays of Unity, Beauty, and Pride: Examining the Intersectionality of Climate Change Advocacy, Youth Violence, and Adolescent Health

Friday, December 5, 2025, 3:00 PM to 4:00 PM

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Co- Director, Department of Pediatrics DEIT
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For decades climate change has threatened the health and wellbeing of communities and families across the globe. The intersectionality of climate change, violence, and health has been studied extensively in adults; however, limited evidence exists on effects on children and adolescents. This workshop is designed to highlight knowledge gaps through examples of climate change's impact on health and violence, and the role health providers can take in promoting safer and healthier environments. We will review a youth-led initiative, The Sunflower Project, in which high school students worked to create a green space in an impoverished area of Chicago. Westbrook Memorial Green space was created with over a dozen sunflowers planted by local volunteers. These flowers symbolize a sense of "unity, beauty, and pride" for volunteers and community members.

The Intergovernmental Panel on Climate Change states that the severity of climate related health risks is dependent on how well health systems and professionals can protect people; yet education around these climate-related health risks remains uncommon, particularly for adolescents. The youth led Sunflower projects demonstrate how education regarding climate change is its harmful effects on violence and health can be turned into advocacy. Health care providers are therefore urged to educate themselves and their patients on the harmful effects of climate change on youth violence and health.

Objectives:
1. Review the intersectionality of climate change, violence, and adolescent health.
2. Examine climate change as a threat multiplier for AYA populations.
3. Illustrate how education on the threats of climate change and violence can serve as an advocacy tool for youth.
4. Describe strategies to help change environments, reduce violence, and improve health outcomes for adolescents.

WORKSHOP SESSION 2C

Empowering Pediatric Trainees as Advocates: Building a Longitudinal Injury Prevention and Media Communication Curriculum

Friday, December 5, 2025, 3:00 PM to 4:00 PM

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This interactive workshop will introduce participants to a replicable, innovative model for teaching pediatric residents injury prevention through longitudinal advocacy and communication training. Based on the new curriculum being implemented at Valley Children's Healthcare, this session will provide attendees with the tools to create a similar injury prevention program at their own sites, with a specific focus on empowering residents to become effective advocates for child safety through digital media.

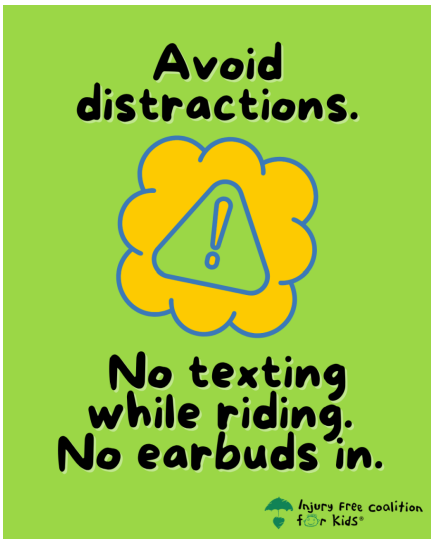
Participants will explore how a curriculum was designed to fill a gap in second-year residency training, incorporating mentorship, community partnerships, and media production. The program's structure leverages an X+Y scheduling format to deliver experiential learning on priority injuries (drowning, motor vehicle safety, burns, and safe sleep), culminating in resident-led health campaigns.

Interactive components will include:

- Small group breakout to brainstorm top injury priorities in each attendee's community and how to structure a cohort-based curriculum around them.
- Hands-on media activity, where attendees work in teams to "translate" a peer-reviewed injury prevention article into a mock social media post or infographic.
- Role-play simulations of advocacy conversations between pediatricians and families, with feedback from peers.
- Capstone planning exercise, in which attendees draft a mini health campaign pitch tailored to a specific audience (e.g., teens, caregivers, school staff).

The session will also explore evaluation strategies including pre/post surveys, rubric-based assessments, and qualitative feedback from stakeholders. Attendees will leave with a toolkit including templates for planning, educational material development, and campaign evaluation.

Objectives:
1. Describe a longitudinal model for injury prevention and advocacy education integrated into pediatric residency training.
2. Identify injury prevention priorities in their own communities and outline a feasible cohort-based curriculum.
3. Apply health communication strategies to create a media-based educational message on a selected injury topic.
4. Practice advocacy communication techniques through role-play simulations.
5. Develop an outline for a resident-led injury prevention campaign in partnership with community organizations.



WORKSHOP SESSION 2D

From Prevention to Promotion: Advancing Your Academic Career Through Your Injury Prevention Efforts

Friday, December 5, 2025, 3:00 PM to 4:00 PM

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An academic career in pediatric injury prevention is rewarding as it has a direct impact on children and can result in many lives saved. Yet many early-career faculty struggle to see how their injury prevention efforts—whether in advocacy, program implementation, education, clinical work, or research—can contribute meaningfully to academic promotion.

This interactive workshop is designed to bridge that gap. Faculty leaders who have successfully navigated the promotion process will offer practical guidance and candid insight into how injury prevention work can be strategically aligned with institutional promotion criteria.

Participants will learn to recognize the value of their full scope of contributions, even those that may not traditionally “count” in academic culture. We’ll explore how to position injury prevention activities within teaching, service, and scholarship portfolios—and how to translate these efforts into language that resonates with promotion committees.

Topics will include:

• Key similarities and differences in academic promotion criteria across institutions.
• How to “play the game” by your institution’s rules.
• Strategies to build your CV beyond publications—through leadership, community partnerships, mentorship, and policy impact.
• Tapping into national networks like Injury Free to support your case and increase visibility.

Participants will engage in reflective exercises and small-group discussions to identify their own goals, assets, and barriers. Everyone will leave with tailored action steps to help them integrate promotion planning into their everyday work—and to advocate for broader recognition of injury prevention as an essential academic contribution.

Objectives: 1. Describe common promotion pathways and how they apply to injury prevention work.
2. Identify local and national resources and mentors to support their promotion journey.
3. Develop personalized action items that align injury prevention efforts with academic advancement.

PANEL DISCUSSION

From Reels to Real Safety: Pediatric Injury Prevention in the Digital Space

Saturday, December 6, 2025, 8:00 AM to 9:00 AM

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In today's rapidly evolving digital landscape, social media has become a powerful tool for reaching families, caregivers, and communities with lifesaving injury prevention messages. This panel brings together physician-influencers, communication leaders, and organizational voices who have successfully leveraged social media platforms to share evidence-based pediatric injury prevention content. Panelists will explore their personal journeys into digital engagement, discuss strategies to amplify injury prevention messages, and provide insights on navigating the challenges of online spaces. Attendees will gain a deeper understanding of how to effectively use social media to promote injury prevention—whether as a content creator, collaborator, or amplifier. Panelists will highlight lessons learned, pitfalls to avoid, and ways to handle difficult online situations, while underscoring why pediatric injury prevention professionals cannot afford to ignore social media in today's evolving environment.

Objectives:
1. Identify strategies for effectively engaging in social media to promote pediatric injury prevention messages.
2. Recognize common pitfalls and challenges of professional engagement on social media, including managing negative or harmful interactions.
3. Discuss opportunities for individual professionals and organizations to amplify pediatric injury prevention efforts through digital platforms.

PLATFORM PRESENTATIONS

Community Focus

Saturday, December 6, 2025, 9:00 AM to 10:00 AM

This session showcases five complementary community-focused strategies to reduce pediatric injuries: a mobile Pop-Up Safety Town tailored for high-risk Hispanic and Black communities; an interactive Charlie's House Virtual Safety Experience that extends a physical safety demonstration home into a widely accessible digital platform; a multi-hospital Safe Sitter® model that scales age- and role-specific safety training for youth and caregivers across New York City; enhancements to the online Checkpoints teen driver safety program driven by partner feedback and UX/technical redesign; and a national review of Community Health Needs Assessments using text mining to identify gaps and develop injury-focused questions, particularly around underrepresented domains like drowning and burns. Together, these efforts highlight how partnerships, technology, and data-driven assessment can broaden reach, improve engagement, and better align community resources with injury prevention priorities.

Learning Objectives:
1. Describe community-based and virtual models for delivering pediatric injury prevention education using mobile, in-person, and online experiences.
2. Discuss how hospitals, public agencies, and industry partners can collaborate to scale and sustain safety education programs.
3. Identify methods to improve online injury prevention interventions such as teen driver safety tools by incorporating stakeholder feedback, using analytics to increase engagement and completion of key behavior-change components.
4. Explain approaches for integrating injury and violence prevention into Community Health Needs Assessments.

Moderators:

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Pop-Up Safety Town Evaluation

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Background: Unintentional injury is a leading cause of death in children, particularly in high-risk communities with substantial health disparities. Pop-Up Safety Town (PST) is a pediatric injury prevention program created to address the limitations of a "traditional" Safety Town to meet the injury education needs of the children and families who otherwise are unlikely to have access to this education and/or resources. Last year this program was adapted and implemented at the United Community Center, a local school/community center that serves primarily Hispanic children and families. This year we expanded PST to an additional site: the Midtown Clinic associated with our tertiary children's hospital which serves primarily Black children and families. Feedback was obtained in the form of surveys to help improve future PST events.

Methods: Each event was tailored to the community's individual needs. Topics that were identified as areas of need by both communities included 1) animal safety, 2) bike safety, 3) burn safety, 4) car seat safety, 5) fire safety, 6) pedestrian safety, 7) water safety, and 8) medication safety. The Midtown Clinic event also included 1) firearm safety, 2) lead testing, 3) Planned Parenthood, and 4) behavioral health resources. Feedback was obtained from school/community center staff, event volunteers, and caregivers of children impacted by PST. Survey questions addressed types of injuries experienced by their child/student, topics to be covered in future events, and how our injury prevention work can be sustained in their community.

Results: We provided essential injury prevention education to approximately 350 K4 and K5 students over four half-day PST sessions at the United Community Center. Additionally, we reached approximately 40 children, as well as their caregivers, at our Midtown Clinic event. Every child was fitted with an adjustable bike helmet to take with them for use at home. A drawstring backpack filled with injury prevention resources was provided to each child to share with their caregivers. At the Midtown Clinic event, 15 children underwent lead testing. In addition, every caregiver was given a "Gun Safety in the Home" teaching sheet, regardless of whether they said there were firearms in their home. Fifteen trigger locks and 38 cable locks were distributed.

We collected 19 survey responses from the United Community Center events. Responses were overall positive with 84% of respondents stating they were very satisfied or satisfied with the event. Injuries most commonly sustained by their children

included bike, skateboard, or scooter related injuries (45%), falls (45%), and animal bites (27%). Asks for future events included education surrounding playground safety and materials regarding affordable car seats. Survey responses from the Midtown Clinic event are still being collected.

Conclusions: PST is a mobile and budget friendly injury prevention program that seeks to include children and families that may be at higher risk for unintentional injury. PST is adaptable and reproducible in different settings. Program evaluation is essential to ensure that topics covered and resources provided are applicable to each community's individual needs.

Objectives:
1. Pop-Up Safety Town (PST) is a pediatric injury prevention program developed to address the limitations of a "traditional" Safety Town and include children and families who otherwise are unlikely to have access to injury prevention education and/or resources.
2. PST events are tailorable to each community.
3. Program evaluation is essential to ensure that topics covered and resources provided are applicable to each community's individual needs.

Charlie's House Virtual Safety Experience: Exploring Interactive Strategies to Broaden Reach of Household Safety Education

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Background: Residential injuries to children result in more than 4 million ED visits annually, representing nearly 40% of total ED visits; more than half a million are moderate to severe with nearly 75,000 admissions resulting (1). Charlie's House, the nation's only safety demonstration house, addresses a wide range of household safety matters through immersive demonstrations but the program's reach is severely limited by the necessity of visiting a single, fixed location—a common limitation of many safety outreach programs. Charlie's House Virtual Safety Experience (VSE) delivers a similar set of experiences in the context of a readily accessible, highly interactive online experience usable in a variety of digital media devices.

Methods: Amazon/AWS partnered with Charlie's House to create a series of interactive virtual experiences that reconstructs much of the information presented in a physical tour of Charlie's House. Each element was reviewed by a panel of safety professionals to identify the risk factors, place it into a relatable context, and provide simple, straight-forward mitigation strategies that can be implemented with limited effort or expense. The beta version was released at the International Consumer Product Health and Safety Organization's (ICPHSO) 2024 International Symposium in Brussels, Belgium for broader expert input, and the final version was released in February 2025 at the ICPHSO Annual Symposium in Orlando, Florida.

Results: The beta version had 57 downloads with 11 individuals providing feedback and suggestions through a short, voluntary survey. More than 2,070 downloads had been recorded as of May 2025. Anecdotal feedback from users has been overwhelmingly positive, including successful in situ utilization by home visiting professionals, child protective services, and other outreach personnel. Amazon/AWS provides additional assistance with platform expansion and dissemination. Several other retail and specialty platforms are exploring active partnerships as well; this broadening will enable implementing "click through" pathway capabilities, allowing consumers to compare products available from various vendors and promoting mitigation strategies. Such features potentially highlight Juvenile Products Manufacturers Association (JPMA) or similar safety certifications, empowering consumer action while salience is highest. Subsequently, digital output analytics will facilitate moving to more definitive outcomes involving mitigation devices added to one's home.

Conclusions: The unique partnership between Amazon/AWS and Charlie's House has facilitated development of a state-of-the-art, interactive safety experience with a wide and rapidly expanding range of avenues to deliver household safety instruction, mitigation strategies, and ultimately direct, real-time access to acquire products and devices from an assortment of vendors. Early users find utility in a variety of settings, greatly expanding the reach and the impact of Charlie's House and its experiential safety programs. The feedback from users helped refine informational and operational aspects of the platform. Regional grant funding will be supporting further development of automobile, bicycle, and pedestrian elements, including enhancements to analytics functions; additional partners are exploring opportunities for participation and support.

Objectives:
1. Download and interact with the Charlie's House Virtual Safety Experience.
2. Explore the features of the platform and its potential applications in improving household safety.
3. Examine the benefits of partnership between safety related agencies/organizations and vendors to expand reach and impact of information delivery to caregivers.

Scaling Pediatric Injury Prevention Education in NYC: A Collaborative Hospital-Based Model Using Safe Sitter® Programs

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Background: Pediatric injury prevention efforts often miss preteens and non-traditional caregivers, despite their important roles in child safety. To address these gaps, Maimonides Medical Center became a Safe Sitter® site in 2016, offering competency-based and medically accurate safety training to adolescents in Brooklyn. Staten Island University Hospital joined the initiative in 2019. Together, the hospitals now deliver three evidence-based programs—Safe Sitter®, Safe@Home, and Grandparents: Getting Started—to provide age-appropriate safety education to a broad audience across NYC.

Methods: Each course targets a specific population:

- Safe Sitter® (launched 2016/2019): A full-day course for youth ages 11–13 covering childcare skills, safety, first aid, and CPR.
- Safe@Home (added 2021): A 90-minute course for students in grades 4–6 focused on safe decision-making and emergency preparedness when home alone.
- Grandparents: Getting Started (added 2025): A 3-hour class for older caregivers covering current recommendations on safe sleep, behavior management, and injury prevention practices.

In 2024, Gia and Julia supported the onboarding of NYCHHC Kings County Hospital as an independent Safe Sitter® site, expanding reach in Brooklyn. In early 2025, the NYC Regional Trauma Advisory Committee (RTAC) Injury Prevention Subcommittee was awarded a grant from the American Trauma Society (ATS) to support expansion of Safe Sitter programming across New York City. The grant funds onboarding at five new hospital sites—one in each borough—each of which will receive instructor training and student handbooks to implement one or more of the three Safe Sitter courses based on local needs. Sites are currently completing onboarding paperwork and preparing for implementation.

Results: To date, over 100 youth and caregivers have completed courses at Maimonides and SIUH. Student evaluations show that participants find the courses engaging and practical. Common feedback highlights favorite parts of the class, such as learning first aid, practicing with manikins, or gaining confidence in babysitting. Many students express plans to use their skills to stay home alone, babysit, or care for younger siblings.

Caregivers participating in the Grandparents: Getting Started course report appreciation for current safety recommendations and hands-on learning opportunities. Expansion sites are on track to begin programming by late 2025, with initial onboarding nearly complete.

Conclusions: Safe Sitter programming fills a longstanding gap in injury prevention for middle school-aged children and caregivers. Through strong hospital collaboration and grant support, this model has scaled citywide while remaining responsive to local needs. The borough-based expansion offers a replicable blueprint for trauma centers aiming to embed evidence-based injury prevention across diverse urban populations.

Objectives:
1. Describe how Safe Sitter®, Safe@Home, and Grandparents: Getting Started programs support age- and role-specific injury prevention.
2. Understand the value of hospital partnerships and structured onboarding to scale education initiatives.
3. Recognize how external funding can support sustainable and equitable program expansion across geographic regions.

Improving Checkpoints, an Online Teen Driver Safety Program, to Increase Reach and Accessibility

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Background: The Checkpoints program is designed to educate parents and teens about teen driving risks and encourage them to create a Parent-Teen driving agreement. Using feedback from partners, we have collaborated with specialists to enhance the program's reach and accessibility.

Methods: We partnered with the Tennessee Department of Health, Kentucky Injury Prevention and Research Center, and Wyoming Department of Health to implement the Checkpoints program. Feedback from these agencies helped us identify barriers. In 2024, we collaborated with MindSpring to improve the program's language, structure, and design and with BoxCar to enhance the website's technical features.

Results: Partner conversations revealed the need for several site improvements to boost engagement and reach. In the Tennessee version of the program, between August 2021 and February 2024, we observed over 18,000 pageviews but only 17 agreements, indicating that participants were not completing the critical agreement portion. Stakeholders also noted difficulties in accessing necessary reporting information,

such as participant names and total agreements. Furthermore, tracking revisits to the agreement was not possible, limiting valuable insight into user engagement. Identified platform limitations included email reminders, registration bugs, and navigation issues, as well as needs related to content framing, design, reporting, and accessibility.

Conclusions: In response to stakeholder feedback and partnership expertise, we enhanced the Checkpoints program. With MindSpring, we transitioned content from video-based to reading and activity-based and split the program into separate sections for teens and adults to complete individually, adding tailored behavioral content. We also reduced the reading level. BoxCar's collaboration improved site navigation and technical aspects, simplifying participant use and administration.

By improving the platform, we believe that we will be able to increase the number of people completing the driver agreement. Ultimately, this will help keep teen drivers safe during their first year of licensure.

Objectives:
1. How to work with vendors to create an online intervention.
2. How to work with external partners to gather actionable feedback for interventions.
3. How to incorporate behavioral content into a teen driver safety intervention.

Integrating Injury Prevention into Community Health Needs Assessments

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Background: Community Health Needs Assessments (CHNAs) are a critical tool for hospitals to identify and address a community's health priorities. Despite the high burden of injuries and violence in the United States, these issues are thought to be underrepresented in CHNAs. For example, in a recent study of CHNAs in 20 cities with the highest rates of violence, only 32% reported violence as a priority need. Nearly 26% of CHNAs did not mention the word "violence" at all in their report. Given that unintentional injuries are the leading cause of death for individuals aged 1-44, including pediatric populations, this lack of representation is a missed opportunity for hospitals to engage in injury prevention. We partnered with Safe States on a project to further assess the inclusion of injury prevention topics in community health needs assessments and also develop sample questions that might support the integration of these topics into the assessments.

Methods: CHNAs were systematically analyzed from 40 hospitals across the U.S. to assess their inclusion of injury prevention topics. To ensure that we were selecting a geographically diverse sample of CHNAs, we geolocated and mapped the location of each hospital publishing the CHNA. Diversity, in terms of CHNA service area, urban/rural classification, and social vulnerability, was also considered. The project team then developed a list of injury and violence prevention keywords to flag while reviewing the community health needs assessments. The project team created and utilized a text mining software that identified the use of each keyword within each CHNA. This software counted and identified the occurrences of keywords within CHNAs. Reviewers then manually examined each keyword instance to confirm appropriate contextual use and to identify potential questions to be recommended for CHNA inclusion.

Results: The injury domains most commonly addressed in the CHNAs included mental health and suicide (97.5% of sample used at least one term from this domain) and substance abuse (95%). Domains that were least addressed were drowning (0%) and burns (5%). These findings underscore the need for questions and assessments related to drowning and burns in the CHNA process, especially given their disproportionate impact on pediatric populations. Addressing these gaps may help drive the allocation of new resources toward prevention efforts in these areas.

Conclusions: These findings have informed the creation of sample questions for specific injury-related domains, such as abuse/neglect, concussion, violence, drowning, burns, and motor vehicle crash. We hope that these questions can act as a starting point for CHNA teams to better represent injury in their assessments. Future research might involve the development of a validated key word bank, creation of a larger list of useful questions and guidelines for CHNA development, and evaluation of changes over time.

Objectives:
1. Identify gaps in injury prevention representation in CHNAs and its impact on communities.
2. Describe a systematic approach to assessing CHNAs for injury & violence content.
3. Explore potential methods for integrating injury-related questions into CHNAs.

LIGHTNING ROUND PRESENTATIONS

Saturday Lightning Round: ATVs and Other Vehicles

Saturday, December 6, 2025, 10:30 AM to 11:30 AM

We will examine pediatric and adolescent injuries related to ATVs, UTVs, off-road vehicles, and lawnmowers, combining national data on off-road and lawnmower-related eye trauma, a statewide analysis of pediatric ATV injuries in Arkansas, and survey data on rural Iowa teens' use of UTVs on public roads, alongside programmatic and regulatory perspectives. Studies describe mechanisms and severity of eye injuries from off-road vehicles and lawnmowers, highlighting low use of eye protection and higher risks for youth and bystanders; evaluate demographic, geographic, and socioeconomic patterns of ATV injuries in Arkansas; and assess rural adolescents' risky roadway UTV use and pervasive misconceptions about safety and legality. We will learn how Chinese youth ATVs are marketed online and have widespread noncompliance with federal standards. A school-based ATV safety initiative in rural Arkansas demonstrates knowledge gains and positive reception when education, pledges, and safety gear distribution are combined.

Learning Objectives:
1. Describe recent injury patterns for off-road vehicle- and lawnmower-related eye injuries, as well as pediatric ATV injuries.
2. Identify key risk factors for ATV/UTV and power-equipment injuries among children and adolescents.
3. Outline core components of a school-based ATV safety program that combines education, pledges, and equipment distribution to improve safe riding behaviors.
4. Discuss how mislabeling of age, speed, and engine size of online marketed ATVs may increase pediatric injury risk.
5. Identify opportunities for injury prevention partners to strengthen education and legislation aimed at reducing pediatric ATV/UTV and lawnmower injuries.

Moderators:

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Off-Road Vehicle-Related Eye Injuries in the U.S.

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Background: Off-road vehicles remain a public health concern in the U.S. and are associated with approximately 700 deaths and 100,000 emergency department visits per year. Our study objective was to determine the epidemiology of eye injuries related to off-road vehicles, including all-terrain vehicles (ATVs), dune buggies and utility task vehicles (UTVs), with determination of the mechanisms of injury and associated diagnoses and the trend of injuries over time.

Methods: Off-road vehicle-related eye injuries were identified from 2004-2023 using the nationally representative National Electronic Injury Surveillance System which is maintained by the Consumer Product Safety Commission. Periorbital injuries were not included. The database narratives were utilized to code the mechanism of injury. Descriptive and comparative analyses (chi-square and Fisher's exact test) were performed.

Results: An estimated 20,076 ORV-related eye injuries (yearly average 1,004 cases) occurred, but incidents decreased significantly over time. Greater decreases in eye injuries were seen among youth, males, and those occurring at home or on farms/ranches. Injured victims were 77% males, 76% adults, and 90% non-Hispanic White. Nearly half (46%) occurred at home and 32% at a place of recreation/sports. Primary injury mechanisms included being hit by a foreign body/projectile (52%), hit by a branch (17%), and vehicle collisions/ejections (13%). The most common diagnoses were eye abrasions/contusions (55%) and foreign bodies (19%). Severe injuries included lacerations, hyphemas, traumatic uveitis, retinal detachments and ruptured globes. The vast majority (97%) were able to be discharged. Debris in foreign body/projectile injuries were 70% grass/dirt/dust/rocks, 20% insects and 5% sticks/wood. Only 1.4% of operators/passengers injured were documented as using safety glasses/goggles, with few using helmets. Injury mechanisms varied significantly between adult males and females, p=0.002. Higher proportions of injured youth were females and required admission for their injuries as compared to adults, p=0.002 and p=0.043, respectively.

Conclusions: ORV-related eye injuries are typically due to mechanisms that could have been avoided or have their severity decreased with the use of eye protection. The promotion and use of helmets with face shields or safety googles when riding ORVs are critical for preventing these

injuries, especially among youth who had greater proportions of severe eye injuries requiring admission.

Objectives:
1. Describe the trend in overall and pediatric off-road vehicle-related eye injuries over time.
2. Identify at least three mechanisms for off-road vehicle-related eye injuries.
3. State two comparative differences between off-road vehicle-related youth versus adults and how most of these injuries could be prevented.

ATV Safety Initiative: Providing Safety Education in Rural Communities with Effective Outcomes

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Background: Over the past decade, all-terrain vehicles (ATV) have increased in popularity with children and adolescents, especially those living in rural areas in the United States. Youth have 12 times greater risk of ATV related injuries compared to adults, and the incidence of pediatric emergency department visits for ATV related injuries in Arkansas has similarly increased. To improve the ATV safety education among youth in our state, we developed a school-based educational program called Operation Safe T.R.I.P.S.S. that addressed safe ATV riding behaviors for adolescents.

Methods: Operation Safe T.R.I.P.S.S. is a school-based, 50-minute, assembly style ATV program adapted from the hospital-based, day-long ATV Safety initiative “Ride on TN” at Vanderbilt and in collaboration with University of Iowa Children’s Hospital. Utilizing the internal and external partnership injury databases of our hospital’s trauma department and Emergency Medical Services for Children (EMSC), we identified six counties, in rural areas of the state, with higher numbers of ATV injuries, which were subsequently targeted for this program. Participants completed pre- and post-surveys to measure knowledge gained of safe ATV riding behaviors. After completion, participants signed ATV safety pledge cards and had the opportunity to receive ATV safety gear.

Results: Seventeen school presentations were completed between February to May 2025 with a total of 2817 participants. We had 94% pre-survey completion and 74% post-survey completion. Participants had a 21% increase in overall knowledge of ATV safety riding behaviors after the program. The program’s approval was 93% among participants and 63% of participants noted willingness to promote ATV safety with family and friends. Over 90 sets of ATV helmets, goggles and gloves were distributed in addition to 27 Stop the Bleed kits. Participants were referred to our hospital’s Family Resource Center for helmet fittings and further ATV education.

Conclusions: School-based ATV safety education programs, like Operation Safe T.R.I.P.S.S., can have a significant impact by increasing ATV safety knowledge among adolescents in a rural state. The success of this program also led to development of public service announcement that has been displayed across our hospital’s social media platforms to reach a broader audience.

Objectives:
1. Understand the risks of ATV related injuries for youth
2. Describe how ATV safety education can be implemented in a school-based program
3. Discuss preliminary outcomes used to assess program effectiveness

Lawnmower-Related Eye Injuries in the US

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Background: Power lawnmowers pose significant ocular hazards and understanding these injuries can inform prevention strategies. The study objective was to determine the epidemiology, mechanisms, and trends of lawnmower-related eye injuries in the U.S., focusing on national estimates, injury types, and high-risk populations.

Methods: A retrospective cross-sectional study of U.S. lawnmower-related eye injuries from 2004-2023 was performed using the Consumer Product Safety Commission’s National Electronic Injury Surveillance System. Periorbital injuries were not included. The mechanism of injury and several other variables were coded using the database narratives. Descriptive and comparative analyses (chi-square and Fisher’s exact test) were performed.

Results: An estimated 120,613 lawnmower-related eye injuries occurred in the U.S. from 2004-2023 (N=2,467 NEISS cases). Those injured were 82% males, 95% adults and 82% non-Hispanic Whites. Ninety-nine percent of injuries occurred at home. Most injuries (77%) were from projectiles (predominately grass, dirt and rocks), 12% non-projectile injuries during mowing, 8% maintenance/repair-related and 2% from chemical exposures (primarily gasoline). Common diagnoses included eye abrasions/contusions (55%) and foreign bodies (27%). Severe injuries included retinal detachment, iris sphincter tear, corneal erosion, lens dislocation and globe rupture. Only 2% of projectile injuries were documented in narratives as using eye protection including eyeglasses. The average annual estimate for lawnmower-related eye injuries was 33% lower when comparing 2018-2023 to 2004-2017 (n=4,502 vs. n=6,686, $p<0.001$). Injuries decreased more in males than in females, (35% vs. 23%, $p<0.001$) and in adults aged 18-65 (35%) as compared to youth <18 yrs (26%) and adults >65 yrs (23%), $p<0.001$. Whereas injuries decreased in non-Hispanic Whites by 41%, they increased in Blacks (18%) and other racial/ethnic groups, including Hispanics (42%), $p<0.001$. Youth <18 years

were a higher proportion of bystander (50%) versus operator (5%) injuries, p<0.001. As compared to adults, a greater proportion of injured children were African American and Hispanic (p=0.003) and were injured somewhere other than at home (p=0.023). Bystanders, as compared to operators, had higher rates of severe injuries requiring hospital admission, p=0.002.

Conclusions: Lawnmower-related eye injuries remain a serious risk, especially from projectiles. The risk could be significantly lessened if proper safety glasses/goggles were utilized both while operating mowers and when performing maintenance/repair. Though less frequent, bystander injuries also occur with half of these being children and with a greater proportion requiring admission. Other individuals should not be in the vicinity of a mower's operation, especially children.

Objectives:
1. Describe the trend in overall and pediatric lawnmower-related eye injuries over time.
2. Identify at least three mechanisms for lawnmower-related eye injuries.
3. State at least three comparative differences between lawnmower-related eye injuries in youth versus adults.

On-line Marketing of Chinese Youth ATVs: Are Dealers Following Mandatory Federal Standards?

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Background: There are federally mandated Specialty Vehicle Institute of America (SVIA)/American National Standards institute (ANSI) standards that apply to all all-terrain vehicles (ATVs) including youth models. Youth models are presently categorized by maximum restricted and unrestricted speeds. The maximum speed for Y6+ models (for youth >=6 years) is 15 mph and for Y10+ and Y12+ models (for youth >=10 years and >=12 years) is 30 mph. Prior to 2009, youth models were based on engine displacement with models for youth >=6 years having engine sizes less than 70cc and those for youth >=12 years being 90cc or less. There are no models approved for children under 6 years. The youth ATV market in recent years has been dominated by less expensive Chinese models. The objective of this study was to examine how Chinese youth ATVs are marketed by on-line dealers and whether they comply with federal standards.

Methods: Internet searches were conducted from August 2024-March 2025 with various search terms regarding youth ATVs and Chinese models to identify dealers on-line. The websites were reviewed to determine the youth models available and how they were marketed including the ages for which the model was recommended, the engine displacement and maximum speed, as well as dimension specifications. Descriptive analyses were performed.

Results: 201 Chinese youth ATVs advertised by eighteen dealers on-line were identified. There were 23 youth models on two websites that were advertised for children <6 years (22 models for as young as 3 years). Most engine sizes for these vehicles ranged from 107-125cc, except one was 40cc; maximum speeds for the six models where stated were 10-45 mph, average 27 mph. Of the remaining 177 youth ATVs, 76 models at ten on-line sites had age recommendations and/or stated maximum speed such that one could determine whether they followed federal regulations. Fifty-two (68%) did not meet speed standards for age. For models not meeting the standard, speeds ranged from 25-37 mph for Y6+ (6 models), 32-45 mph for Y10+ (4 models), 32-45 mph for Y12+ (7 models), and 31-45 mph for those with no age specified (35 models). All 18 sites advertised youth models for which federal standards were not met or did not provide age recommendations or the maximum speed so that this could be determined. Of models recommended for children ?6 years, 173/177 provided the engine displacement. All of them exceeded previous engine size standards for youth models. Engines ranged from 107-135cc for Y6+ (8 models), 107-125c for Y10+ (25 models), 107-125c for Y12+ (22 models) and 107-250cc for ATVs with no specific age designation (122 models).

Conclusions: Dealers marketing Chinese manufactured youth ATVs are generally not following federally mandated standards and/or not providing the recommended age ranges for the youth ATVs they are selling on-line. This is potentially leading to more children riding ATVs that are not designed for them and potentially leading to increased crashes and injuries.

Objectives:
1. To state how youth ATV models are categorized now and how that differs from the past.
2. To discuss the present marketplace regarding the sale of youth ATVs in the U.S.
3. To identify at least three ways in which on-line dealers of Chinese youth ATVs are not following mandatory federal standards and luring customers to purchase ATVs for younger children.

Rural Iowa Adolescents' Use, Knowledge and Attitudes Regarding UTVs on Public Roads

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Background: Manufacturers warn against the use of utility task vehicles (UTVS) on public roads as they are not designed for roadway use. In fact, most UTV-related deaths occur on public roads with the majority not involving another vehicle. Despite this, legislative bodies across the U.S. are passing laws allowing increased UTV use on public roads. The study objective was to examine rural adolescent's use, knowledge and attitudes regarding UTVs on public roads.

Methods: An anonymous survey was performed of 2024 Iowa FFA (formerly Future Farmers of America) Leadership Conference attendees. Descriptive, bivariate (chi-square) and logistic regression analyses were performed using Stata 15.1 (StataCorp, College Station, TX).

Results: 1,029 FFA members participated. Respondents were 13-18 years with 67% being 14-17 years. One-half were from a farm, one-fifth lived in the country/not a farm, and 30% were from a town. Almost all (96%) were non-Hispanic White. Over half (53%) of respondents' families owned a UTV and over two-thirds (69%) had driven/ridden one. Of those who had driven/ridden a UTV, 94% had driven/ridden on an unpaved public road (51% reported doing so at least weekly) and 87% had been on a paved road (41% reported doing so at least weekly). Males and owners of UTVs had greater odds of having driven on both unpaved (2.2x and 30.7x, respectively) and paved (1.7x, 13.4x, respectively) public roads at least weekly as compared to their peers. Overall, 64% and 63% stated it was safe to drive UTVs on unpaved and paved public roads, respectively, while 62% and 54% stated UTVs were designed for unpaved and paved roads, respectively. Males (2.8x), owners of UTVs (2.1x) and those that had ridden on public roads (3.1x) all had greater odds of stating it was safe to drive UTVs on both unpaved and paved roads than their comparative peers. Less than half (44%) agreed that most UTV deaths occur on public roads. Over half agreed to assertions that UTV manufacturers state UTVs are safe on unpaved (54%) and paved (52%) public roads. Generally, males, UTV owners, UTV riders, those who had ridden on public roads and more frequent riders all had greater proportions that held these misconceptions. The vast majority (82%) incorrectly believed one could be under 18 years to legally drive UTVs on Iowa county roads.

Conclusions: A majority of study participants had driven/ridden a UTV and almost all of these had been on public roads. The majority agreed it was safe to drive UTVs on both unpaved and paved public roads and were unaware that most UTV-related deaths occur on roads. They also believed the falsehood that manufacturers state UTVs are safe on unpaved and paved public roads. Targeted education and enforced legislation prohibiting use on public roads may be critical in decreasing UTV-related deaths and injuries.

Objectives:
1. Describe present practices of rural adolescents regarding driving UTVs on public roads.
2. Discuss the attitudes rural adolescents have related to the driving of UTVs on public roads.
3. State at least three demographic groups that had higher proportions who held misconceptions and falsehoods related to UTVs on public roads.

Pediatric ATV-related Injuries in Arkansas by Region

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Background: The use of commercial or recreational all-terrain vehicles (ATVs) has significantly increased, particularly amongst the pediatric population with over 300,000 children requiring Emergency Department evaluation between 2001 and 2010. Similar to national trends, ATV use in Arkansas has also increased over the years. However, little is known regarding specific demographic information of those who sustain ATV injuries in Arkansas in more recent years. We aim to compare frequency and severity of ATV injuries in urban and rural parts of Arkansas.

Methods: This is a retrospective demographic study of all patients that sought emergency department (ED) care due to an ATV related injury in Arkansas between 2018 and 2023. Data from hospitals outside of the Arkansas Children's Hospital system were captured by utilizing the trauma repository from the Arkansas Department of Health. Review of individual patient charts was performed with documentation of various demographics including but not limited to age, race, gender, zip codes, ATV type, transport data, and ED disposition status. Descriptive statistics were used to summarize the data.

Results: In total, 3,356 patients under the age of 21 received ED care due to an ATV related injury during this five-year time frame. Of these patients, 65% were male, 82.2% white, 9.6% black, and 6.9% Hispanic ethnicity. The median age was 13 years, with total ages ranging from 6 months to 21 years. The majority of cases occurred in 2020, with 677 ED encounters, and the least in 2018 with 441 total encounters. The greatest number of cases were in Cabot, AR which overall has a low child opportunity index and area deprivation index of 5 and 8, indicating areas of high socioeconomic disadvantage.

Conclusions: These results show that the rates of ATV related injuries in Arkansas are consistent with national trends. These injuries do occur more frequently in rural areas, especially those that have lower childhood opportunity indices. We hope to use these results to support community education around safe ATV riding practices in schools and/or recreational areas, particularly in rural regions of Arkansas. Furthermore, these results may support changes within state or local legislation for safer ATV use.

Objectives:
1. Examine demographic characteristics of pediatric ATV injuries in Arkansas
2. Identify geographic distribution of these injuries to target community specific education regarding ATV use
3. Identify socioeconomic status and barriers of communities with high rates of ATV injuries

KEYNOTE

Pioneer Award Keynote: A Perspective from Someone in the Caravan

Saturday, December 6, 2025, 11:30 AM to 12:30 PM

Judy Schaechter, MD, MBA
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When I hear the term “pioneer,” I think of a trailblazer, the first, or among the first, to forge a path, chart a course, or show the way. An epic hero, a singular individual at the reigns before a great expedition or conquest, a person who will, or already has, claimed new territory. Injury prevention counts such exemplary, visionary leaders among its pioneers.

At the same time, “pioneers,” when applied to injury prevention, and across public health, rarely exists in the singular. Leaders of child injury prevention are collaborative, inclusive, diverse, spanning across departments, institutions and communities. They make change by leading movements and coalitions. They value the caravan. Increasingly, they are the caravan.

From the Bible to the Oregon Trail, from the discovery of small pox vaccination to mRNA utilization, from child labor laws to cannabis packaging, we credit great accomplishments to great individuals. And while individuals absolutely inspire us to action and themselves make tangible difference, it is hard to think of an epic event or accomplishment that did not depend – absolutely depend – on many people. Certainly, nothing I ever did that matters did I do alone. As Margaret Mead said, "Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has". The ‘group’ is key. That group is the Coalition, and it allows us to move forward together as pioneers, pioneers who share an “Injury Free” vision.

IFCK welcomed me into the caravan of pioneers twenty-five years ago and has done so time and time again. When, knowing nothing and bringing no tangible resources, I asked to join as a new site, IFCK showed me the map/handbook and helped our Miami site launch. When Miami looked at local data and declared that its primary concern was firearm injury prevention (always a sensitive topic, one some groups wanted to keep at a distance), IFCK welcomed us, and even circled the wagons when one of us became part of a lawsuit for child safety. When asked to consider injury in the context of anti-racism and then climate change, IFCK again said yes.

Our current times bring unprecedented change and challenge, putting children and the public’s health at significant risk, now and into the future. The landscape and horizon are altered in terms of funding, access, and agenda. While visionary leaders are still needed, singular individuals are easily targeted. The times call for caravans. It is on us to connect, to collaborate, to reinforce partnerships and coalitions – to find and expand community. Communication is essential; sharing of truth, and clarity of the limits of that truth, are critical to credibility. Committing to our common values and principles will help move us forward.

I am incredibly grateful to this coalition of colleagues, this caravan that is IFCK, which has helped me (and each of us) to be one among the pioneers.

Objectives:
1. Identify three significant public health advances associated with more than a single individual.
2. List at least three skills essential to successful injury prevention advocacy.
3. Adapt crisis management communication approaches to injury prevention tool kit.

PLATFORM PRESENTATIONS

Safe Sleep/SUID/Mental Health

Saturday, December 6, 2025, 1:30 PM to 2:45 PM

This session highlights strategies to prevent SUID and promote mental health through data-driven, equity-focused, and community-based approaches. Analyses from Cook County link unsafe sleep and SUID to socioeconomic and environmental risks; a revised equity framework translates findings into actionable prevention steps. Partnerships in Oregon show how multidisciplinary efforts can deliver culturally tailored safe sleep education, while Iowa data reveal teens' frequent caregiving roles and unsafe practices. A decade of Fresh Check Day events demonstrates the success of peer-led suicide prevention, and a reimagined injury report model emphasizes community voice and measurable equity goals.

Learning Objectives:
1. Identify key social and environmental risks contributing to unsafe sleep and SUID.
2. Apply equity frameworks and partnerships to guide targeted prevention strategies.
3. Recognize the role of youth and caregivers in promoting infant safe sleep practices.
4. Evaluate peer-led programs improving mental health awareness and help-seeking.
5. Use community-informed reporting to prioritize equitable injury prevention actions.

Moderators:

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Layered Risk: Sudden Unexpected Infant Death in the 2nd Largest US County

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Background: Sudden Unexpected Infant Death occurs about once a week in Cook County, Illinois, the second largest county in the United States, where SUID disproportionately affects families from high hardship communities. Factors like prematurity, prenatal smoking, and unsafe sleep environments are known risk factors for SUID. The Cook County SUID Case Registry team reviews each SUID following monthly Child Death Review meetings and these data are analyzed annually to identify possible prevention insights.

Methods: Cook County SUID Case Registry data from 2019-2023 were analyzed for descriptive characteristics including infant age, race, ethnicity, gestational age, maternal age, prenatal/household smoke exposure, and sleep environment hazards. Case reviews (including narrative review) identified patterns of risk which were quantified to provide proportions of SUID that occurred among families with histories of domestic violence or substance use; and among families whose infant died when they were away from their usual home ("temporary stays"). SUID that occurred among preterm infants during temporary stays were further analyzed to detail risk among this population.

Results: From 2019-2023 there were 220 SUID, of which 206 (94%) were sleep-related. SUID peaked among infants aged 1-2-months old. 55 (27%) SUID were found to be due to accidental suffocation. Nearly all infants (99%) were found in an unsafe sleep environment. Infants were found on their side or stomach (86, 42%); while bedsharing (134, 65%); in a non-approved infant sleep space (172, 83%); and/or with soft bedding (189, 92%). SUID occurred among 154 (75%) Non-Hispanic Black (NHB) infants, 33 (16%) Hispanic infants, and 17 (8%) non-Hispanic White (NHW) infants. SUID occurred in 56 (28%) preterm infants. SUID occurred among 30/166 (15%) infants with prenatal/household smoke exposure, among 31 (15%) families with a history of domestic violence and 49/181 (27%) families with a history of substance use (when these variables were known). SUID occurred among 33 (16%) infants during temporary stays, whose peak age at death was 4-months-old. Thirteen SUID occurred among preterm infants during temporary stays: Amont these infants, all were Non-Hispanic Black (NHB) and 5 (38%) were one of twins. Four (31%) were categorized as suffocation-related SUID. No crib was present in the temporary stay location for 5/11 (45%) infants for whom this information was known. Multiple unsafe sleep factors [non-supine sleep (5/13, 38%), non-approved

sleep surface (13/13, 100%), bedsharing (11/12, 92%), soft bedding (13/13, 100%)] were present. Bedsharing occurred on adult beds (12/13) which were shared by adults [10/13 (77%)], siblings [8/13 (62%)], or both adults and siblings [6/13 (46%)]. Ten families (77%) had a history of child welfare involvement. Six infants (46%) were in the care of non-parent supervisors when they died.

Conclusions: SUID in Cook County is closely tied to complex social issues including domestic violence, substance use and temporary stays. Preventing SUID connected to these issues necessitates partnership with the trusted social agencies that address them.

Objectives: 1. SUID epidemiology in Cook County, IL 2. Proportion of SUID associated with complex social circumstances 3. Local SUID epidemiology may drive new prevention partnerships

The Utility of a Modified Kendi-Macy Framework for SUID Prevention

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Background: Sudden Unexpected Infant Death (SUID) takes the lives of ~3500 infants each year in the United States and has seen virtually no progress in prevention for more than 2 decades. SUID risk is tied closely to poverty. The relationship between SUID risk and poverty is multilayered and complex which hinders the generation of simple and effective prevention programs. In 2023, an Injury Equity Framework was proposed to aid careful review of child deaths and injuries to generate prevention recommendations.

Methods: Beginning in July 2023 the Kendi-Macy Injury Equity Framework was applied to review SUID in Cook County, Illinois which includes Chicago where racial disparity of SUID is highest among the most populous cities in the country. The original framework was tailored to work best for SUID and for a resource-limited setting. The Cook County SUID Case Registry team used this process in monthly meetings to carefully review how social influences of health directly contributed to each death and to generate practical SUID prevention recommendations addressing contributing factors in high-risk populations of Cook County. For each death, the grid of the matrix was filled with contributions from all team members. Recommendations were generated and efforts to act on these recommendations were taken.

Results: From July 2023 to May 2025, a total of 64 SUID were reviewed using the Cook County-modified injury equity matrix (IEM). IEM review surfaced 52 ideas among 5 categories of further pursuit: 1) data discovery (7), 2) messaging lessons (14), 3) advocacy opportunities (8), 4) actionable prevention (19), and 5) policy recommendations (4). Of these ideas, all data discovery was completed; 4/8 advocacy opportunities were pursued; 13/19 prevention programming efforts were completed or are ongoing, and 2/4 policy recommendations were adopted. Data discovery included further analysis of SUID related to temporary stay situations, domestic violence, substance use history, and child welfare involvement. Prevention programming included outreach to relevant support agencies (e.g. domestic violence, substance use, shelters), safe sleep training tailored to local agency needs (e.g. WIC/home visiting/doulas), and a combined SIDS and DV awareness resource fair. Adopted policy recommendations included developing Guidance for Safe Sleep in Shelters, including advocacy to ensure infants in Chicago shelters have a bassinet or portable crib for sleep; and a collective advocacy effort eliminating the prenatal visit requirement for families to receive a portable crib from a Medicaid managed care plan. Pending policy recommendations include work to require hotels/motels to provide safe sleep spaces for infants, and advocacy to have all SUID in Cook County receive equitable evaluation by the Illinois Department of Children and Family Services. At times, IEM review generated questions that led to rich discussion without an actionable outcome (4).

Conclusions: The Kendi-Macy framework modified for SUID was fruitful to identify innovative prevention measures to address the complex interplay between poverty and SUID risk.

Objectives: 1. SUID review using a methodical approach deepens understanding of the association between poverty and SUID risk. 2. A multidisciplinary review team allows for diverse perspectives and generates multiple avenues to further SUID prevention. 3. SUID surveillance is enhanced by methodical case review.

Strange Bedfellows: A Non-Traditional Safe Sleep Program in Oregon

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Background: In Oregon, sleep-related deaths account for the highest percentage of infant deaths behind perinatal conditions and congenital malformations. To address this issue, a local county government agency traditionally not associated with public health has partnered with public health organizations and local hospitals to provide free safe sleep kits (portable crib and sheet, sleep sack, safe sleep book, pacifier and educational materials) along with in-person safe sleep education to income eligible families in either English or Spanish. The program's objectives include a reduction in sleep related deaths for infants in the county through increased access to culturally appropriate in-person education and the distribution of free safe sleep kits to income eligible families. AAP approved bassinets are available for transient families or those whose living space won't accommodate a full-sized portable crib to ensure the caregivers needs are appropriately met.

Methods: Public health nurses from the local county health department and injury prevention specialists from local

hospitals meet with families individually to assess their needs around safe sleep. This 1:1 education is targeted to meet the family where they are and provide the resource in safe and familiar setting such as their home, local community baby shower, 1:1 appointment, or when inpatient at local hospital. Safe sleep education, including hands on portable crib set up, is provided to caregivers in either English or Spanish, however, every attempt is made to provide the safe sleep education and instruction in the caregiver's native language. To be eligible, families must be a resident of the county and must qualify for public benefits or demonstrate a financial need. The program is managed by the county government agency, which has designated state funding available to support local child fatality prevention initiatives. Prior to program implementation, local public health agencies and hospitals struggled to find funding for safe sleep resources for families in need.

Results: Since program inception in July 2021, more than 1300 safe sleep kits and 1:1 education has been provided for income eligible families in the county.

Conclusions: Fatalities related to an unsafe sleep environment are the number one cause of preventable death for infants in this Oregon county. Our non-traditional safe sleep program utilizes a multidisciplinary approach to better identify and reach more families in need of safe sleep resources and education.

Objectives: 1. The benefits of utilizing a multidisciplinary and non-traditional approach to address a public health issue. 2. How to leverage community partnerships to implement an upstream prevention program. 3. A different approach to reducing sleep related deaths for infants.

Addressing College Mental Health with the Fresh Check Day Program

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Background: Suicide is the second leading cause of death among teens and college-aged young adults and 12.2% of people aged 18-25 experiencing serious thoughts of suicide in the past year. This data highlights the urgent need for prevention efforts tailored to this high-risk population. Fresh Check Day (FCD), designated in the Suicide Prevention Resource Center's Best Practices Registry, is a peer-driven mental health promotion and suicide prevention program developed by the Jordan Porco Foundation to support student mental health needs on college campuses. The program aims to reduce stigma, increase awareness of available mental health resources, and encourage help-seeking behavior through interactive booths, campus-wide collaboration, and student engagement. The rate of 18–25-year-olds experiencing mental, behavioral, or emotional health issues has been increasing significantly over the past several years so hospital- and campus-based programs play a critical role in promoting mental health and connecting individuals with resources.

Methods: Following the FCD programs, anonymous post-event participant surveys were administered to assess student perceptions, knowledge gains, and changes in attitudes toward mental health. Scaled, and open-ended items were included, focusing on key metrics such as preparedness to support peers, awareness of mental health resources, and comfort discussing mental health. Survey responses and demographic information were analyzed using Microsoft Excel and Tableau to visualize trends and examine the program's utilization across diverse student populations. Qualitative feedback was thematically analyzed to understand the personal impact of the program, identify common themes, and highlight areas for improvement.

Results: From January 2014 to May 2025, 1,517 FCDs took place at colleges in 46 states; Over 300,000 students participated in FCD programs and 119,803 (40%) students completed the post-event surveys. 83.7% reported feeling more prepared to help a friend exhibiting warning signs of suicide; 87.4% were more aware of mental health resources available to them; 83.7% were more likely to ask for help if experiencing emotional distress themselves; 82% felt more comfortable talking about mental health and suicide. Data collected from community colleges showed equal or greater impact across all effectiveness indicators when compared to all FCD campuses. Hispanic/Latinx, Black/African American, and Asian/Asian American respondents averaged equal to or greater than White/Caucasian respondents across all effectiveness indicators.

Conclusions: Data collected over the past decade supports FCD's quality, efficacy, and vital importance to college communities across the country and justifies further expansion of the program. Results indicate a significant increase in student awareness of mental health resources and services available on campus and in the broader community, enhanced student capacity to recognize and respond to mental health crises among peers, and increased willingness among students to seek out mental health support for themselves. These impacts may prevent young adult suicide deaths.

Objectives: 1. Understand the importance of effective primary suicide prevention programs for college-aged young adults. 2. Describe Fresh Check Day participants' reported perceptions, knowledge gains, and changes in attitudes toward mental health. 3. Illustrate comparisons across campus demographics and student identities.

Infant Safe Sleep Practices of Rural Iowa Adolescents

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Background: The number of infants <1 year of age that die of Sudden Unexpected Infant Death (SUID) in the U.S. each year is similar to that of the number of motor vehicle-related deaths in those <20 years. By following safe sleep practices, the risk of SUID can be decreased. Our study objectives were to: 1) determine the proportion of rural Iowa adolescents that take care of infants <1 year of age and in what capacity, and 2) identify the proportion that have placed infants <1 year of age to sleep and whether they always followed basic infant safe sleep practices.

Methods: An anonymous survey was performed of 2025 Iowa FFA (formerly Future Farmers of America) Leadership Conference attendees at the University of Iowa Stead Family Children's Hospital safety booth. Surveys were completed either electronically on Qualtrics via phone or on paper which were later entered into Qualtrics. Data were exported and descriptive and bivariate (chi-square) analyses were performed using Excel and Vassarstats (http://vassarstats.net/).

Results: 1641 adolescents 13-18 years of age completed the survey. Nearly three-fifths (59%) were 16-18 years old and over three-fifths (61%) were female. Nearly half (48%) lived on a farm, 23% lived in the country, but not on a farm and 29% lived in a town. The vast majority (95%) were non-Hispanic White. Overall, nearly three-quarters (72%) had taken care of a child <1 year of age; of these, 55% had done so as a babysitter, 43% did so for a relative's infant (not a sibling) and 35% had taken care of a sibling <1 year of age. Overall, 57% stated they had placed a baby <1 year of age down for a nap or nighttime sleep. Of adolescents that had placed a baby <1 year of age down for sleep, 45% only reported places that would be considered safe (i.e., bassinet, baby's own crib, pack and play/portable crib). As far as the sleep position, 78% stated they only placed babies <1 year of age down to sleep on their back. There were no significant differences by sex regarding proportions that had taken care of a baby <1 year of age, that had babysat, taken care of a relative's child or had taken care of a sibling, that had placed a baby <1 year of age down to sleep, or that had reported always placing a baby in a safe place and a safe position to sleep.

Conclusions: Most rural adolescents in the study had placed a baby <1 year of age down to sleep with most having placed an infant in an unsafe place and one-fifth having placed infants not on their back. Adolescents should be targeted for infant safe sleep education, for example, in school and during babysitting classes.

Objectives:
1. Discuss the proportion of rural adolescents that take care of babies less than 1 year of age and their relationship to those children.
2. State the proportion of adolescents that report always placing an baby less than 1 year of age for a nap or nighttime sleep in a safe place and in a safe position.
3. Identify at least two ways in which adolescents could be educated regarding infant safe sleep practices.

Starting with "Why:" Setting a course for the future of injury prevention

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Background: Every three years, for over 30 years, the Injury Prevention Coalition created the Childhood Unintentional Injuries Report to the Community. The report provides data trends on unintentional injury deaths, hospitalizations and emergency department discharges for children 0 to 14 years of age for the across the county. Throughout the years leading injuries tables informed other county report cards and organizational programs throughout the county. The Report stood as a resource for organizations throughout the county and a guide to injury prevention practices.

Methods: The 2025 report is distinctly different than the previous reports. Influenced by three separate events, the Report changed from a resource document to a call to action. The first shift was in an injury prevention mindset. The Coalition members, charged with keeping children safe and healthy met and began action planning, building specific and achievable programs and collaborations that would begin to move the needle on intractable injuries for kids, drowning, roadway crashes, and safe sleep for infants. The second event occurred when the state changed its injury data reporting process. Although easily accessible, the data for injuries is not available if the number of incidents met a threshold of 11 or more individuals. This change impacted the data and trend analysis historically included in the report. This change created challenges in comparing data year-over-year and resulted in an incomplete unintentional fatalities table. Despite the changes, the table on unintentional injury death still aligned data to show the three leading causes, drowning/submersion, suffocation and motor vehicles. The final influence in the context of a changing world was seeking the input of a community voice, the Injury Prevention Advisory Committee, to confirm and guide our work and this report. We invited a group of diverse leaders and parents to share their insights about child injuries that will lead to designing programs building on the communities' strengths.

Results: When Simon Sinek speaks of starting with "Why" it is because there is familiarity and comfort in describing the "How" and the "What". This report is in the wake of a pandemic that changed our world. Starting with "Why" was critical to understanding the new reality of childhood injury. The result of this new perspective on the Community Report shows in the language, the structure, and the promise to report back to the community in 3 years with the progress and challenges. These are commitments through words, data and action plans calling for equity for all children.

Conclusions: Bringing community voice to the design and discussions about unintentional injury puts children in the context of family and culture. The Action Plans, built with the community voice, are measurable and accountable. Sharing the latest data trends and proven practices we can make the lives of children safer and healthier

Objectives:
1. By combining data, action plans and community voice you expand your perspective on solutions
2. Taking the time to develop Action Plans with measurable outcomes holds a coalition of individuals accountable.
3. Data challenges are inevitable and seeking out other sources of data, like community voice can build the richness of lived experience.

WORKSHOP SESSION 3A

Establishing and Maintaining a Successful Adaptive Needs Seating Clinic

Saturday, December 6, 2025, 3:00 PM to 4:00 PM

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Presenters from two major hospital systems share successes and discuss challenges of running an Adaptive Needs Assessment Clinic from initial development through current implementation.

Follow the challenges and learnings of two major children's hospital systems in the development and successful implementation of their Adaptive Needs Seating Assessment Clinics. In this session we discuss the need for adaptive seating clinics and the need for thorough, effective evaluation to ensure that our most vulnerable and medically fragile children are able to be transported safely with their caregivers/families.

We discuss the evolution of these seating clinics including barriers to the establishment of seating clinics such as staffing time, space to complete assessments in a welcoming environment, methods for completion of initial evaluation and obtaining demonstration product to ensure all needs are met and that seating systems are a good fit for the child as and people using the product as well as taking the time to ensure these seating systems are compatible in family and/or caregiver vehicles. Unfortunately many providers and therapists prescribing this necessary equipment are not well-versed on child passenger safety as a whole so many mistakenly order incorrect or incompatible equipment for children and their families. Presenters walk through language in letters of medical necessity that our teams have been successful with including diagnosis codes and medical equipment coding for insurance billing purposes.

We then take workshop participants further, discussing the partnerships and connections made with durable medical equipment providers to follow families from the initial seating assessment, the submission of the letter of medical necessity, to medical equipment provider intake, through the insurance approval/denial process, through funding of the seating system and finally delivery and education for families/caregivers on installation and proper use of the product received.

Additionally, we will discuss learnings and challenges in our multi-disciplinary support for Administrative Rule advocacy and will touch on legislative changes made to support the requirement for insurance funding for children in need of this valuable equipment.

Objectives:
1. Learn how two hospital systems built Adaptive Needs Assessment Clinics.
2. Recognize challenges and discover successful remedies, and how programs can evolve.
3. Understand the need for follow-through after the initial assessment has been completed.

WORKSHOP SESSION 3B

Way Beyond the ABC's: Tailoring Safe Sleep Training for Community Health Agencies

Saturday, December 6, 2025, 3:00 PM to 4:00 PM

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Following extensive dissemination of the Cook County SUID Case Registry (SUID-CR) data and Community Partnership Approaches for Safe Sleep (CPASS Chicago) prevention efforts, CPASS Chicago was asked to provide safe sleep training to the City of Chicago's postpartum home visiting nurses. This invitation spurred our efforts to replicate and expand CPASS Chicago's approach with families and community members to reach community health partners supporting pregnant and parenting families.

This workshop will provide an overview of the CPASS Chicago approach and lessons learned in tailoring Safe Sleep training to specific community health agency roles and needs. We will share our experience training home visiting nurses, doulas, social workers and WIC providers. We will discuss the value of 1) sharing local epidemiology coupled with individualized SUID case review, 2) describing barriers to safe sleep among specific populations served by community health agencies, 3) listening to community health partners' experiences within their community, 4) encouraging community health partners to consider their role in SUID prevention, and 5) using a trauma-informed, strengths-based, relational approach.

We will then break out into 3 groups to lead colleagues in considering various approaches to tailoring safe sleep training for their communities. We will share elements of our approach including humanizing data, conversation starters, #clearthecrib challenge, building on agency values, strengths and assets, addressing common myths, and providing tangible resources. At the conclusion of the workshop, colleagues will come away with methods to strengthen their safe sleep training approaches to get way beyond the ABC's.

Objectives:
1. Identify opportunities within your current workflow to address safe sleep practices in your community.
2. Identify strategies for addressing barriers within a specified population.
3. Analyze the applicable areas of evidenced based practice that address safe sleep barriers & solutions.
4. Summarize opportunities for optimizing safe sleep practices and provide family-centered methods to support safe sleep.

WORKSHOP SESSION 3C

Question, Persuade, and Refer Gatekeeper Training

Saturday, December 6, 2025, 3:00 PM to 4:00 PM

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Surveys show that most healthcare professionals, including mental health professionals, do not receive specific or adequate training in how to help those at risk of suicide. Unless you are a psychiatrist, the odds are you did not receive adequate and specific suicide intervention or treatment as part of your professional academic experience. Your patients assume that you are competent to help them or their loved ones survive a suicide crisis.

QPR stands for Question, Persuade, and Refer – the 3 simple steps anyone can learn to help save a life from suicide. Just like CPR, QPR is an emergency response to someone in crisis and can save lives. QPR is the most widely taught Gatekeeper training in the world. A gatekeeper is someone in a position to recognize a crisis and the warning signs that someone may be contemplating suicide. Gatekeepers can be anyone, but include parents, friends, neighbors, teachers, ministers, doctors, nurses, office supervisors, squad leaders, foremen, police officers, advisors, caseworkers, firefighters, and many others who are strategically positioned to recognize and refer someone at risk of suicide.

Each participant receives a booklet that contains all the material covered in the class, as well as referral numbers/information. A certificate of completion is provided to all participants after the class. Participants also receive addition items such as stress balls, pens/pencils, and other suicide prevention items for attending.

Objectives:
1. Recognize the common causes of suicidal behavior
2. Recognize the warning signs of suicide
3. Identify local and national resources to help themselves or someone in crisis
4. Recognize opportunities to bring suicide prevention training to clinical and non-clinical team members within your institution

WORKSHOP SESSION 3D

AI in Action: Leveraging AI for Injury Prevention Campaigns

Saturday, December 6, 2025, 3:00 PM to 4:00 PM

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Co-host, *Communications Breakdown*
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Join us for an interactive workshop designed to teach you how to harness the power of artificial intelligence to create impactful injury prevention campaigns. Participants will follow a step-by-step demonstration to learn how AI tools can support campaign planning, content creation, understanding your audience, and evaluation. No technical expertise needed – just bring your curiosity. By the end of the session, you'll walk away with practical tips and a new confidence in using AI in your injury prevention efforts.

Attendees will leave the workshop with practical skills and the confidence to start integrating AI into campaign development. They will learn how to use AI tools that can assist with each step of the campaign building process – from streamlining research, to brainstorming messaging ideas and developing visuals, to strategic outreach planning. This session will provide a roadmap for using AI as a partner to maximize productivity while maintaining high-quality outputs.

Objectives:
1. Identify at least three AI tools that can assist with injury prevention campaigns.
2. Use an AI tool to complete at least one step of a campaign-building process, such as generating a message, creating a visual, or planning an outreach strategy.
3. Outline a plan for integrating AI into their injury prevention campaigns, including identifying key tasks where AI can improve efficiency and creativity.

BONUS WORKSHOP

Making Your Dollar Stretch in Injury Prevention Programming

Saturday, December 6, 2025, 4:00 PM to 5:00 PM

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Funding is a challenge for any project, and recently, it seems to have gotten even more complicated with current cuts to budgets that were once considered consistent. For younger faculty and injury prevention professionals, finding funding is even harder as they are developing their experience and contacts. Despite these obstacles, the need for injury prevention outreach continues. Through this workshop, we'd like to take participants through planning and developing resource ideas for a new project or a program that has been in development.

The first part of the workshop is establishing a topic and framework for a specific project by establishing goals, stakeholders, a target audience, timelines, and outcome measures. We will also share common pitfalls and learning opportunities so that others can avoid these same mistakes. Through group discussion, we will also explore ensuring that program development is as equitable as possible and considers as many unintentional consequences as possible.

The second part of the workshop will focus on exploring funding opportunities through traditional and non-traditional avenues. We will also work on drafting initial communications with potential sponsors and discuss possible institutional restrictions and challenges. The focus will be on smaller capital and deliverable resources for pilot projects with the goal of developing them into long-term or recurrent projects with results that can then be used in future proposals for continued support with larger agencies.

Objectives:
1. Construct the framework for a pilot injury prevention program
2. Determine priorities and potential challenges for a pilot injury prevention program
3. Explore funding and resource opportunities for a pilot injury prevention program

CPS BONUS WORKSHOP

Learning With the *LATCH Manual*: 2025 and Onward

Saturday, December 6, 2025, 4:00 PM to 5:00 PM

Denise Donaldson, MBA, CPST-I
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This session will review several hot topics in child passenger safety and recent regulatory updates. The editor of the *LATCH Manual* will cover these topics while highlighting how that essential resource can assist CPSTs as they navigate several of the latest issues in the CPS field, like new vehicle technology and CR energy-management approaches. Along the way, examples of unusual information contained in the *LATCH Manual* that might surprise CPSTs will be highlighted.

Objectives:
1. Dig into some hot topics in CR instructions, like seatback touching and using load legs.
2. Review how some new non-LATCH vehicle features, like rear seat belt reminders and advanced air bags, can affect CR installation.
3. Learn some of the highlights of the new NHTSA rule that will affect the future of LATCH, particularly new vehicle design.
4. Help attendees become more adept at finding information they need in the *LATCH Manual*.

CHILD PASSENGER SAFETY GROUP MEETING

Deciphering CPST Lingo: Challenges Faced by Non-English Speakers

Saturday, December 6, 2025, 5:00 PM to 6:00 PM

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There are many terms in the CPST curriculum that can be difficult for people who didn't grow up speaking English. Even when a multilingual participant speaks fluent English, understanding of content is often achieved in their native language, causing potential delays in broader understanding. Presenters will share anecdotes from multilingual CPST class participants and stories from community car seat checks when the caregiver communicated through means other than spoken English.

Objectives:
1. Identify challenges individuals who were not raised speaking English may face when being presented with CPST curriculum content
2. Identify resource available to the curbside tech when presented with a situation where a language barrier is evident
3. Discuss effective teaching strategies to ensure increased understanding of technical content

PLATFORM PRESENTATIONS

Special Populations/Education

Sunday, December 7, 2025, 9:00 AM to 10:00 AM

This session explores approaches to injury prevention and mental health support through communication, education, and system-based change. Research shows children's hospitals rarely use their large social media platforms to share injury prevention content, revealing untapped outreach potential. Other projects demonstrate how targeted counseling for families of children with autism can improve safety behaviors, and how suffocation risk is higher among individuals with ASD and related conditions, highlighting the need for tailored strategies. A residency curriculum integrates injury prevention and advocacy into pediatric training, while a trauma-center initiative using the PsySTART tool enhances mental health screening and referrals for injured youth.

Learning Objectives: 1. Identify opportunities to expand injury prevention messaging through children's hospital social media.
2. Describe tailored injury prevention strategies for children and adults with autism.
3. Summarize effective models for embedding injury prevention and advocacy training in pediatric residency programs.
4. Explain how structured mental health triage tools can improve post-injury psychological care.

Moderators:

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Social Media Posts by Children's Hospitals and Injury Prevention Content - A Missed Opportunity for Education & Advocacy

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Background: Preventable injuries are the leading cause of pediatric death. Most healthcare organizations and the general public engage in social media (SoMe) to disseminate and consume health-related information. However, it is unclear how frequently pediatric hospitals leverage their SoMe platforms to educate the general public on injury prevention (IP) topics. Thus, we sought to better characterize SoMe messaging and IP content by children's hospitals.

Methods: This was a retrospective cross-sectional study of US children's hospitals' primary SoMe Facebook (FB), Twitter/X (X), and Instagram (IG) accounts. Included hospitals were associated with the Injury Free Coalition for Kids (IFCK), a current or past Centers for Disease Control and Prevention Injury Control and Research Center (CDC ICRC), a level 1 pediatric trauma center, or a pediatric surgery fellowship. Accounts established after 1/1/23 or covering adult health topics were excluded. Trained data abstractors reviewed all posts from 2023; posts were dichotomized into IP vs non-IP content, with further subcategorization based on injury mechanisms and other topics covered. Data abstraction is ongoing. Descriptive statistics and frequencies with ranges were calculated. Chi-squared analyses were used for comparisons between groups.

Results: Of the 82 unique hospitals with eligible SoMe accounts, all used FB and 69 (84.1%) used all 3 SoMe platforms. FB accounts had the most followers (median=53,500; 25th%ile 25,750; 75th%ile 124,250) compared to IG (median 12,831; 25th%ile 6,512; 75th%ile 22,229) and X (median 10,125; 25th%ile 5,840; 75th%ile 23,572). IP affiliations included IFCK (N=40; 48.8%), level 1 pediatric trauma center (N=78; 95.1), pediatric surgery fellowship (N=50; 61.0%), and CDC ICRC (N=18; 22.0%). Only 10 hospitals (12.2%) had all four IP affiliations, while 27 (32.9%) had three, 20 (24.4%) had two, and 25 (30.5%) had only one.

Of 25,685 posts from 43 hospitals, 1,600 (6.2%) posts covered IP. Individual hospital SoMe accounts discussed IP in 0% to 12.4% of posts. Amongst IP posts, the most frequently covered specific topics were mental health/suicide (N=210; 0.8%), poisonings (N=161; 0.6%), and water safety (N=124; 0.5%). Most non-IP posts were focused on general publicity/goodwill (N=24,085; 46.5%); the most frequently covered medical categories were cardiac (N=1,110; 4.3%), cancer (N=984; 3.8%), and neonatal (N=804; 3.1%). Hospital affiliation with IFCK (??2 =10.72; p<.001), pediatric surgery fellowship (??2 =16.81; p<.001), and level 1 pediatric trauma center (??2 =6.65; p=.01) was associated with more IP content. More affiliations with IP oriented organizations were also associated with more IP content (??2 =35.05; p<.001).

Conclusions: Although children's hospitals have large SoMe followings, IP is rarely discussed in SoMe content. While ties to IP oriented organizations improves coverage of IP content, this represents a critical missed opportunity to address the leading causes of pediatric deaths.

Objectives: 1. Although children's hospitals have large social media followings, pediatric injury prevention is infrequently covered on social media channels. 2. Stronger connections to organizations that promote injury prevention improves the frequency of injury prevention content on social media.

3. Content covered on US children's hospitals' social media channels do not reflect the epidemiology of pediatric injuries or pediatric morbidity & mortality.

Assessing Feasibility of Providing Injury Prevention Counseling for Caregivers of Children with Autism in the Outpatient Setting

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Background: Unintentional injury is the leading cause of death for children and teens ages 0-19 years old. Children with Autism Spectrum Disorder (ASD) can exhibit high-risk behaviors, placing them at increased injury risk due to accessing improperly secured dangerous items, elopement, and drowning. The primary objective is to examine the feasibility of injury prevention counseling in a pediatric ASD outpatient clinic. The secondary objective is to evaluate caregiver injury prevention practice changes related to firearm safety, elopement, and water safety.

Methods: This was a prospective interventional study of caregivers of youth with ASD of varying severity presenting for new patient appointments to an outpatient pediatric ASD clinic in a large metropolitan area between July 2024 and January 2025. Advanced practice providers, specifically nurse practitioners, assessed caregiver injury risk awareness utilizing standardized questionnaires and provided verbal anticipatory guidance and written injury prevention resources. Caregivers were invited to participate in one-month follow-up phone surveys, which assessed the feasibility of injury prevention counseling and caregiver injury prevention practice changes. The primary analysis included feasibility measures such as caregiver attrition and intervention acceptability. Likert-scale responses were tabulated manually and dichotomized to strongly agree/agree (affirmative) vs. neutral/disagree/strongly disagree. Secondary analysis evaluated injury prevention practice changes related to elopement, water safety, and firearm safety via mixed-effects logistic regressions.

Results: In total, 68% of approached caregivers completed a follow-up interview (n=21). Of these, 100% determined the clinic to be an appropriate setting to discuss elopement and water safety and 94% for firearm safety. Caregivers were most knowledgeable regarding elopement injury risk (76%). Enrollment in swimming lessons had the highest relative increase (153%) of all assessed water safety practice changes (pre: 19%, post: 48%). Among firearm owning families (n=6), there was a 24% relative increase in those "always" utilizing safe storage devices (pre: 67%, post: 83%) and a 66% relative increase in those storing firearms separately from ammunition (pre: 50%, post: 83%). There were significantly more self-reported preventive measures post-intervention compared to pre-intervention for both elopement (OR=2.22, 95% CI [1.45, 3.40], p=0.0002) and water safety (OR=1.60, 95% CI [1.18, 2.16], p=0.002).

Conclusions: The outpatient subspecialty clinic setting offers a unique opportunity for injury prevention counseling for children with ASD. Our study demonstrates that these subspecialty outpatient clinics are an appropriate place for these conversations and that caregivers respond to the injury prevention education with tangible practice changes.

Objectives: 1. Determine if outpatient clinics are an appropriate setting for injury prevention counseling for caregivers of children with ASD. 2. Illustrate perception of injury risk in caregivers of children with ASD. 3. Examine caregiver injury prevention strategies relating to elopement, water safety, and firearm safety.

Association of Autism Spectrum Disorder and Common Co-Occurring Conditions with Suffocation

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Background: People with autism spectrum disorder (ASD) are at heightened risk of injury-related death and specific injuries, such as drowning and self-injury. As ASD prevalence rises, epidemiologic data describing specific injuries, such as suffocation, are essential for prevention efforts. We aimed to describe the excess risk of suffocation associated with ASD and common co-occurring diagnoses among people treated in United States (US) emergency departments (EDs).

Methods: Using a repeated cross-sectional study design, we analyzed data from the 2016-2020 Nationwide Emergency Department Sample (NEDS), the largest US all-payer ED visit claims database. Children ? 1 years and adults diagnosed with ASD and treated in EDs were identified using ICD-10-CM code F84.0. Intellectual disability (ID), attention-deficit/hyperactivity disorder (ADHD), and Alzheimer's disease and related dementia (ADRD) were similarly identified using relevant ICD-10-CM codes. ED visits for suffocation were identified using the ICD–10–CM external cause-of-injury matrix. Weighted multivariable logistic regression models were used to estimate the adjusted odds ratios (aOR) and 95% confidence intervals (CI) of suffocation-related ED visits in persons with and without ASD, ID, ADHD, and ADRD. Each model was adjusted for the other conditions, age, sex, urbanicity, and payor.

Results: The 2016-2021 NEDS recorded a weighted total of 803,777,608 ED visits, of which 1,012,210 (0.13%) were related to suffocation. Suffocation accounted for 0.35% of ED visits in patients with ASD, 0.67% of ED visits in patients with a diagnosis of ID, 0.07% of ED visits in patients with a diagnosis of ADHD, and 0.34% of ED visits in patients with a diagnosis of ADRD. Patients with ASD had a 75% increased odds of suffocation (aOR = 1.75; 95% CI: 1.65, 1.86), patients with ID a more than six-fold increased odds of suffocation (aOR = 6.56; 95% CI: 6.2, 6.94), patients with ADHD a 44% increased odds of suffocation (aOR = 1.44; 95% CI: 1.35, 1.53), and patients with ADRD a 106% increased odds of suffocation (aOR = 2.06; 95% CI: 2.01, 2.12). Across the lifespan suffocation accounted for a larger proportion of ED visits among patients with ASD than those without ASD.

Conclusions: Children and adults with ASD have an increased odds of ED-treated suffocation. ID, ADHD, and ADRD common co-occurring diagnoses with ASD across the lifespan, are also associated with increased odds of ED-treated suffocation. Further understanding of environmental circumstances and unique factors that may increase risk of suffocation in people with ASD is needed.

Objectives: 1. Children and adults with autism have an increased odd of ED-treated suffocation. 2. Review the risk of suffocation in children with autism among various age groups. 3. Understand risk factors that may predispose children with autism to suffocation.

Developing a Longitudinal Advocacy and Injury Prevention Curriculum for Pediatric Residents

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Background: Unintentional injuries remain the leading cause of death for children ages 1–21. In 2023 alone, a regional children's hospital reported over 700 trauma admissions, excluding numerous additional injuries managed in the emergency department. The majority of the hospital's pediatric patients are from underserved backgrounds, with high proportions of racial/ethnic minorities and families living below the federal poverty line. While the pediatric residency program includes some advocacy-focused education, a gap in training exists during the second and third years. Additionally, current curricula lack emphasis on media literacy and strategic communication—key tools for modern advocacy. This project aims to develop a longitudinal curriculum for senior residents during "Y weeks" that equips pediatric residents with both injury prevention knowledge and communication skills to effectively engage communities.

Methods: This program will span July 2025 to March 2026. Twenty-seven senior residents will be divided into five large cohorts (5-6 residents each), with each cohort assigned one of five high-priority injury topics: drowning prevention, poison prevention, safe sleep, burn prevention, or motor vehicle safety. Each cohort will be further divided by age focus (0–10 and 11–18 years). In partnership with Safe Kids California, each cohort will be paired with a content expert mentor and participate in a series of structured learning modules, including written-to-verbal translation of research articles; simulated advocacy conversations with families; health policy workshops; and field trips to relevant community organizations. Residents will then design and implement a health campaign for their injury topic, including bilingual (English/Spanish) materials such as blog posts, infographics, and short videos. Campaigns will be presented during an Interprofessional Injury Prevention Day to residency faculty, hospital staff, AAP Chapter members, and Safe Kids Coalition partners.

Results: By March 2026, we anticipate ten distinct health campaigns (one per sub-cohort), each consisting of a minimum of two educational deliverables. This will yield at least 20 bilingual materials to be used in community outreach. Qualitative evaluation will include grading rubrics used by stakeholders during the capstone showcase to assess content accuracy, public engagement, and creativity. Residents will complete pre- and post-tests to assess their knowledge of injury prevention and advocacy, alongside self-assessment surveys to measure growth in confidence and skill.

Conclusions: This novel curriculum fills a critical training gap by integrating injury prevention and advocacy skills into a longitudinal format. With structured mentorship and community partnerships, residents gain real-world communication experience while producing valuable educational resources. The model is scalable and replicable for other institutions aiming to enhance resident advocacy and community impact.

Objectives: 1. Describe the structure of a longitudinal injury prevention and advocacy curriculum integrated into pediatric residency training. 2. Identify effective strategies for teaching communication skills to residents using injury prevention topics. 3. Demonstrate how to leverage community partnerships to guide resident-led health campaigns and evaluate outcomes.

From Triage to Treatment: Enhancing Mental Health Screening Compliance in Pediatric Trauma Patients

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Background: Pediatric trauma can lead to serious mental health issues, but identifying at-risk patients is challenging. To address this, a Pediatric Emergency Department (PED) at a level 1 pediatric trauma center launched the PsySTART Pilot Project in June 2024. PsySTART is a validated triage tool that screens trauma patients for mental health risks and helps connect individuals at high risk to a 12-week trauma-focused cognitive behavioral therapy (TF-CBT) program. The tool satisfies the 2022 American College of Surgeons Trauma Center performance measure for a mental health screening on all trauma patients. However, following implementation, only 46% of triage forms were completed in the first five months, highlighting system inefficiencies. Incomplete screening may lead to missed follow-up care, raising concerns about equitable mental health support for all pediatric trauma patients.

Methods: This program aims to raise PsySTART triage form completion for pediatric trauma activations in a level 1 PED from 52% to 70% over 12 months. Using the Plan-Do-Study-Act (PDSA) quality improvement method, a multidisciplinary team identified key interventions, including a Just-in-Time training video and an electronic health record (EHR) reminder. Training

completion and PsySTART form completion rates will be tracked, and an annotated run chart will track each intervention's impact.

Results: After the first PDSA cycle (Just-in-Time training video), completion rate dropped to 42%. Only 30% of eligible staff completed the training. After the second PDSA cycle (EHR reminder), completion rate increased to 71%. Overall completion rate is now 50% since PsySTART implementation. Prior to the first PDSA cycle, the percentage of patients referred to a mental health provider per trauma activation was 13%. This increased to 17% and 24% during the first and second PDSA cycle, respectively. 2 patients (1%) were referred to TF-CBT prior to the first PDSA cycle. 2 patients (4%) and 3 patients (5%) were referred to TF-CBT during the first and second PDSA cycle, respectively. 2 patients have completed TF-CBT and 2 are currently enrolled.

Conclusions: Implementing the PsySTART triage system revealed the importance and challenges of identifying pediatric trauma patients at risk for developing mental health complications. Despite low initial completion and training rates, targeted interventions—especially EHR reminders—led to improved PsySTART use and more referrals to specialized mental health care. Although training uptake remained low, the increase in PsySTART completion and subsequent referrals to mental health and TF-CBT providers suggests early progress toward more equitable and effective post-trauma care. Continued refinement is needed to sustain improvements and ensure timely access to appropriate post trauma mental health care.

Objectives: 1. Describe the purpose and function of the PsySTART triage tool in identifying high-risk pediatric patients and facilitating mental health referrals.
2. Evaluate the effectiveness in specific quality improvement interventions on PsySTART completion and subsequent referrals to mental health and TF-CBT services.
3. Compare the effectiveness of an educational intervention to a behavioral prompt during program implementation.

LIGHTNING ROUND PRESENTATIONS

Sunday Lightning Round

Sunday, December 7, 2025, 10:30 AM to 12:00 PM

This lightning session brings together data tools, hospital- and community-based programs, and epidemiologic studies to advance pediatric injury prevention, including a curated data warehouse and ED surveillance system, implementation of trauma-informed youth violence interventions, expansion of child passenger safety partnerships and a car seat loaner program for children in spica casts, and analyses of attitudes toward firearm storage among farming parents. It also updates trends and risk factors for key injury mechanisms—motor vehicle crashes, dog bites, ATVs, wheeled recreational devices, and pediatric traumatic brain injury—while exploring follow-up patterns and mental health emergency department use after firearm injuries in youth.

Learning Objectives:
1. Explain how data systems enhance pediatric injury surveillance and prevention.
2. Summarize key trends across major child injury types.
3. Highlight effective trauma-informed program approaches.
4. Identify gaps in follow-up and mental health care after pediatric injuries.

Moderators:

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A Novel Data Warehouse for Injury-related Research

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Background: The Injury Control Center for Biomedical Research Excellence (COBRE) at Rhode Island Hospital is the first and only NIH-funded COBRE research center to focus solely on injury control, and supports the research activities of injury control researchers to ensure their transition to independently funded scientists. The Research to Practice and Policy (RPP) Core equips COBRE-affiliated investigators with tools to tailor their study methodologies and dissemination strategies for impact on clinical practice and policy. Our primary objective was to design a Data Warehouse with comprehensive archiving of training and seminars related to the Injury Control COBRE, as well as creation of a clearinghouse of publicly available data sources that can be used to study injury.

Methods: Identification of open-access datasets and other metadata for public use were identified through internet searches and snowball sampling of researchers in various injury networks. Once databases were identified and collated, PubMed and Google Scholar searches were conducted to identify publications and authors who had used each database. These authors were contacted and asked to contribute by completing slides based on a standardized template describing the database in depth. They were also asked to add a brief description of exemplar publications they co-authored

using the same database. A brief (5-7 minute) video was created using the slides and narrated by the respective authors, who were compensated for their time from the COBRE grant.

Results: To date, 51 databases have been identified and 24 supplemental videos have been created. They are publicly available on our Injury Control COBRE website. https://injurycontrolcobre.org/cores/research-to-practice-and-policy-core/research-to-practice-and-policy-database/

Conclusions: Creation of a novel Data Warehouse can be used by our Injury Control COBRE grant awardees (research project leads and pilot program researchers), and are publicly available as a centralized resource for a broad group of injury researchers.

Objectives:
1. How to access and utilize a curated warehouse of injury-related public datasets
2. Innovative methods for enhancing data usability and dissemination
3. Ways this resource bridges research to policy and practice

An Analysis of a System Change: Implementing Trauma-Informed and Evidenced-Based Practices in Injury Prevention

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Background: Project Ujima, a hospital-based violence intervention program affiliated with Children's Wisconsin, provides comprehensive trauma-informed services to youth impacted by community violence. As part of a federally funded initiative to expand gender-responsive, trauma-focused interventions, Project Ujima integrated two evidence-based programs (EBPs)—Voices: A Program of Self-Discovery and Empowerment for Girls and A Young Man's Guide to Self-Mastery (AYMG)—into its existing service framework. While theoretically aligned with the program's trauma-informed mission, implementation revealed tensions related to system readiness, staff engagement, and curriculum fit. This study explores facilitators and barriers to EBP implementation, with the goal of informing sustainable, context-responsive practice.

Methods: A qualitative narrative design was used to explore staff experiences with implementation. Eight EBP training sessions were delivered in early 2022 to 50 participants, including five Project Ujima staff. Four of these staff later participated in semi-structured interviews, alongside two leadership team members. Interview topics included perceptions of the EBPs' purpose, alignment with existing program culture, training experiences, and implementation processes. Interviews were recorded, transcribed, and thematically analyzed using a hybrid inductive-deductive coding approach. Triangulation was conducted by evaluators from Children's Wisconsin and Wraparound Milwaukee.

Results: Staff expressed differing levels of clarity regarding the rationale for integrating Voices and AYMG. While leadership articulated alignment with trauma-informed care, frontline staff reported confusion stemming from limited communication and historical resistance to structured programming perceived as "research-based." Implementation was challenged by a lack of shared decision-making and unclear role expectations during group facilitation. Shifts in responsibilities and limited onboarding for new staff contributed to inconsistency in group structure and delivery. Initial training sessions were viewed as informative but overwhelming, with limited opportunities for practical application. Staff valued informal supports but noted the absence of systematic refreshers or guidance for new facilitators. Despite this, staff demonstrated adaptability by modifying delivery to engage youth, balance curricular demands with group dynamics, and remain responsive to trauma-related needs. Despite these constraints, Project Ujima staff delivered a total of 244 hours of curriculum instruction to 47 youth, with groups held twice yearly. Sessions were co-facilitated by Crime Victim Advocates and Mental Health Professionals, with adjustments made for inclusive delivery across genders. Project Ujima also provided transportation and meals to support participation and safety.

Conclusions: Integrating structured EBPs into established, flexible trauma-informed systems like Project Ujima requires careful attention to alignment, communication, and workforce readiness. While gender-responsive curricula offer important enhancements, successful implementation hinges on engaging frontline staff early, reinforcing training through ongoing support, and adapting content without compromising core principles. Findings underscore the need for transparent leadership, shared ownership of program goals, and cross-agency collaboration to ensure that EBPs are both effective and sustainable in complex, community-based service environments.

Objectives:
1. Identify key facilitators and barriers to implementing trauma-informed, evidence-based practices within a youth violence intervention program.
2. Describe strategies for aligning curricula with program culture, staff capacity, and youth needs in community settings.
3. Apply lessons learned from implementation to inform future efforts in sustaining gender-responsive, trauma-informed interventions in multidisciplinary systems

Locked and Loaded: Attitudes Regarding Firearm Storage Among Farming Parents in Iowa

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Background: Suicides and unintentional death rates due to firearms are greater in rural areas as compared to those more urban, and the rates are increasing. The presence of firearms in the home increases the risk of firearm-related deaths and injuries, and rural households, especially farms, are more likely to have firearms. Safe firearm storage is a major factor in preventing these tragedies. However, a study of nearly 1400 adolescent Iowa FFA members found over four-fifths had at

least one firearm stored unlocked or loaded at least some of the time in their home. Our study objective was to evaluate the attitudes held by farming parents in Iowa regarding home storage of firearms.

Methods: Rural parents participated in focus group sessions conducted in person or on-line in 2024. Participants were recruited through several methods: Iowa FFA (formerly Future Farmers of America) club advisors were contacted by e-mail to inform member parents, a mass email was sent to University of Iowa faculty/staff, and invitations were distributed to 2024 Farm Progress Show attendees. Inclusion criteria were: (1) Must live on and actively farm/ranch in Iowa, (2) Must have at least one child between 10-19 years, and (3) Must have at least one firearm in the home. Dedoose, a qualitative analysis software package, was used for transcript content analysis. Further coding was performed by three team members. Major themes and subthemes emerged. Coding discrepancies were discussed by the team until consensus was achieved.

Results: Thirty-two participated. A few felt safe storage best kept children safe, and that unsafe storage was dangerous. However, some felt it was important more so to prevent theft and maintain gun condition, and to appease others. The majority had views that unsafe storage was acceptable or even not required. In many cases, subjects felt safe storage was incompatible with their use including personal protection and protecting/euthanizing livestock (i.e., they use it as a tool and store it that way). Many felt unsafe storage was safe such as hiding firearms and educating children “not to touch” when younger and how to use properly when older. Some didn’t feel they needed to meet best practices to have safe storage including not having ammunition locked or locked separately, having firearms unlocked but not loaded, and having “most” locked or just temporarily not locked and/or unloaded.

Conclusions: Our study found that the majority of farming parent participants were comfortable with firearm storage that did not meet safe storage criteria (i.e., firearms unloaded and locked with ammunition locked and stored separately) for a variety of reasons. Healthcare providers and other stakeholders will need to address these attitudes/barriers and find compromises that would improve but not necessarily meet best firearm storage practices.

Objectives:
1. State at least three reasons why safe storage is important as provided by some rural farm parents at focus group sessions.
2. Identify at least three reasons why safe storage is not required and is unnecessary as provided by some rural farm parents at focus group sessions.
3. Discuss how attitudes held by rural parents might be addressed by healthcare providers and other stakeholders to improve firearm storage.

Partnerships Expanding Child Passenger Safety Efforts

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Background: Motor vehicle crashes continue to be a leading cause of death among children in the United States. According to the Centers for Disease Control and Prevention (CDC), in 2022 there were more than 1,100 children ages 12 and younger who died in motor vehicle crashes. The National Highway Traffic Safety Administration (NHTSA) reports child occupant traffic fatalities accounted for 80 percent of child traffic fatalities in 2021, a 3 percent increase from 2020. In California, the Department of Public Health (CDPH) reports that motor vehicle occupant injuries are among the top five causes of both death and hospitalization among children under age 16. NHTSA reports that California has the second highest number of children fatalities in vehicle crashes. Our program created partnerships to expand child passenger safety efforts.

Methods: Our program is hospital-based and community-driven. This intervention supports families with motor vehicle collision traumas, in birthing centers, and within school regions with high occurrence of injuries and fatalities. Classes are offered in person at the hospital and virtually to allow for varied methods of participation. Caregivers challenged by technology were eager to return to in-person education while other families appreciated the continued opportunity to learn remotely. Partnerships with outside birthing hospitals, schools, and social welfare organizations expanded outreach efforts to increase modality options and attendance rates.

Results: The effectiveness of the program was determined by the analyzed data gathered at each session. Data collected includes attendance rates, pre- and post-test surveys, and evaluations upon completion of the educational sessions. 2023 data of child passenger safety classes shows a 52% increase in knowledge of car seat use and state laws. Evaluations captured self-reported positive behavior change confirming increased safety in transport children. Partnering with local hospitals and agencies increases outreach efforts to be able to plan and implement this program.

Limitations include barriers in technology, internet access, and language. Our classes are offered in English and Spanish only. Los Angeles County in California includes a vast melting pot of cultures and languages. If a participant did not have a family member that could be on the class with them, unfortunately we could not provide interpretation services.

Conclusions: Fostering relationships with prenatal programs in outside birthing hospitals, school administrators and police, and social welfare organizations are key components of a successful program. Education was designed as a PowerPoint presentation to include state laws, best practices, and tailored to the targeted audience at schools. Classes and presentations were led by Injury Prevention Program staff and school police officers who are nationally certified Child Passenger Safety Technicians and Instructors. Vehicle seat simulators, different size dolls, and varied car seat types were utilized to demonstrate proper harnessing and installation techniques. Data including pre-tests, post-tests, and evaluations were collected via an online collection tool. These processes can be applied to other jurisdictions across the country by connecting with local agencies and partnering to gather resources within the community.

Objectives:
1. Session attendees will learn how to replicate successful partnership models to enhance outreach and education in the community.
2. Session attendees will identify strategies for implementing child passenger safety educations programs.
3. Session attendees will gain insight into measuring program impact through data collection methods.

Injury Prevention on the Road Home: A Hospital-Based Car Seat Loaner Program Evaluation

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Background: Femur fractures are among the most common injuries requiring hospitalization in young children. Spica cast immobilization, a standard treatment for pediatric femur fractures, creates a significant challenge for safe vehicle transport at discharge. National guidelines recommend specialized car seats for these patients, yet many families face cost, availability, and care coordination barriers. Safe Kids Connecticut, a community program affiliated with a Level 1 pediatric trauma center, operates a Child Passenger Safety Program that loans adaptive car seats and provides caregiver education. This program evaluation examines the program's reach, effectiveness, and sustainability.

Methods: From September 2021 through December 2024, data was collected on all patients under 6 years old who were treated at a Level 1 pediatric trauma center for femur fracture with spica cast stabilization. The Injury Prevention Center was notified when a patient needed a specialized car seat, and Child Passenger Safety Technicians (CPSTs) fit the child with an appropriate seat and instructed caregivers on proper use. Program reach is assessed by comparing operating room case data to CPST seat distribution records. Outcome measures include the number of seats distributed, completion of caregiver education, return rates, and average loan duration.

Results: Thirty children received spica cast stabilization during the evaluation period. Of these, 80% (n=24) were discharged with a specialized car seat and received in-person education from a trained CPST. The program achieved an 86% return rate (n=26), with an average loan duration of 3.75 months (range: 2–6.5 months). One family kept their seat due to ongoing medical need, while three families have not returned their seats. The primary challenge to program sustainability is the high cost of medical-grade car seats, which range from $300 to over $2,000 and require periodic replacement due to expiration, damage, or loss.

Conclusions: A hospital-based loaner program that provides adaptive car seats and caregiver education addresses a critical gap in discharge safety for pediatric patients with spica casts. The program effectively reduces financial and logistical barriers for families, supports safer transitions home, and promotes injury prevention. Prompt communication between healthcare providers and CPSTs is important to ensure timely seat provision and prevent discharge delays. Sustained funding is essential to maintain seat inventory and ensure long-term program impact.

Objectives: 1. Describe the transportation safety needs of pediatric patients discharged in spica casts.
2. Identify key components of a sustainable hospital-based child passenger safety program.
3. Discuss challenges and strategies for overcoming financial and logistical barriers in car seat access.

Updated injury trends in the Child Injury Database (CID)

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Background: The Children's Injury Database (CID) is an injury surveillance system developed to collect data from injury-related visits to our tertiary care pediatric emergency department (ED). The purpose of this study was to examine updated injury trends from ED visits that occurred in 2023 and 2024 vs. those reported in 2021 (McCain et al., 2023).

Methods: Demographic and injury data on children 0-16 years old identified as having an injury-related ED visit in 2023 and 2024 were descriptively analyzed and compared to trends documented in 2021.

Results: A total of 28,745 injury visits from 2023-2024 were analyzed. Demographic trends remained consistent from 2021, with 56% of the cases identified as males and 53% identified as White in 2023-2024. A total of 3,991 injury visits (13.8%) resulted in hospital admission, consistent with 2021 trends (13.5%). Compared with 2021 data, in 2023-2024 there were notably fewer cases of poisonings (13.2% vs. 8.9% of all injuries, respectively), motor vehicle crashes (7.9% vs. 4.3%), dog bites (2.0% vs. 1.6%), and assault (2.1% vs. 1.6%). Conversely, there were more cases of injuries because of ATVs (1.1% vs. 2.9%) and insect bites (<1% vs. 2.8%). Cases injuries due to falls, burns, intentional self-harm, pedestrian, and bicycle-related events were consistent. Drownings (45.2%, poisonings (41.7%), chokings (38.0%), ATVs (34.0%), and burns (33.0%) had the highest rates of admissions.

Conclusions: There were notable differences in injury trends from 2021 to 2023-2024. This underscores the importance of injury surveillance systems, which can assist with reporting new injury patterns while also acting as a stimulus for new research ideas, planning interventions targeting the most at-risk populations, and evaluating the effectiveness of injury prevention interventions.

Objectives:
1. Injury trends in an emergency department post-COVID era.
2. Ways injury surveillance systems can assist with research and real-world practice.
3. Primary injury mechanisms across demographic factors.

When the Dog Bites: A 5-Year Retrospective on Canine Bite Encounters in Pediatrics

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Background: Dog bites are a common cause of injury, with the CDC estimating that 4.5 million occur annually. Children are particularly susceptible to this injury, with one study finding that 46.1% of school aged children report being bitten in their lifetime. Families experience long term consequences following this injury, as 50% of children develop PTSD symptoms for more than one month. According to WISQARS the total cost of nonfatal emergency department pediatric dog bite visits including medical expenses, work loss and quality of life loss in 2023 was $859.36 million. It is estimated that 45.5% of U.S. households own a dog, making the emphasis of safe ownership practices among families with small children essential in preventing this injury.

Methods: A retrospective ICD 10 query over five years was performed to identify canine related bites (W54.0XXA) presenting to a Children's Hospital in the Southeast. Data was exported to a standardized review sheet and demographic data was categorized. Injuries due to falls or scratches were excluded. Data analysis was performed using Epi Info 7 (CDC), Version 7.2.4.0.

Results: Between 2019-2023, our emergency department saw 1,403 dog bite related visits. There were 1,252 initial visits and 151 return visits for follow-up care related to the same injury. The most common reason for a return visit was rabies prophylaxis (n=114). Despite experiencing an overall reduction of ED visits in 2020, there was a significant change in dog bite related visits per 1000 emergency department visits, increasing 70% from the previous year. Nearly 12% of patients required admission. Injuries occurred to the head/neck/face (64%, n=805), extremities (38%, n=471) and torso/pelvis/buttocks (9%, n=99). Frequently consulted specialties include OMFS (n = 170), ENT (n=90), plastic surgery (n=86), ophthalmology (n=82), and surgery (n=59). The most common procedure performed was wound closure (63%, n=784), and severe injuries required interventions such as facial nerve repair, fracture reduction and subdural drain placement. Males (57%, n=711) were more likely to be affected than females (43%, n=541). Injuries occurred most often in the patient's own home (38%, n=480). Age groups involved include less than 2 (n=155), 2 to 5 (n=431), 6 to 12 (n=538), and older than 12 (n=138). Dog breeds were identified in 596 cases, and the most frequently involved were Pit Bulls (41%, n=243), German Shepherds (11%, n=67) and Labrador Retrievers (10%, n=60).

Conclusions: Dog bite injuries are a common reason for emergency department visits. Our institution experienced a significant increase in the proportion of dog bite related visits in 2020. This may be due to the increase in dog adoptions that occurred during the COVID-19 pandemic and stay-at-home ordinances causing children to spend more time in the household. Pediatricians have a crucial role in reducing this type of injury by educating families on ways to make the home safer for both children and dogs.

Objectives:
1. The prevalence of dog bite related injuries among the pediatric population.
2. Epidemiologic characteristics of patients who have been bitten by dogs.
3. The role of pediatricians in educating families about strategies they can implement to reduce this type of injury.

Correlation Between Various Systemic Factors and Pediatric Traumatic Brain Injury (TBI) Follow-up Rates after the implementation of the Visio-Vestibular Exam

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Background: Mild to moderate head injuries are common in pediatric patients, yet follow-up care is often inconsistent. The Visio-Vestibular Exam (VVE) System was implemented in two Corewell Health Emergency Centers (Troy and Royal Oak) to enhance concussion assessment and potentially improve follow-up compliance.

Methods: As part of a quality improvement initiative, we retrospectively analyzed data from pediatric patients treated for mild to moderate head injuries between October 2023 and October 2024. Variables assessed included injury severity markers (loss of consciousness, vomiting, CT use), race, age, insurance status, and whether a VVE was performed in the ED.

Results: Out of 509 eligible patients, 43.4% attended their follow-up appointment. No statistically significant differences in follow-up rates were found based on age, race, insurance status, or injury severity. Unexpectedly, patients who received a VVE during their ED visit were significantly less likely to follow up than those who did not (30.7% vs. 47.6%, p = 0.00023).

Conclusions: Demographic and clinical factors traditionally believed to influence follow-up adherence did not significantly predict outcomes in this cohort. Notably, completion of a VVE was associated with lower follow-up rates, suggesting that families may perceive the exam as sufficient care. These findings underscore the importance of improving discharge communication to emphasize the necessity of post-injury follow-up, regardless of initial ED findings.

Objectives:
1. To evaluate follow-up rates after pediatric head injuries
2. To understand how factors such as injury severity, race, age, insurance type, and completion of a VVE influenced the likelihood of attending a scheduled follow-up appointment

Wheels of Misfortune: A Tale of Two Rides

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Background: Injuries are the number one cause of death in children and cause significant morbidity. Common scenarios for injury involve wheeled recreational devices (WRDs) as they allow children to be mobile and independent. This study compares injury patterns and mechanisms between dirtbikes (motorized, often used in organized events) and bicycles (primarily used for recreation and transportation) to evaluate common injuries and outcomes.

Methods: Following IRB approval, the Children's Injury Database (CID) of our emergency department (ED) at a tertiary care children's hospital was queried to identify all patients with an injury related to a dirtbike or bicycle during a two-year period (2023 and 2024). Demographic information along with injury specific data (dirtbike versus bicycle, helmet use and admission rates) were collected and analyzed.

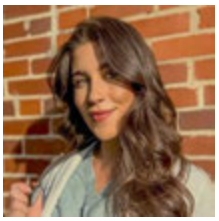
Results: A total of 282 patients met criteria for inclusion with 123 dirtbike riders and 159 bicycle riders. Ages of patients ranged from 2 to 16 years for dirtbikes and 1 to 16 years for bicycles. The mean age was significantly higher for dirtbikes as compared to bicycles (11.1 versus 8.8 years; t=5.4, p< 0.0001). The majority of patients were Caucasian (81% for dirtbikes, 66% for bicycles), which is in contrast to our overall ED population, which is only 42% Caucasian. The majority of patients were male (88.62% for dirtbikes, 69.18% for bicycles).

Helmet documentation was done in 173 charts (61%) with usage rates being 65% for dirtbikes versus 16% for bicycles among documented cases. Non-documentation was higher for bicycles (53%) than dirtbikes (20%). Patients with injuries from dirtbike mechanisms were at a significantly higher likelihood of requiring admission as compared to bicycle-related injuries (34% versus 13%, p<0.00001) and also as compared to the general admission rate for all injuries (13.4%, p<0.00001).

Conclusions: This study reveals distinct injury differences between motorized dirtbike riders and bicycle riders in pediatric population. While demographic differences were minimal, dirtbike riders were found to be significantly older. Despite higher helmet documentation and usage rates among dirtbike riders, they required hospitalization at nearly three times the rate of bicycle riders, indicating likely more severe injuries in this group. These findings highlight the importance of age-appropriate safety measures and protective equipment for all WRD users.

Objectives:
1. Participants will identify key differences in dirtbike and bicycle injuries and severity
2. Participants will compare differences in hospital admission rates and helmet usage between the two mechanisms
3. Participants will describe epidemiological characteristics of pediatric WRB injuries presenting to emergency departments

Utilization of the Emergency Department for Mental Health by Pediatric Survivors of Firearm Injuries



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Background: In 2020, firearm injuries became the leading cause of death among U.S. children and adolescents. For Black youth, this has been true since 2006. While 14–25% of pediatric survivors of firearm injuries develop new mental health conditions, little is known about their use of emergency departments (EDs) for mental health care post-injury. This study aims to describe the epidemiology of pediatric firearm injuries in one region and investigate the prevalence of mental health-related ED visits within one year after injury.

Methods: This retrospective cohort study includes all firearm-injured pediatric patients (ages 0–18) presenting to a Level 1 Pediatric Emergency Department (PED) and a Level 1 Adult Trauma Center in the same city January 2018 - December 2023. Comprehensive chart reviews across both hospital systems are conducted to capture all patients and visits without omission.

Data collected includes: (1) demographics (age, sex, race, ZIP code, insurance), (2) firearm details (type, shooter, location, intent), (3) injury characteristics (injured body area, Abbreviated Injury Score [AIS], disposition, length of stay, diagnoses), (4) mental health history (pre-existing conditions, prior PED crisis visits, new mental health diagnoses, new crisis visits post-injury), and (5) somatic health comparisons (non-mental health PED visits post-injury).

Descriptive statistics will characterize the cohort. Chi-square and Mann-Whitney U tests will compare key variables. Kaplan-Meier curves will estimate time from injury to new mental health diagnosis or crisis event.

Results: Chart review is ongoing. Preliminary analysis of 2023 patients seen at the PED show most were male (80.8%), Black (92.3%), and publicly insured (80.8%), with a mean age of 11.7 years. The largest subgroup was ages 13–16 (53.8%). Injuries involved extremities (46.2%), trunk (30.8%), and head (23.1%). About one-third had an AIS of 2 (34.6%).

Shooters were unknown in 50.9% of cases. Assault was the most common intent (37.3%), followed by unknown (35.3%) and unintentional (27.5%). Shooting locations included street (35.3%), home (35.3%), community (13.7%), vehicle (5.9%), or unknown (9.8%). Most patients (73.1%) were admitted.

Pre-existing mental health conditions were present in 23.1%. No new mental health diagnoses requiring a PED visit were identified within one year post-injury. However, 11.5% presented for somatic complaints.

Conclusions: Preliminary findings show a disproportionate burden of firearm injury among Black, male, and publicly insured youth. Despite notable pre-existing mental health needs, no new mental health-related PED visits were recorded within one year, suggesting potential gaps in recognition, access, or care utilization. These results highlight the urgent need for improved mental health screening, structured follow-up protocols, and community-level support to address the full impact of firearm trauma in youth.

Objectives:
1. Describe the demographics of pediatric firearm injuries.
2. Identify the prevalence of pre-existing and new mental health conditions within one year post-injury.
3. Discuss gaps in post-injury mental health care utilization and implications for ED/community interventions.

Moderator and Presenter Biographies

Sarah Beth Abbott, BS, EMT-LP — Sarah Beth Abbott, BS, EMT-LP is the Pediatric Injury Prevention and Outreach Education Coordinator at Children's Memorial Hermann Hospital in Houston, TX. She has experience delivering health education to stakeholders within the local community and has extensive background in program planning, team building and regulatory experience. She received her Bachelor of Science with a focus on Health Education from the University of Houston. She has been appointed to the Injury Prevention and Public Education Committee of the Texas Governor's EMS-Trauma Advisory Council (GETAC) for a three-year term, ending in December 2027. She is the program coordinator for the Injury Free Coalition for Kids – The University of Texas Health Science Center at Houston – McGovern Medical School (UTH) and Children's Memorial Hermann Hospital (CMHH).

Maneesha Agarwal, MD, FAAP — Dr. Maneesha Agarwal is an associate professor in pediatrics and emergency medicine at Emory University School of Medicine and an attending physician in pediatric emergency medicine at Children's Healthcare of Atlanta. She received her undergraduate and medical school degrees at the University of North Carolina in Chapel Hill followed by pediatrics residency in the Boston Combined Residency Program in Pediatrics and pediatric emergency medicine fellowship at Carolinas Medical Center in Charlotte. She is passionate about injury prevention, and her previous work encompasses multiple fields including poisoning prevention, child passenger safety, teen driving, firearm safety, consumer product safety, and adverse childhood experiences. Dr. Agarwal enjoys research, advocacy, education, and mentoring the next generation of injury prevention leaders. She co-founded the Children's Healthcare of Atlanta Injury Prevention Program (CHIPP) and serves as the pediatrics expert for the Injury Prevention Research Center at Emory. She is also faculty for the national Trainees for Child Injury Prevention program.

Laurel Barker, BS — Laurel Barker is a recent graduate of the University of Alabama, where she earned her B.S. in Commerce and Business Administration in 2024. Currently pursuing a pre-med path with coursework at the University of Alabama at Birmingham, she is passionate about combining research with clinical care and hopes to continue to explore ways to promote safety and preventative practices in pediatric healthcare.

Ashley Blanchard, MD, MS — Dr. Ashley Blanchard is a pediatric emergency room physician and Assistant Professor at Columbia University Irving Medical Center. She completed her residency in pediatrics and fellowship in pediatric emergency medicine at Morgan Stanley Children's Hospital at Columbia University Irving Medical Center. During her clinical training she obtained a Masters in Biostatistics and Patient Oriented Research at Columbia Mailman School of Public Health. Her research focuses on 1) the epidemiology of special populations at high-risk of injuries, such as those with autism spectrum disorder and 2) ED-based interventions for the prevention of youth suicide.

Melissa Blumberg, MD, MPH — Melissa Blumberg, MD, MPH is a pediatric emergency medicine attending physician at the Children's Hospital of Philadelphia. She completed her pediatric residency at Cincinnati Children's Hospital Medical Center and her pediatric emergency medicine fellowship at Nemours Children's Hospital. Her research focuses on injury epidemiology and health equity in pediatric emergency care.

Lauren Bozarth, BS — Lauren Bozarth is a second-year medical student at the Heersink School of Medicine at the University of Alabama at Birmingham, dedicated to advancing health equity and community-based care. Originally from Boaz, Alabama, she earned her undergraduate degree from Troy University and spent nearly three years working in the UAB Emergency Department, where she discovered her passion for improving access to care. As Community Health Director for Equal Access Birmingham Clinic, Lauren leads targeted outreach, education, and the operation of two monthly free clinics at sites across Birmingham serving the city's unhoused populations. She is especially passionate about building partnerships that connect individuals and families to high-quality, accessible healthcare, and about developing programs that reduce preventable injuries and support underserved communities.

Shea Buckley, MEd, BCBA, CPST — Shea Buckley, M.Ed., BCBA, CPST is a master's level Board Certified Behavior Analyst who provides applied behavioral (ABA) services to children diagnosed with autism spectrum disorder (ASD) in the Complex Behavior Support Program at the Marcus Autism Center. Shea began her career in the public school system as a special education teacher and, later, as a behavior intervention specialist for the school district. She is responsible for developing and conducting individualized assessment and treatment packages aimed at reducing maladaptive behaviors, such as aggression, disruption, elopement, and self-injurious behavior. Shea is also a Child Passenger Safety Technician and oversees the Child Passenger Safety Program at Marcus which provides assessment and intervention to children who exhibit unsafe behaviors while being transported in a motor vehicle.

Sofia Chaudhary, MD, FAAP — Sofia Chaudhary is an Assistant Professor in Pediatrics and Emergency Medicine at Emory University School of Medicine and a Pediatric Emergency Medicine Attending Physician at Children's Healthcare of Atlanta. She completed her pediatric residency at Emory University and her pediatric emergency medicine fellowship at the Children's Hospital of Philadelphia. She is currently the co-PI of the Atlanta Chapter for Injury Free Coalition for Kids, co-chair of the Violence Prevention Task Force for Injury Prevention Research Center at Emory, and Chair of the Council of Injury, Violence, Poison Prevention for the GA Chapter of the American Academy of Pediatrics. Outside of caring for children in the pediatric emergency room, her primary academic research and advocacy focus has been on pediatric injury prevention with a specific focus on firearm injuries. She has authored multiple injury prevention-related publications and spoken as an injury prevention expert at national scientific meetings. She enjoys working with trainees and mentoring them as they become injury prevention advocates. She co-founded the Children's Healthcare of Atlanta Injury Prevention Program (CHIPP) and serves on the steering committee for the Injury Prevention Research Center at Emory.

Enjuli Chhaniara, DO, PGY-3 — Dr. Enjuli Chhaniara is a pediatric resident in her final year of training at Valley Children's Hospital in Madera, California. Originally from Seattle, Washington, she earned her Doctor of Osteopathic Medicine degree from A.T. Still University School of Osteopathic Medicine in Arizona. She completed her clinical rotations in Oregon, returning to the Pacific Northwest to deepen her commitment to pediatric primary care. Dr. Chhaniara is passionate about community medicine, with a particular interest using media advocacy to promote injury prevention and preventive health. Through her work as a "mediatrician," she aims to foster a culture of physician media advocacy to help educate beyond the clinic setting that safe behaviors can be both appealing and fun for children. Dr. Chhaniara plans to pursue a career in pediatric primary care following the completion of her residency.

Caroline Chivily, MD, MPH — Caroline Chivily is a recent graduate of Emory University School of Medicine and a first

year pediatrics resident at Northwestern/Lurie Children's Hospital. She became interested in injury prevention and harm reduction while obtaining her MPH, which evolved into a passion for child injury prevention in children with autism and other developmental disorders. She hopes to continue developing this passion during residency!

Felicia A. Clark, D-ABMDI — Felicia A. Clark D-ABMDI, is a Certified Medicolegal Death Investigator. She worked as the Child Death Investigator for the Cook County Medical Examiner's Office for nearly 10 years. After retiring from the CCMEO in February 2021, she partnered with the Cook County SUID Case Registry to establish and serve as Prevention Coordinator for Community Partnership Approaches to Safe Sleep (CPASS)-Chicago. Felicia also serves on the Illinois Child Death Review Team for Cook County and the Family Focus Advisory Board, in Cicero, IL. Felicia can be found throughout Chicagoland communities creatively engaging, equipping and empowering families to practice safe sleep and distributing safe sleep education material and cribs to underserved communities. Felicia is a Follower of Christ, a wife to Thomas, a mother to 3 adult children, one of whom has special needs, and a grandmother to one granddude.

Lindsay D. Clukies, MD, FAAP — Dr. Clukies is a pediatric emergency medicine physician at St. Louis Children's Hospital. She completed her undergraduate degree at McGill University in Montreal, Canada and medical school at New York Medical College. She went on the pediatrics residency and pediatric emergency medicine fellowship at Washington University in St. Louis/St. Louis Children's Hospital where she stayed on as faculty. She is the associate trauma medical director and has particular interests in injury prevention, clinical guidelines, firearm injuries and pre-hospital care. When she is not working she is keeping busy with her 3 sons and 3 rescue dogs.

Joseph M Colella, CPST-I — Joe Colella is the Director of Child Passenger Safety for the Baby Safety Alliance, where he leads the organization's educational, regulatory, legislative and partnership efforts in the child occupant protection space. A certified Child Passenger Safety Technician Instructor (CPSTI) with over three decades of experience, Joe is a nationally respected advocate, instructor and expert in child passenger safety.

At the Baby Safety Alliance, Joe guides member manufacturers and stakeholders through evolving standards and evidence-based improvements, and played a key role in adding car seats to the organization's Verification Program in the U.S. and Canada. He regularly collaborates with NHTSA, AAP, Safe Kids Worldwide, Safe States Alliance and other national safety organizations, and serves on the Society of Automotive Engineers Children's Restraint Systems Committee.

Joe has taught in 48 states and five countries, developed CPS training curricula, and chaired the National Child Passenger Safety Board. He continues to shape the field through his leadership at the Lifesavers Conference and editorial contributions to Safe Ride News Publications. His impact has been recognized through multiple honors, including induction into the Child Passenger Safety Hall of Fame.

Emma Cornell, MPH — Emma is the Senior Clinical Research Program Manager at Northwell Heath's Center for Gun Violence Prevention. Emma's portfolio spans over half a dozen research projects, with the primary aim to help further the evidence base for firearm injury prevention strategies across all levels of healthcare. She oversees the implementation and expansion of Northwell Health's universal screening program for firearm injury risk, and directs the Cohen Childrens Medical Center's first-ever hospital-based violence intervention program. Emma holds an MPH from Columbia's Mailman School of Public Health, where she pursued a specialized course in injury and violence prevention, focusing on firearm injury.

Sadhana Dharmapuri, MD — Dr. Dharmapuri is the Interim Chief, Division of Adolescent Medicine at Stroger Hospital and a Visiting Associate Clinical Professor at UIH in the Department of Pediatrics. She completed her medical education at Poznan University Medical School, in Poznan, Poland, completed her Pediatric Residency at University of Illinois in Chicago and went on to finish an Adolescent Medicine fellowship at Children's National Hospital in Washington DC. She served as the Medical Director for the Eating Disorder clinic at the Medical College of Wisconsin, Children's Hospital for 4 years and was the Division Director for Adolescent Medicine at the University of Mississippi Medical Center. In 2018 she joined the Division of Adolescent Medicine at Stroger Hospital.

She is the co-chair of the Society for Adolescent Health and Medicine Climate Change SIG, a member of the International Pediatric Association Environmental Health and Climate Change group, and a member of the advocacy group for the Global Consortium on Climate Change and Health Education. She has presented nationally on Climate Change and its impact on children's health and is the lead author on a climate change and adolescent health joint position statement with the Society of Adolescent Health and Medicine and the International Association of Adolescent Health . She has a passion for climate change advocacy and protecting our youth's future.

Barbara DiGirolamo, M.Ed., CPSTI — Barbara DiGirolamo is the Injury Prevention Coordinator at Boston Children's Hospital. She serves as the MA State Chapter Director and State Directors Chair for the ThinkFirst National Injury Prevention Program along with sitting on their Board of Directors. She is also a CPSTI and teaches CPST certification classes in MA and RI. When not working she enjoys running, traveling and spending time with her 12, 9 and 7 year olds.

Marc Doobay, MPAS, PA-C, DFAAPA — Marc Doobay is a Clinical Assistant Professor and the Director of Didactic Education in the University of Iowa Carver College of Medicine. His work focuses on integrating public health principles into medical education and clinical practice, with a focus on child and adolescent firearm injury prevention. Drawing from his experience in Family and Community Medicine, Marc empowers future clinicians to address firearm safety in clinical practice. His research and advocacy aim to reduce firearm-related harm through education, community engagement, and evidence-based prevention strategies.

Olivia Frank, MPH — Olivia is the Injury & Violence Prevention Program Manager at Northwell Heath's Center for Gun Violence Prevention. Olivia's work focuses on implementing and evaluating the Center's community-and-patient-facing programs, including the Hospital Violence Intervention Program (HVIP), and strengthening collaborations with surrounding New York City and New York State community violence intervention organizations. Olivia holds an MPH from Columbia's Mailman School of Public Health, where she pursued a specialized course in injury and violence prevention, focusing on the intersections of adverse childhood experiences and community violence. Olivia has extensive experience across diverse community and healthcare settings and has conducted research on substance use, intimate partner violence, and child maltreatment.

Adrienne Gallardo, MA, CPST-I — Adrienne is the Program Manager for the OHSU Doernbecher Injury Prevention Program at OHSU Doernbecher Children's Hospital in Portland, Oregon. Adrienne completed undergraduate studies in social work and obtained a master's degree in organizational management. She has dedicated her professional focus on Injury Prevention and advocating for children. She has been a Child Passenger Safety Technician since 2002, and an instructor since 2012. Adrienne has led the development of the Injury Prevention Program at OHSU Doernbecher Children's Hospital which

includes an Injury Control Program benefiting patients and their families along with an Injury Prevention outreach program serving Oregon, SW Washington and Portland Metro communities. Adrienne currently is a member of the Injury Free Coalition for Kids Board of Directors and received the Injury Free Program Coordinator of the Year Award in 2022.

Shreya Gautam, BA — Shreya Gautam is a fourth-year medical student at the University of Missouri – Kansas City who dedicated a gap year to work as a research assistant at Emory University School of Medicine last year, studying relationships between firearm injury and social determinants of health and adverse childhood experiences. In the injury prevention space, she has developed advocacy skills through an internship with the organization, Georgia Clinicians for Gun Safety, and as a trainee with the Trainees for Child Injury Prevention 2025 Cohort. She is continuing to collaborate on a project at Children's Healthcare of Atlanta to identify resource gaps at the institutional level in children and families affected by traumatic injury.

Richard Gist, PhD — Dr Richard Gist brings a half century of innovative work in public health and safety. A public health researcher and practitioner, he left a successful academic career to serve 27 years as Deputy Director of the Kansas City Fire Department. There he led design and implementation of a number of community safety programs and interventions, receiving the International Award for Fire Service Excellence and securing grants in excess of $40M to support a wide range of innovations benefiting children, elders, schools, and firefighters by promoting safety, injury prevention, and preparedness in multiple settings. Now retired, he brings that broad expertise in behavioral epidemiology, community education, program development, and service delivery systems to support the Charlie's House mission of preventing accidents and injuries in the home.

Julia Glauboch, BSN, RN, CPST — Julia Glauboch is an Injury Prevention Coordinator at Staten Island University Hospital, a Level 1 trauma center. She is responsible for helping to improve outcomes resulting from trauma and to prevent injury by raising public awareness of both adult and pediatric injury prevention practices. She is responsible for the development, implementation, and evaluation of trauma prevention programs for each major age group. Julia is passionate about using public education to increase prevention efforts and raise awareness for public policy change that recognizes and treats injury as a preventable health problem Her education outreach program includes fall prevention programs, teen injury prevention classes, car seat safety and teaching bleeding control techniques. Julia is also an active member of many local, regional, and national community-based and injury prevention organizations with whom she frequently collaborates on broader trauma prevention outreach efforts.

Alise Haddad, BS — Alise Haddad is a third-year medical student at Oakland University William Beaumont School of Medicine with a Bachelor of Science in Biochemistry and a minor in Philosophy. She has extensive clinical and volunteer experience in pediatrics, including serving as a medical assistant at Grand Blanc Pediatrics and volunteering at the Al Ghassaneyh Charitable Dispensary and Orphanage in Syria, where she provided direct patient care to children. Her research focuses on pediatric neutropenia related to long-term antibiotic use and pediatric traumatic brain injury (TBI) follow-up rates, specifically evaluating systemic factors influencing post-discharge care after implementation of the Visio-Vestibular Exam (VVE). Alise's broader research experience includes biochemistry, organic chemistry, and clinical case reports. She has founded UNICEF at her institution, emphasizing child advocacy and global health equity. Alise is fluent in Arabic and actively engaged in medical education outreach as an admissions ambassador.

Taylor Hautala, MPH — Taylor has been part of the University of Michigan Injury Prevention Center (UM IPC) since 2021. In her role, she supports training and outreach across all of the UM IPC's focus areas of injury prevention. Taylor holds a Master of Public Health Degree in Health Behavior & Health Education from the University of Michigan School of Public Health and has experience in health communications, child/adolescent health, and substance abuse research.

Jamie Holland, MD — Dr. Jamie Holland is a pediatric sports medicine fellow at Northwestern University Feinberg School of Medicine. She obtained her medical degree from the University of Nebraska Medical Center. Following this she completed her general pediatrics residency training at the University of Utah and a pediatric emergency medicine fellowship at the Medical College of Wisconsin. She has an interest in advocacy and injury prevention.

Pam Hoogerwerf, BA — Pam Hoogerwerf is the former Program Director of Injury Prevention and Community Outreach at the University of Iowa Health Care Stead Family Children's Hospital, retiring in 2025. She graduated from the University of Iowa receiving a BA in Communication Studies/Broadcasting Journalism. With her passion for injury prevention, she led many injury prevention efforts at the hospital including those addressing all-terrain vehicle safety, bike safety, firearm injury prevention, safe sleep and lawnmower safety. She served on many state, regional and national committees for injury prevention and at the Children's Hospital. Pam was presented with the Injury Free Coalition for Kids Program Coordinator of the Year Award in 2024.

Chris James, CPS-MH, CAMS — Chris James is the Executive Director for Creative Connections, noted for providing programming for Black and Brown middle and high school students in the American South. He is a certified mental health first aider, public speaker, and author of the book, "Get Up, Get Out, and Get Some Healing". He is a 2x TED Talk alum, and his second TED Talk presentation titled "How Everyday People Can Prevent Mental Health Crises" was presented in Stamford, Connecticut. Chris James is a nationally award-winning spoken word artist who has been known for ranking 2nd place in the world's second-largest poetry slam, Southern Fried in 2014. In 2019, he was invited to be the keynote speaker at the United States Capitol for the 39th Annual Congressional Artist Competition. As a writer, he also penned numerous national touring stage plays, including "Dear Black People," which won Best Original Play in 2019. Most recently, he was responsible for writing the film, Devon's Day: A Juneteenth Story for BET Networks. Chris James is most definitely a multi-hyphenate creative. He uses his many talents to accomplish a particular mission: to serve people. He desires to serve by inspiring people to overcome their hurt, heal, and become whole, sharing practical ways to achieve this with them.

Kristi James, DrPHc, MPH, CHES — Kristi James is a dedicated public health professional, consultant, and educator with over 10 years of experience in community health, workforce development, and health policy. Currently pursuing a Doctorate in Public Health (DrPH) in Health Policy and Management at the University of Georgia, she holds a Master of Public Health (MPH) in Family and Child Health and is a Certified Health Education Specialist (CHES). Kristi has a proven track record in designing and implementing evidence-based health initiatives focused on mentorship, mental health, and policy change. As a Consultant for the American Public Health Association (APHA), she plays a key role in shaping workforce development strategies for Public Health AmeriCorps, supporting leadership training, networking, and program coordination. She also serves as Regional Director for the Urban Leaders Fellowship, where she guides emerging leaders in policy development and career growth. Currently, as the Chief Health Officer for Creative Connections, Kristi leads public health initiatives addressing health disparities among Black and Brown students, chronic disease management, and

systemic policy change in underserved communities. Her work has been recognized in academic research, conference presentations, and leadership fellowships, including the Students Who Rocked Public Health Award in 2022. Her expertise in strategic partnerships, health equity, and community engagement makes her a respected leader in the field, committed to driving sustainable changes in public health.

Kristyn Jeffries, MD, MPH — Dr. Kristyn Jeffries is an assistant professor in pediatrics at University of Arkansas for Medical Sciences and an attending physician in pediatric hospital medicine at Arkansas Children's Hospital. She completed medical school at Indiana University School of Medicine followed by pediatrics residency at University of Alabama in Birmingham and pediatric hospital medicine fellowship at Children's Mercy in Kansas City. She is co-chair of the Injury Free Social Media committee and helps manage the Injury Free Instagram. She currently serves as the medical director of Infant Child Death Review at Arkansas Children's, a member of the Trainees for Child Injury Prevention Alumni committee, and serves on the Arkansas AAP Chapter Board of Directors. She is passionate about injury prevention and advocacy, and loves when she can share these passions with trainees.

Charles Jennissen, MD — Charles Jennissen, MD, is a pediatric emergency medicine physician and a clinical professor in the Department of Emergency Medicine and the Stead Family Department of Pediatrics at the University of Iowa Carver College of Medicine. Dr. Jennissen is the Principal Investigator for IFCK at the University of Iowa Stead Family Children's Hospital and presently serves on the IFCK National Board. He grew up on a dairy farm in central Minnesota and has been an advisory board member of I-CASH (Iowa Center for Agricultural Safety and Health) for 26 years. He feels honored to have received the National IFCK Principal Investigator of the Year Award in 2023.

Jeannette M. Joly, MD — Jeannette M. Joly, MD, is a general surgery resident at Inova Fairfax Medical Center currently completing a two-year clinical research fellowship in pediatric surgery at The University of Texas Health Science Center at Houston. She is dedicated to a career in academic pediatric surgery and plans to incorporate quality improvement and outcomes research into practice and advocacy, with the hope of optimizing patient care and safety, and improving perioperative patient experiences. In the field of pediatric surgery, she enjoys exploring particular interests in critical care, thoracic, and congenital pathophysiology; and outside of the hospital, she continues to be a loyal supporter of her hometown DC sports teams.

Brent D. Kaziny, MD, MA — Dr. Brent D. Kaziny completed his medical degree at the University of Texas – Houston, School of Medicine. He started his pediatric intern year at the Tulane-Ochsner Pediatric Residency Program, where he received the Hurricane Katrina Code Grey Hero Award for his efforts caring for patients and assisting with the evacuation of Tulane Hospital during the aftermath of Hurricane Katrina. After completing his intern year, he transferred to Baylor College of Medicine, where he completed his residency training in general pediatrics. He completed his fellowship in Pediatric Emergency Medicine at the University of Utah in Salt Lake City. Upon completing fellowship, Dr. Kaziny took a position at Baylor College of Medicine and Texas Children's Hospital. On a national level he serves as the Co-Director of the Disaster Domain for the Emergency Medical Services for Children – Innovations and Improvement Center, the Co-Lead of the Disaster Management Domain of the Pediatric Pandemic Network, the Vice-Chair of the AAP's Council on Children and Disaster, and a voting member of the National Advisory Committee on Children and Disasters. At Texas Children's Hospital he works in the Emergency Center and serves as the Medical Director of Emergency Management. Dr. Kaziny is the Principal Investigator for the third pediatric disaster care center of excellence, the Gulf 7 Pediatric Disaster Network funded by the Administration for Strategic Preparedness and Response.

Narmeen Khan, MD — Dr Khan grew up in Chicago and currently resides in Milwaukee. She advocates for violence recovery for patients and families who have been affected by interpersonal violence. She is training for a career in pediatric emergency medicine and violence interruption.

Melissa H. Kwan, MD, FAAP — Melissa Kwan, MD, FAAP is an Assistant Professor with the UTHealth Houston's McGovern Medical School. She attended UT Health Science Center of San Antonio for medical school and completed her residency with the Johns Hopkins Harriet Lane Pediatric Residency Program. She is the Director of Community Pediatric Hospital Medicine for Memorial Hermann Community Hospitals and Chief of Staff for Memorial Hermann Sugar Land. While she loves developing a growing community hospitalist program, she is also passionate about preventing injuries for kids. She is co-chair for the TPS Committee for Injury Prevention and Co-PI for the UTHealth Houston and Children's Memorial Hermann Hospital Injury Free Coalition for Kids chapter. With these groups, she's had the opportunity to work with a talented team to develop programing and education for students, residents, physicians, and most importantly, the community where they live on child passenger safety, safe infant sleep, water safety, and firearm injury prevention. When she's not at work on injury prevention, she spends summers working with children at Texas Lions Camp in Kerrville, TX, a camp for kids with physical disabilities, cancer, and type 1 diabetes. Of course, none of this would be possible without the support of her colleagues, mentors, friends, and family; most notably her talented architect husband, Danny Rigg, and her energetic son, Alexander.

Christie Lawrence, DNP, RNC-NIC, APN/CNS — Christie Lawrence DNP, RNC-NIC, APN/CNS is an Assistant Professor in the Department of Women, Children, and Family Nursing at Rush University. She received a DNP in nursing from Rush University and has over 24 years of clinical experience caring for mothers and critically ill infants which solidifies her passion for providing equitable and just care for birthing families. Dr. Lawrence seeks to expand best practices in maternal-child health that promote equity and social justice and decrease morbidity and mortality in African American birthing people and their newborns through improving birthing practices and breastfeeding in African American families, developmental care, and safe sleep to decrease SUID. Her interest in improving outcomes is both professional and personal as she lost a close family member in childbirth due to negligence. She currently serves as a co-chairperson on the Rush University Children's Hospital Safe Sleep Taskforce, and is the Birth Hospital Outreach Education Coordinator for the Cook County SUID Case Registry and Prevention, additionally serving on CPASS Chicago's prevention team. She teaches and mentors General Entry Master's Nursing students and Clinical Nurse Specialist students at the doctoral level.

Michael N. Levas, MD, MS — Dr. Michael N. Levas is a Professor of Pediatrics in the Section of Emergency Medicine at the Medical College of Wisconsin, where he serves as Vice Chair of Respect and Belonging and Medical Director of Project Ujima, a hospital-based violence intervention program. He is nationally recognized for his leadership in pediatric injury prevention, health equity, and trauma-informed care. As Principal Investigator on multiple federally funded studies—including an NIMH R01 examining long-term PTSD risk in violently injured youth using machine learning and neuroimaging—Dr. Levas has built a robust research portfolio focused on youth violence, emergency department-based interventions, and system-level approaches to trauma response. He has authored over 50 peer-reviewed publications, including more than 20 specifically addressing advocacy, injury, and violence prevention. Dr. Levas also serves as Associate Director of the Comprehensive Injury Center and

holds national leadership roles with the Injury Free Coalition for Kids and the Health Alliance for Violence Intervention, advancing multidisciplinary approaches to violence prevention and community health.

Darria Long Gillespie, MD, MBA — Dr. Darria Long is a board-certified Emergency Medicine physician, Clinical Assistant Professor at the University of Tennessee, and founder of No-Panic Parenting. She recognized early in her career that to truly protect families, she needed to reach them before they arrived in the ER - and that media was the most direct way to do so. She went on to become a national medical expert on CNN, NBC, ABC, and Netflix, and built a large social media following helping parents prevent illnesses and injuries, and know what to do when they happen. Her TED Talk, "An ER doctor on how to triage your crazy busy," has been viewed by millions worldwide, and she is the national bestselling author of Mom Hacks.

Dr. Long is co-Principal Investigator of The Study of Burnout in Women, a national spokesperson for the American College of Emergency Physicians, and an affiliate member of the American Academy of Pediatrics' Council on Injury, Violence, and Poison Prevention. Across her research, clinical work, and digital engagement, she translates evidence into practical strategies that reduce childhood injury and empower parents with peace of mind.

She completed her residency in Emergency Medicine at the Yale University School of Medicine and earned her MBA from Harvard Business School.

Gina S. Lowell, MD, MPH — Gina Lowell MD, MPH is an academic general pediatrician at Rush University Children's Hospital in Chicago with specialty interests in childhood injury prevention, child abuse and neglect, and early relational health. As Director of Community Health for Pediatrics she collaborates with public health agencies and community-based organizations to advance maternal-child health equity. She is the current Principal Investigator for the CDC-funded SUID Case Registry and Prevention for Cook County, IL. This team established Community Partnership Approaches for Safe Sleep (CPASS) - Chicago in 2022 and has since expanded their SUID prevention approaches to include training opportunities for public health nurses, doulas, WIC staff, and other community health organizations motivated to partner in SUID prevention.

Lorrie Lynn, MA, CPSTI — Lorrie Lynn is the Manager of Injury Prevention Programs within the Center for Healthier Communities at Rady Children's Hospital San Diego. She is the site Coordinator for Injury Free Coalition for Kids and Coordinator for Safe Kids San Diego. These roles dovetail to highlight projects that address the leading causes of injury and death for children 0 to 14 years old in San Diego County. Projects addressing this population include Safe Sleep for Infants, Window falls, Water Safety and Drowning Prevention, Pedestrian and Bicycle Safety, Child Passenger Safety and Teen Safe Driving. Lorrie is also a member of the Injury Free Coalition for Kids Board. Lorrie is the President of Kaleidoscope LGBTQIA+ Team Resource Group. The leadership team is instrumental in building belonging and a sense of safety for the members with monthly meetings, community events and the Progressive Pride Flag Raising at Rady Children's.

Ashley Mahnke, MBA, CHES, CPST-I — Ashley Mahnke is the Community Health Education and Prevention Supervisor at the Children's Wisconsin Safety Center. She has been working in community health since March 2019. Ashley oversees the Safety Center's clinical operations at both the Milwaukee and Fox Valley Hospitals, as well as in primary care clinics and community car seat clinic. Her initiatives include the regular and loan distribution of car seats and the Safe at Home program, which provides safety products to families. Ashley holds a Master's degree in Business Administration and a Bachelor's degree in Public Health from Carroll University. She is also a certified Child Passenger Safety Technician Instructor and a Community Health Education Specialist. Ashley is passionate about promoting community health and ensuring that children in Wisconsin are safe and healthy.

Kathleen McDonough, MPA — Kathleen McDonough, MPA, is the Vulnerable Populations Program Coordinator for the Washington County District Attorney's Office in Oregon, where she also manages the county's Child Fatality Prevention Program. She has over twenty years of experience working in the non-profit and governmental sectors serving vulnerable populations, specializing in work with youth.

Sandra McKay, MD, FAAP — Sandra McKay, MD FAAP is a general pediatrician and an associate professor of pediatrics at the University of Texas Health Science Center at Houston. Dr McKay is the Division Chief for Community and General Pediatrics, Vice Chair for Advocacy, and the co-principal investigator for the Injury Free Coalition for Kids Houston site. She is the current co-Principal Investigator for a National Institutes of Health funded grant to investigate a hospital-based violence intervention program. She has innovated undergraduate and graduate medical education advocacy curricula relating to poverty and firearm secure storage counseling within the clinical encounter as well as working with firearm retailers to create coalitions to reduce injury in TX. Her passion also lies with policy and advocacy, as she is also the Huffington Fellow with Rice University's Baker Institute for Public Policy, and is active with the Texas Pediatric Society's Executive Legislative Committee. Her dedication to advocacy is rooted in her desire to make the world better for her favorite people, her husband of 22 years and her 3 children.

Tracy Mehan, MA — Tracy Mehan is the Director of Research Translation and Communication at the Center for Injury Research and Policy at Nationwide Children's Hospital. She is also co-host of Communications Breakdown - a podcast that breaks down what works, and doesn't, in health and science communication. She is a nationally recognized expert in injury prevention and health communication, with a passion for making evidence-based information accessible, inclusive, and engaging. Tracy leads strategic communication efforts that bridge research and public engagement, and she trains professionals across disciplines on how to effectively share their work. A strong advocate for the role of digital media in public health, she creates content and campaigns that resonate with families, health care providers, and policymakers while regularly advising organizations on how to use social media to expand their impact. Tracy's work blends storytelling, strategic messaging, and emerging technologies—including artificial intelligence—to amplify pediatric injury prevention messages in today's fast-paced digital world.

Michael J. Mello, MD, MPH — Michael J. Mello, MD, MPH, is a Professor of Emergency Medicine at The Warren Alpert Medical School of Brown University, with additional appointments in Medical Science and in Health Services, Policy & Practice at the Brown University School of Public Health. He directs the Injury Prevention Center at Rhode Island Hospital/Hasbro Children's and serves as principal investigator of the Rhode Island Hospital Injury Control Center of Biomedical Research Excellence (COBRE). A past president of both the Injury Free Coalition for Kids and the Society for Advancement of Violence and Injury Research, Dr. Mello is nationally recognized for his leadership and research in injury prevention.

Shenoah Miller — Shenoah Miller is an External Relations Manager at Amazon, where she leads the Product Safety portfolio on the Customer Trust-External Relations team. In this role, Shenoah manages strategic relationships with key product safety influentials and regulatory stakeholders, and drives engagement with industry leaders, consumer advocacy groups, and regulatory bodies to advance product safety

initiatives and strengthen Amazon's position as a leader in consumer protection.

With over 11 years of brand protection and product safety/compliance experience, and over 16 years' experience in the legal field, Shenoah has led critical product compliance programs to ensure safety and regulatory excellence across Amazon's US and Canadian stores. Her experience includes developing comprehensive frameworks for compliance with key regulations and building scalable solutions for emerging regulatory challenges.

Throughout her career, Shenoah has dedicated herself to mentoring emerging professionals and helping to develop the next generation of safety and compliance experts through mentorship and hands-on guidance. Shenoah holds a BA in Law and Justice from Central Washington University, is a member of the International Consumer Product Health and Safety Organization (ICPHSO) and the Society of Product Safety Professionals (SPSP), and currently serves on the Board of Directors for the Baby Safety Foundation (formerly JPMA Cares).

Kathy W. Monroe, MD, MSQI — Kathy Monroe is Professor of Pediatrics at the University of Alabama in Birmingham. She is the Division Director of the Pediatric Emergency Medicine Department. She has served in the past as the Alabama AAP chair of the Injury Prevention committee and as an executive committee member of the AAP Council on Injury, Violence and Poison Prevention. She is currently completing her term as Injury Free Coalition for Kids President.

Larisa Nefedov, MA, CPST-I — Larisa Nefedov is the Adaptive Needs Transportation Specialist and Injury Prevention Health Educator at OHSU Doernbecher Children's Hospital in Portland, Oregon. She has a strong educational foundation which includes an Associate of Arts in Early Childhood Education, an Associate of Science in Fire Technology, a Bachelor of Arts in Liberal Studies, and a Master of Arts in Teaching. Larisa has dedicated her career to the safety and well-being of children. Since becoming a Child Passenger Safety Technician in 2010, Larisa has remained deeply committed to child passenger safety. She became a certified Instructor in 2019 and a Safe Travel for All Children (STAC) Instructor in 2024. Larisa leads efforts in assessing, fitting, and distributing adaptive car seats and vests, working closely with a collaborative team of fellow technicians and DME providers to support children with specialized transportation needs. Her work continues to make a meaningful impact in communities by advocating for safer environments for all children.

Hailey D. Nelson, MD, FAAP, IBCLC — Hailey Nelson, MD, FAAP, IBCLC is a complex care pediatrician at Valley Children's Healthcare in Madera, California. A vocal advocate for children's wellness, Dr. Nelson regularly appears in local, regional and national media. As an official spokesperson for the American Academy of Pediatrics, she is a frequent contributor to the AAP's HealthyChildren.org website and has been featured as a subject matter expert by publications including The New York Times, Insider and USA Today. Dr. Nelson is a Safe Kids ambassador and hosted the Lunch and Learn series on Facebook Live for parents covering safety and injury prevention topics.

Michelle Nichols, CPST-I — Michelle is the Oregon Child Passenger Safety Coordinator and a Health Educator with the Doernbecher Injury Prevention Program at OHSU Doernbecher Children's Hospital in Portland, Oregon. Michelle has dedicated her professional focus on pediatric injury prevention along with supporting the development of Child Passenger Safety technicians and instructors in Oregon. She has been a Child Passenger Safety Technician since 2012, and an Instructor since 2018. Michelle presents locally and nationally in areas of injury prevention, child passenger safety, and adaptive needs transportation.

Marisol Nieves, LMSW, CPST — Marisol Nieves serves as the Program Coordinator for the Pediatric Injury Prevention Program at UTHealth Houston in the Texas Medical Center. She obtained her master's degree in social work with a focus on children and families and leads community initiatives centered on child passenger safety, firearm safety, program development, and injury prevention education. Marisol is an active member of several advocacy groups, including her county's Child Fatality Review Team and the National Association of Social Workers. She also collaborates with the Houston Hospital-Based Violence Intervention Program, the Texas Violence and Injury Prevention Center, and Injury Free Coalition for Kids. In her role, she has organized large-scale outreach events such as distribution of firearm safety locks, drowning prevention, annual helmet distributions and National Injury Prevention Day activities. In addition to her program coordination work, Marisol engages in social work clinical practice, providing trauma-informed support to individuals navigating depression, anxiety, and family dynamics. She is dedicated to advancing public health and strengthening the safety and well-being of children and families.

Nkeiruka Orajiaka, MD, MPH — Dr Orajiaka is assistant professor in pediatrics and emergency medicine at department of Pediatrics University of Texas Southwestern Medical Center and an Attending physician in Pediatric emergency medicine at Children's Medical Center of Dallas. She completed her medical school in Nigeria, and obtained her Masters in Public health at the Mailman school of Public Health, Columbia University, New York. She then completed her pediatric residency at Columbia University affiliation at Harlem Hospital.

She worked as a General Pediatrician Attending at the Nationwide Children's Medical Center for a little bit, where her interest in Injury prevention education grew. She then proceeded to complete her Pediatrics Emergency Medicine Fellowship at University of Texas Southwestern Medical Center Children's Medical Center of Dallas where her research was focused on injury prevention and also involved with introducing medial trainees to the importance of injury prevention education.

She is a passionate health educator and a strong advocate for children's health and safety. She has been featured on many media and parenting outlets for both writing and speaking on injury prevention, first aid and other pediatric health related topics. She curates content for her multiple social media channels where she actively provides pediatric education and also advocates for kids with particular focus on injury prevention and safety.

Nikita Patil, DO — Nikita Patil, DO, is a third-year pediatric emergency medicine fellow at University of Arkansas for Medical Sciences in Little Rock, AR. She is originally from California, however her path in medicine has taken her all over the country including New York for her undergraduate degree in biomedical sciences and Mississippi for medical school. She completed her general pediatric residency at University of Tennessee Health Sciences Center in Chattanooga, TN. She has a special interest in injury prevention.

Kyran Quinlan, MD, MPH — Kyran Quinlan MD, MPH is an academic general pediatrician, educator, researcher and advocate in Chicago. He led the foundation of the CDC-funded Sudden Unexpected Infant Death-Case Registry for Cook County, Illinois. He and his team established the Community Partnership Approaches to Safe Sleep (CPASS)-Chicago which targets innovative prevention activities in areas of greatest risk of SUID based on their geocoded SUID-Case Registry surveillance data. Dr. Quinlan serves on Child Death Review for Cook County, Illinois. He is contracted with Safe Kids Worldwide regarding prevention of sleep-related infant deaths.

Gia Ramsey, MBA, ADN, LPN, CPST-I — Gia Ramsey is the Injury Prevention and Education Outreach Coordinator at

Maimonides Medical Center in Brooklyn, NY. She has 14 years of experience leading data-driven injury prevention initiatives and coordinates the hospital's involvement in the CPSC's NEISS surveillance program. Gia is a certified Child Passenger Safety Technician Instructor and also holds instructor certifications in Safe Sitter, Stop the Bleed, Tai Chi for Arthritis, A Matter of Balance, and Stepping On. She serves as faculty for the American Trauma Society's Injury Prevention Coordinator Course, chairs the ATS Webinar Planning Group, and leads the NYC RTAC Injury Prevention Subcommittee. Her research has been published in peer-reviewed journals, and in 2020, she was named Injury Prevention Professional of the Year by the NYS American Trauma Society.

Ky Renshaw, Undergraduate — Kynan Renshaw is a third-year undergraduate at the University of Iowa studying Human Physiology. Originally from Queensland, Australia, he relocated to Denver, Colorado, six years ago, and has since become an avid skier and a swim instructor. Kynan's current research in injury prevention focuses on the knowledge and use of safe sleep practices among rural adolescents. He aims to address the gap in literature, as virtually no studies have examined preconception teens' awareness and implementation of safe sleep protocols.

James "Trey" Rhodes, MD — Dr. Trey Rhodes is a Pediatric Resident Physician at Texas Children's Hospital through Baylor College of Medicine, where he served as a leader of the residency's Advocacy Committee. He is passionate about child injury prevention and is a member of the Trainees for Child Injury Prevention (T4CIP) program, leading local, evidence-based education initiatives for families and physicians. His current research evaluates the economic benefits of four-sided isolation pool fencing to prevent pediatric drowning in Texas. Dr. Rhodes was selected for the American Academy of Pediatrics (AAP) Advocacy Internship and will spend a month on Capitol Hill this spring advancing child injury prevention policy. He will begin fellowship training in Pediatric Critical Care Medicine this upcoming summer and aims to integrate his clinical work in the ICU with policy-driven advocacy to safeguard children before they ever need intensive care.

Steven C. Rogers, MD, MS — Steven Rogers, MD, MS is Pediatric Emergency Medicine doctor and the Medical Director of Emergency Behavioral Health Services at Connecticut Children's. He is an Associate Professor at the University of Connecticut School of Medicine. He also serves as the Medical Director of the recently established Youth Suicide Prevention Center. He is a Research Scientist at the Connecticut Children's Injury Prevention Center. His current research, academic and advocacy efforts focus on youth suicide prevention. He was recently awarded the AAS 2023 Roger J. Tierney Award for applied contributions to the field of suicidology.

Haley Romine — Haley Romine is a senior honors student at the University of Houston, studying a B.S. in Psychology with minors in Biology and Medicine & Society. For two years, Haley has conducted clinical research under Dr. Shenoi at Texas Children's Hospital in collaboration with the Baylor College of Medicine. As an aspiring physician, Haley has a strong interest in pediatric medicine, with research focused on childhood injury prevention and healthcare disparities.

Mackenzie Rose, CHES, CPST — Mackenzie Rose is a Program Coordinator at the Children's Wisconsin Safety Center helping coordinate the Safe at Home and Car Seat Programs. She has been working in community health since September 2021, but joined Children's Wisconsin in March 2025. Mackenzie coordinates and supports the Safety Center's clinical operations across Milwaukee and Fox-Valley Hospitals, primary care clinics, and community car seat clinics. Her initiatives include the regular and loan distribution of car seats and the Safe at Home program, which provides safe storage products to families. Mackenzie holds a Bachelor's degree in Public Health and Community Health Education from the University of Wisconsin-La Crosse and is currently pursuing a Masters of Public Health in Community and Behavioral Health Promotion at the University of Wisconsin-Milwaukee. She is also a certified Child Passenger Safety Technician and a Community Health Education Specialist. Mackenzie is driven by a commitment to foster community health and help secure the safety and well-being of children throughout Wisconsin.

Sara Beth Rowell, BS — Sara Beth Rowell, BS, is a third-year medical student at University of Alabama Heersink School of Medicine. She enjoys collaborating with faculty at Children's of Alabama on research initiatives focused on pediatric injury prevention and health literacy. Sara Beth aspires to be a pediatrician dedicated to improving access to quality care for families in medically underserved communities.

Emma Sartin, PhD, MPH — Emma Sartin, PhD, MPH, is an Assistant Professor in the Health Policy and Organization Department in the School of Public Health and the Department of Pediatrics, Division of Pediatric Emergency Medicine, in the Heersink School of Medicine at the University of Alabama at Birmingham. Broadly, her research focuses on childhood injuries, transportation, and the transition to adulthood for neurodivergent individuals.

Judy Schaechter, MD, MBA — Judy Schaechter, MD, MBA, is Professor Emerita of Pediatrics at the University of Miami, where she also teaches Public Health. Formerly, she served as Chair of Pediatrics at the University of Miami and Chief of Child Health at Jackson Health Systems. Recently, she was President and CEO of the American Board of Pediatrics and a Robert Wood Johnson Foundation Health Policy Fellow, working with the Senate Health, Education, Labor and Pensions Committee.

Felicia Scott-Wellington, MD — Felicia Scott-Wellington is Interim Division Chief and Fellowship Director of Adolescent Medicine at the University of Illinois at Chicago. She serves as consultant and primary care physician for teens and young adults ages 12-25. Dr. Scott-Wellington is an active member of the Injury Free Coalition for Kids Chicago Medical District Chapter and Co-chair of the Violence Prevention Committee for the Society of Adolescent Health and Medicine. Her interest includes youth violence prevention, adolescent health disparities, and adolescent health advocacy.

Rohit P. Shenoi, MD — Dr. Shenoi has a long-standing interest in injury prevention, specifically - drowning, opioid stewardship, and screening youth for suicide and drugs in the Emergency Department. He is currently funded by a CDC grant to study subpopulations that experience higher rates of unintentional drowning and investigate the causes and outcomes of these disparities. He has authored several research articles in injury prevention and drowning, coauthored the current AAP Policy Statement and Technical Report on drowning and was a contributor to the US National Water Safety Action Plan.

Kendall Snellgrove, MD — Kendall Snellgrove, MD, is a PGY-6 currently completing her final year of Pediatric Emergency Medicine fellowship at the University of Alabama at Birmingham/Children's of Alabama. She earned her medical degree from the University of Alabama at Birmingham and completed her pediatric residency and chief residency at the Medical College of Wisconsin in Milwaukee. Her academic and clinical interests include firearm injury prevention; pediatric trauma and mental health, with a focus on addressing the psychological and emotional needs of children following traumatic injuries; and global health.

Jill Solomon, MPH, CHES — Jill joined the center in 2022. In her role at the Center, she supports training and outreach across all of the U-M IPC's focus areas of injury prevention. Jill holds a Master of Public Health Degree in Health Behavior & Health Education from the University of Michigan School of Public Health and is a Certified Health Education Specialist

(CHES). She has experience in health literacy, motivational interviewing, and mHealth development.

Victor A. Soupene, PhD, MS — Victor A. Soupene, PhD, MS (he/him/his) is a postdoctoral research scholar at the University of Iowa Injury Prevention Research Center, jointly appointed in the Departments of Emergency Medicine and Occupational and Environmental Health. Originally from Anamosa, Iowa, Dr. Soupene earned his PhD in Epidemiology, MS in Occupational and Environmental Health, and a Graduate Certificate in Agricultural Safety and Health from the University of Iowa. Dr. Soupene's research focuses on injury and violence prevention, with a particular emphasis on reducing occupational injuries, suicides, and firearm-related injuries among farmers and rural communities. He is committed to adapting and implementing evidence-based interventions to address these critical public health challenges and improve outcomes for underserved populations.

Nicholas Stange, MD, MPH — Nicholas Stange is a PGY-1 ophthalmology resident at LSU Health Shreveport in Shreveport, Louisiana. Originally from Des Moines, Iowa, he completed his undergraduate studies at the University of Iowa and went on to earn both his Medical Degree and Master of Public Health from Saint Louis University. His research interests center on injury prevention and the epidemiology of ocular trauma, with a focus on documenting and reducing the prevalence of eye injuries. Outside of medicine, he organizes and participates in Relay Iowa, an annual ultramarathon relay across the state, and enjoys spending time with his growing family.

Parker Sternhagen, Undergraduate — Parker Sternhagen will graduate from the University of Iowa in December 2025 with a degree in biochemistry and a chemistry minor. He grew up in Delhi, Iowa, and is presently applying for medical school. His passion is emergency medicine and hopes his research will bring attention to the dangers of UTVs and how to prevent these injuries.

Jens Strand, High School Student — Jens Strand is a sophomore at Liberty High School. He has lived in the Iowa City, Iowa, area his whole life. He spends his free time running cross country, playing tennis, downhill skiing, working at the local tennis center and volunteering at the local pantry. Jens hopes his research in injury prevention will lead to federal regulations regarding online marketing of Chinese ATVs.

Timothy Ross Thompson, BA — Ross Thompson is a 3rd year medical student at the Alabama College of Osteopathic Medicine. He serves as the Region II Trustee on the National Student Osteopathic Medical Association. He is the recipient of the James M. Lally, DO, OPAC Student Engagement Scholarship in recognition of his leadership and advocacy work. He lives in Dothan, Alabama, with his wife, dog, and two cats; their favorite activity is going all out on Halloween each year making the most outrageous costumes and attempting to win nearby competitions.

Brent M. Troy, MD, MPH, FAAP — Dr. Brent Troy is a pediatric emergency medicine physician and associate medical director of the emergency department at Dell Children's Medical Center. He is also an Assistant Professor in the Department of Pediatrics at The University of Texas Dell Children's Medical School. Dr. Troy received his medical degree from Albany Medical College as well as an M.P.H. degree from Thomas Jefferson University School of Population Health. He completed his pediatric residency training at the University of Louisville School of Medicine, and he subsequently completed his pediatric emergency medicine fellowship at Emory University/Children's Healthcare of Atlanta. Dr. Troy is passionate about injury prevention research focused on high utilization of the emergency department.

Dex Tuttle, MEd, CPST-I — Dex spent 10 years in higher education as a student affairs administrator, planning events, hosting conferences, and advocating for the diverse needs of the students. Looking for a change, he became and EMT in 2011 and began work as an Emergency Room Technician at a busy Level 1 trauma center. Combining these unique experiences, he found his way to Children's Minnesota where he is currently the Injury Prevention Program Manager. He holds a Masters of Education from Penn State University and a BA in Computer Science from NDSU. He's been a Child Passenger Safety Technician for since 2013 and a CPST instructor since 2014. He also teaches the Safe Travel for All Children course on strategies for safety transporting children who can't be safely and comfortably transported in a retail-available car seat and the Safe Native American Passengers (SNAP) course, a car seat education curriculum designed with native and indigenous families in mind.

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Injury Epidemiology

Proceedings of the 29th Annual Injury Free Coalition for Kids® Conference: Forging New Frontiers: Engineering for Equity

Volume 12 Supplement 1

Publication of this supplement has been supported by the Injury Free Coalition for Kids.
The articles have undergone the journal's standard peer review process for supplements.
The Supplement Editors declare that they have no competing interests.

Fort Lauderdale, FL, USA, 6-8 December 2024

Edited by James Dodington and Holly Hanson.

Contents

Johnson *et al. Injury Epidemiology* (2025) 12:38
https://doi.org/10.1186/s40621-025-00597-7

Injury Epidemiology

RESEARCH Open Access

Pediatric hospital visits for unintentional drowning in bathtubs in Central Texas, USA

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Abstract

Background In the USA, drowning is a leading cause of death for children and the leading cause of death for children 1–4 years old. Bathtubs pose the highest risk of drowning for infants. The aim of this study is to determine factors that increase the risk of drowning in a bathtub for children.

Methods This retrospective, cross-sectional study used data retrieved from a hospital-based registry of drowning patients that includes information manually abstracted from patient medical records. This study describes patient characteristics and incident scenarios for children aged 0–17 years who sought care at one children's hospital for unintentional drowning in a bathtub over a ten-year period, 2014- 2023. Chi-square analysis was used to assess associations between whether a supervising caregiver was present during the incident and the likelihood of hospital admission or the likelihood of poor outcome.

Results There were 50 patients 0–9 years old treated for unintentional drowning in a bathtub over the 10-year period. The majority of patients were female (62%), White (86%), or not Hispanic (53%). Most of the patients (84%) were under 2 years old and the majority (56%) were under 1 year old. For most of the patients 2–9 years old, the drowning incident was likely seizure-related. In 91% of the incidents, a caregiver was intending to supervise the child in or around the bath, yet in only 24% of the incidents was the caregiver engaged in supervising the child. The most common reasons for the lapse in supervision was that the caregiver was retrieving a towel and/or clothes (39%) or caring for other children (20%). Chi-square analysis showed that children who were admitted to the hospital for further care were more likely to have no adult caregiver present than those who were discharged after being treated in the Emergency Department only.

Conclusions Findings indicate that lapses in supervision are a common cause of bathtub drowning for young children and are associated with the need for higher levels of care. Additionally, results highlight the need for drowning prevention messaging emphasizing gathering all bath supplies before starting a bath and avoiding distractions, such as caring for other children.

Keywords Drowning, Supervision, Public Health, Hospital Care, Pediatric

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Background

Drowning is a major public health issue worldwide [1]. In the United States (USA), drowning is the leading cause of death for children 1–4 years old [2]. Drowning is fatal in 13% of pediatric drowning incidents [3]. Many children suffer from submersion injuries following a non-fatal drowning incident [2, 4]. In addition to the many children who experience a fatal or non-fatal drowning incident, many more children may be evaluated in hospitals after being rescued from a submersion incident.

In Texas and across the USA, the setting in which most drownings occur varies depending on the age of the victim. Adults, teenagers, and older children most often drown in natural water, such as oceans and lakes; children 1–4 years old most often drown in swimming pools; and infants under 1 year old most often drown in bathtubs [5, 6]. For all age groups combined, bathtubs account for 10% of drowning fatalities in Texas [5].

Infants and young children are at risk of drowning because they may be too young to have reached developmental milestones for movement control and cognitive problem-solving abilities that would enable them to lift their head, roll over, or pull themselves up if they become submerged under water [7]. Without the ability to bring their airway back above water, infants will not be able to adequately oxygenate their lungs and may aspirate liquid into their lungs; they could be in cardiac arrest within five minutes [8]. Even brief lapses in caregiver supervision during baththime can put infants and young children at risk of severe drowning injury or death [9].

Prior research suggests that lapses in supervision are common in bathtub drowning incidents [10, 11]. Yet, many parents may not be aware of the importance of bathtub supervision for infants and young children. Caregivers of small children may not have adequate knowledge about the high risk of drowning for children, the seriousness of drowning injury, or tactics to improve water safety [12, 13]. In fact, studies have shown that some parents think they can briefly leave their infant without adult supervision when bathing [14–16].

The aim of this study is to investigate the epidemiology of pediatric patients who sought care at a hospital for a submersion or drowning incident involving a bathtub. Additionally, we aimed to identify common circumstances leading to bathtub drowning, including lapses in supervision, that could be useful for drowning prevention initiatives.

Methods

This retrospective, cross-sectional cohort study assessed characteristics of patients, incident scenarios, and outcomes for children treated for unintentional drowning in a bathtub at one large urban pediatric hospital, over the 10-year period between January 1, 2014 and December 31, 2023. Data were retrieved from the hospital Submersion and Drowning Registry, a registry of hospital submersion patients maintained by research staff and populated using medical chart review. Two authors oversee the medical record abstraction for all patients in the registry, reconciling differences through discussion and documentation. The submersion registry data are collected and managed using REDCap (Research Electronic Data Capture) electronic data capture tools [17, 18]. The submersion registry includes patients identified as experiencing a submersion or drowning incident or a water rescue based on initial encounter ICD-9 codes (E830.*, E832.*, E910.*, E954.*, E964.*, E984.*, E995.4*, 994.1*) or ICD-10 codes (ending in A and having a 1 in the sixth digit indicating "causing drowning and submersion" in the range W16.011-W16.331 and W16.511-W16.831 or beginning with W16.41, W16.91, W22.041, W65-W74, X71, X92, Y21, or T75.1). Additionally, cases may have been included in the registry based on a search of the chief complaint of the hospital presentation using the *drown* string pattern, with * representing a wildcard character used to stand in for unknown characters for code and keyword searches. Patients are excluded from the registry if it is determined that they were not submerged or immersed in liquid based on medical chart review. The registry includes patients initially or solely treated in the emergency department (ED) and patients admitted to the hospital or directly admitted after transfer from another hospital. Incidents are only characterized as intentional drowning when another person actively caused the submersion, e.g. pushed the child under water (and in one instance, a news report of homicide admission). This may not be the same as determinations by medical examiners, who may code lapses in supervision as homicide, particularly for bathtub drownings involving very young children.

Descriptive data are presented for age, sex, race, ethnicity, year, month, and time of day. Incident scenario factors include data on whether the water time was planned, the activity the child was involved in at the time of the incident, whether a caregiver was present, whether only another child or teen was present, whether the caregiver was intending to supervise the child around water, and what activity the caregiver was involved in at the time of the incident (supervising/bath-related tasks/caring for other children/chores/on phone or texting/other). In some instances, a caregiver was present, but their activity was not coded as supervising because they were engaged in another activity, such as turning away to get a towel or on the phone. Additionally data is presented on whether the child was conscious when removed from the water, whether a Cardiopulmonary Resuscitation (CPR)-based activity was performed immediately after removing the child from the water (includes any use of rescue

Table 1 Demographic characteristics of unintentional pediatric bathtub submersion patients

Variable	Category	n	Percentage
Age	< 1 year	28	56
	1 year	14	28
	2 years	2	4
	3 years	2	4
	4 years	0	0
	5 years	2	4
	6 years	0	0
	7 years	1	2
	8 years	0	0
	9 years	1	2
Sex	Female	31	62
	Male	19	38
Race	Black or African American	4	8
	White	42	86
	Other Race	3	6
Ethnicity	Hispanic	20	47
	Not Hispanic	23	53
Total patients		50	100

Note: Does not include data when race or ethnicity was not known

breathing, compressions, abdominal thrusts, pats on the back, or other CPR-like actions used with the intention of promoting breathing and/or circulation), and whether CPR was performed by a medical professional after arrival of Emergency Medical Services (EMS) or at the hospital. Data are also presented on hospital admission (treated in emergency department only/admitted to hospital) and outcome (death/morbidity—continued medical specialist or hospital care related to the drowning needed at discharge/no morbidity). Unknown data are excluded from percentages.

Fisher's exact test was used to assess if there is an association between whether a caregiver was present and outcome (no morbidity/poor outcome—morbidity or death). Chi square analysis was used to assess if there is an association between whether a caregiver was present and hospital admission. Patients who died in the ED were excluded in this analysis.

Results

Demographic characteristics

Of the 457 pediatric patients treated for unintentional drowning or submersion at the hospital over the 10-year period, 50 (11%) occurred in a bathtub. Patients treated for drowning in a bathtub ranged in age from 0 to 9 years old. The majority of the patients were infants < 1 year old (56%) and most patients were < 2 years old (84%). The majority of patients were female (62%), White (86%), or not Hispanic (53%) (Table 1).

Temporal characteristics

The incidents occurred during every month, with the most submersions occurring in September (14%) and the fewest occurring in August (4%). The bathtub submersion incidents were most likely to occur late afternoon or evening, 4 pm-7:59 pm (48%) or 8 pm-11:59 pm (29%), with fewer occurring in the morning, 8am-11:59am (15%), or afternoon, 12 pm—3:59 pm (8%). The fewest bathtub drowning incidents were treated at the hospital in 2014 (6%) and the most in 2023 (14%) (Fig. 1).

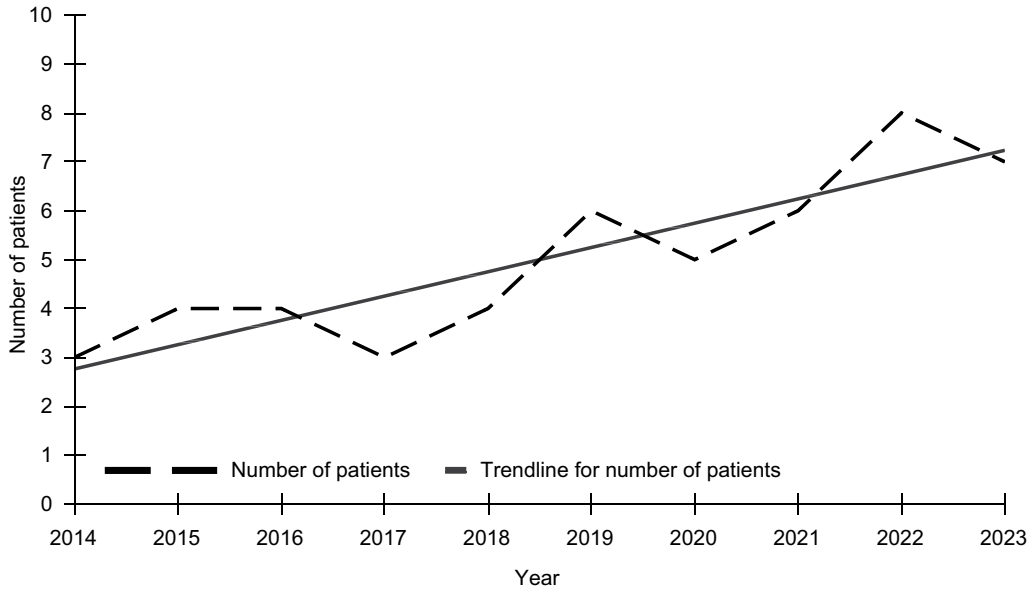

Fig. 1 Number of patients treated for unintentional drowning in a bathtub in Central Texas by year, 2014–2023

Table 2 Caregiver activity during unintentional pediatric bathtub submersion incident

Caregiver activity	n	Percentage
Bath-related tasks	16	39
Supervising	10	24
Caring for other children	8	20
Chores (unrelated to bath time)	2	5
On phone or texting	2	5
Other: watching TV, using restroom, answering door	3	7
Total	41	100

Note: does not include data when caregiver activity was not known

Table 3 Association of whether a caregiver was present and hospital admission for unintentional pediatric bathtub submersion patients

	Hospital admission	Treated in emergency department only	Total
No adult caregiver present	80%	35%	64%
Adult caregiver present in same space	20%	65%	36%
Total	100%	100%	100%

Precipitating factors

The bathtub submersion was precipitated by a suspected seizure in 12% (n = 6) of the patients, including 3/4 of patients more than 1 year old and all of the patients 7–9 years old.

Incident scenarios and supervision

Of the bathtub submersion incidents, 96% (n = 48) were during a time when the parent planned to have the child in or around water and 4% (n = 2) were not during planned water time. The child was bathing during 94% (n = 47) of the incidents, with 2% (n = 1) of incidents occurring when a sibling was bathing, and 4% (n = 2) occurring when the child entered the bathroom without the caregivers' knowledge. There was an adult caregiver present (e.g. in the bathroom) in 35% (n = 17) of incidents and no adult present in 65% (n = 31) of incidents. Only another child or teen was present in 31% (n = 15) of the incidents.

In 91% (n = 42) of the incidents, a caregiver was intending to be present and supervise the child in or around a bath. Despite the fact that a caregiver intended to supervise, an adult caregiver was only engaged in supervising (and no other activities) in 24% of the incidents, with a lapse in supervision by the caregiver in 76% of the incidents. Bath-related tasks were the most common caregiver activity during the lapse in supervision (39%), with all of the bath-related tasks involving retrieving a towel and/or clothes (Table 2).

Outcomes

The patient was not breathing when removed from the water in 46% (n = 22) of the incidents and was not conscious in 42% (n = 21) of the incidents. A CPR-based rescue activity was performed immediately after removing the child from the water in 54% (n = 27) of the incidents. CPR was performed by a medical professional after arrival of EMS or at the hospital in 12% (n = 6) of the incidents.

Thirty-eight percent (n = 19) of the patients were treated in the ED only; 60% (n = 30) of the patients were admitted to the hospital. Two percent (n = 1) of the patients expired before being admitted to the hospital. Fourteen percent (n = 7) of the patients were treated in the intensive care unit (ICU). The outcome of the incident was no morbidity for 88% (n = 44) of the patients, morbidity for 8% (n = 4) of the patients, and death for 4% (n = 2) of the patients.

Outcome and supervision

Pearson's chi-square test showed an association between whether a caregiver was present at the time of the incident and hospital admission ($X^2 = 9.3935$, $P = 0.002$), with children admitted to the hospital more likely to have no adult caregiver present at the time of the incident than those treated in the ED only (Table 3). A Fisher's exact test did not show a significant association between whether a caregiver was present at the time of the incident and the outcome ($P = 0.077$).

Discussion

Results from this study indicate that although caregivers usually intend to supervise their young children during baththime, lapses in supervision are a main driver of pediatric bathtub drowning incidents. Additionally, our data highlight that children requiring a higher degree of care (hospital admission) were more likely to have no caregiver present at the time of the incident compared to those needing less intensive treatment (care in the ED only). Prior research has shown that indoor household duties are the most common distraction during lapses in supervision associated with drowning, with gathering clothing, towels, or shampoo as the common reasons for lapses in supervision during baths [19, 20]. This study highlights the single most common caregiver activity during bathtub drowning in our cohort: more than one third of caregivers were retrieving a bath towel and/or clothes when their supervision lapsed. Bath drowning prevention messaging should encourage parents and caregivers to gather towels and clothes prior to placing an infant in a bath.

Our results showing that 84% of bathtub drowning patients were < 2 years old suggest that infants and toddlers should have supervision while bathing. Caregivers should be advised to never leave an infant in a bathtub

without an adult present for any reason. The American Academy of Pediatrics suggests that adult supervision around water should be close, constant, and attentive [21]. Our results indicate that children 2–5 years old can also be at risk of drowning in a bathtub and should be monitored while bathing. Active play during bathtime and breath holding can be hazardous for children who can slip or accidentally inhale water, so the presence of an adult provides the best injury prevention.

Our data show that it is common to leave infants and young children alone with other children or teens, but caregivers should be advised that children cannot act as substitutes for adult supervision and, in some cases, children can increase the risk of infant drowning (e.g. by closing the bathtub drain so that the tub fills over the infant's head). Prior research shows it is common for children to drown in bathtubs while co-bathing with a sibling and that children who drown in bathtubs often have older siblings [10, 22, 23].

Additionally, children with a history of seizures are at risk of drowning while bathing and steps should be taken to monitor children with a history of seizures while in a bathtub. Research from Australia shows that medical conditions with seizures are the most prevalent condition associated with drowning for children [24]. Prior research from Canada indicates that people with epilepsy are at 6.3 times greater risk of drowning than the general population and that the majority of drownings related to seizures occur in a bathtub [25, 26]. Parents of children with seizure disorders should be educated about increased drowning risk for their child and provided with drowning prevention tips during bathing and other water activities.

Prior research indicates a prevalence of male drownings when all settings and ages are combined, with potentially large disparities depending on the scenario (e.g. 90% of drowning fatalities are male for 15–19-year-olds in Texas) [5]. However, this disparity by sex is not reflected in our pediatric bathtub drowning data. Our data show a slightly higher proportion of female patients (62%). It is likely a larger sample would show a relatively equal proportion of male and female pediatric bathtub drowning patients, as is seen in prior research on bathtub drowning [9].

Drowning incidents that occur in home pools often occur during non-swim times, when a child may access the pool without permission or knowledge of the caregiver [27]. Bathtub drowning incidents, however, mostly happen during planned bathtime (96% in this study), with the incident happening due to a lapse in caregiver supervision. However, care should be taken to protect against unplanned bath access, particularly if the bathtub is intentionally filled, such as during a water shortage. About one third of children 10–18 months old are able to climb into a bathtub [28]. It is suggested that during emergency situations when water utilities are shut off, recommendations to fill bathtubs with water should be qualified with brief acknowledgements of the risk to infants and toddlers and the importance of preventing access to a bathtub with any amount of water in it for families with small children.

Drowning is preventable. Research generally shows improved water safety practices following a variety of water safety interventions ranging from social media posts to parent classes [29–32]. For bath safety, interventions provided to new parents or during prenatal checkups may be useful. One study showed that parents who received tailored safety advice from pediatricians based on safety behavior assessments decreased their unsafe bathing practices compared to a control group who received generic safety information [32]. These findings indicate that prenatal and pediatrician visits should stress the importance of supervision while bathing young children. Further research is needed to evaluate additional injury prevention tactics for improving bath safety.

This study only analyzed patients who sought care at a hospital for a submersion or drowning incident. Over 1/3 of the patients were discharged from the ED after being evaluated or treated. Because infants cannot talk and young children may not be able to communicate their experience or symptoms clearly, parents may choose to bring young children in for evaluation following a submersion incident to be on the safe side. The World Health Organization (WHO) defines drowning as "the process of experiencing respiratory impairment from submersion/immersion in liquid" [33]. It is likely that many of these patients would not be defined as drowning by the WHO. Instead, they might be considered rescues and not included in data on fatal and non-fatal drowning. The authors of this study believe there is value in understanding the scenarios that led to the submersion incidents, whether or not the patient subsequently suffered respiratory symptoms, and so we chose to include all patients who sought care at the hospital for drowning or submersion in a bathtub.

This study assessed data for only one hospital, in one region of the USA Therefore, a limitation of the study is that the results may not be generalizable to other or larger populations. This study also only studied the pediatric population. Drowning most often occurs in bathtubs for infants < 1 year old and in other settings for older children and adults; however, some data suggest that bathtubs may again become a common drowning setting for adults over age 75 or 85 [5, 34, 35]. Future research on drowning should include assessment of drowning settings for older adults, when possible.

Conclusions

The overwhelming majority of patients treated for drowning had no adult caregiver present in this study, which indicates the critical nature of caregiver supervision as a preventative measure for pediatric bathtub drowning. Based on our data, we recommend close, constant, and attentive adult supervision during baths for young children. Additionally, we recommend monitoring for older children, particularly those with a history of seizures. We found that caregivers frequently stopped supervising their child in order to retrieve a bath towel and/or clothes. Our results suggest that these recommendations be prioritized in bath safety messaging: 1) to gather bathing supplies prior to running water for a child's bath, 2) to take an infant out of the bath if leaving for any reason, and 3) to turn off phones and avoid distractions or caring for other children when bathing a child.

Abbreviations

CPR	Cardiopulmonary Resuscitation
ED	Emergency department
EMS	Emergency Medical Services
ICU	Intensive Care Unit
REDCap	Research Electronic Data Capture
USA	Unites States of America
WHO	World Health Organization

Acknowledgements

Not applicable.

About this supplement

This article has been published as part of Injury. Epidemiology Volume 12 Supplement 1, 2025: Proceedings of the 29th Annual Injury Free Coalition for Kids® Conference: Forging New Frontiers: Engineering for Equity. The full contents of the supplement are available online at https://injepijournal.biomedcentral.com/articles/supplements/volume-12-supplement-1.

Author contributions

Authors KL and MJ contributed to the study design. Author MJ led the data analysis and manuscript preparation. All authors contributed to data analysis and interpretation, as well as manuscript preparation and revision. All authors approved the manuscript as submitted.

Funding

Support for this research was provided by the Pilot International Brain Related Research Grant. The funding agency played no role in the design of the study; data collection, analysis, or interpretation; or writing.

Data availability

Data can be made available through written request to the corresponding author.

Declarations

Ethics approval and consent to participate

This study was approved by the University of Texas at Austin Health Sciences Institutional Review Board (STUDY00005633). This was a retrospective study using medical records so informed consent was not possible.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Received: 27 February 2025 / Accepted: 20 June 2025
Published online: 07 July 2025

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Publisher's Note

Troy *et al. Injury Epidemiology* (2025) 12:39
https://doi.org/10.1186/s40621-025-00598-6

Injury Epidemiology

RESEARCH Open Access

Child and neighborhood factors associated with pediatric injuries sustained while engaged in activities where helmet usage is recommended

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Abstract

Background Unintentional injuries, including traumatic brain injuries (TBI) during activities where helmet usage is recommended (AWHUR), are a leading cause of pediatric morbidity and mortality in the U.S. While advocacy and education are proven measures to address safety, community resources in a child's neighborhood are known to have a large impact on their health.

Methods We utilized the trauma registry at two pediatric trauma centers, in a major metropolitan area from 2018 to 2022, to perform a retrospective chart review and Geographical Information System (GIS) mapping on all AWHUR injuries that were included in the trauma registry. Data extracted from the trauma registry included: mechanism, demographics, insurance status, and injury characteristics. AWHUR data was then overlaid with the Childhood Opportunity Index (COI) to assess community resources in relation to injury characteristics.

Results Our sample size included 1425 children throughout the 5-year time period. The most common injury mechanisms included: bicycle 34.0%, ATV 18.2%, skateboard 13.3%, scooter 9.2%, and dirt-bike 7.4%. Most patients in very low and low COI were publicly insured, respectively 81.9% and 63.2%; while 65.8% of high COI injured patients were privately insured children. There was a statistically significant di erence in helmet usage across different levels of COI ($p < 0.001$). The rates of helmet usage by COI ranking from very low to very high were as follows: 21.6%, 25.2%, 37.8%, 40.2%, and 51.6% utilization. Among those injured while wearing a helmet, the odds of sustaining a higher ISS were 34% lower (OR = 0.66, 95% CI: 0.50—0.89) compared to those who were not wearing a helmet at the time of injury. Additionally, GIS mapping identified l w and very low COI communities with higher injury rates and lower helmet use.

Conclusion Children with lower COI were more likely to be publicly insured with a lower percentage of helmet usage. Overlapping injury data and COI identified high- isk communities where low resources can contribute to growing injury severity. This data can then be used to inform injury prevention and highlight the importance of community factors.

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Keywords Helmet, Bicycle, ATV, Traumatic Brain Injury, GIS Mapping, Pediatrics

Background

Unintentional injuries, including traumatic brain injuries (TBI) during activities where helmet usage is recommended (AWHUR), are a leading cause of pediatric morbidity and mortality in the United States [1]. Specifically, TBIs are a leading cause of death and disability amongst children and adolescents in the U.S. [2]. These injuries can commonly occur for children participating in recreational AWHURs including bicycling, scootering, riding all-terrain vehicles (ATVs), snow-sports (skiing, snowboarding), skating (ice, roller, blading), skateboarding, and participation in equestrian sports. Combined, these activities have resulted in over 42,000 pediatric ED visits annually for nonfatal TBI, with bicycle injuries causing the highest incidence of TBI [2, 3]. Concerningly though, there has been an increase in pediatric TBI-related emergency department (ED) visits over recent years, as well as an increase in concussions diagnosed in the ED [4]. In 2014, there were > 830,000 ED visits and hospitalizations, and > 2,500 deaths in children due to TBI [5, 6].

Analysis has also shown that the geographical location of the injury can be associated with the severity of injury and lead to potential delays in care or mis-triage at a non-trauma center [7]. Additionally, rural TBIs are at higher risk for dangerous injury mechanisms and trauma severity when compared to pediatric patients injured in an urban setting [7]. Rural patients were more likely to have unnecessary transfers leading to increased costs as well as inadequate initial evaluation in non-trauma rural EDs. The location of the injury has also been associated with mortality rates four times higher than expected in non-urban areas [8]. Analysis has also shown that there are significant disparities in access to pediatric trauma centers based on race and ethnicity that leave children at risk for poor trauma outcomes [9]. Through Geospatial Information Systems (GIS) mapping of trauma registries, there have been areas identified as high risk for injury [10].

While participation in the above-mentioned AWHUR activities is part of pediatric well-being, helmets have been proven to reduce the incident and severity of TBIs [11–15]. The Center for Disease Control and Prevention, as well as The American Academy of Pediatrics, have published policies on the importance of proper helmet usage during common activities of childhood [16]. We also know that interventions in communities have been shown to increase awareness and helmet usage for children [17–21]. However, these costly efforts should be focused on targeted problematic and high-risk areas [22, 23]. The Childhood Opportunity Index (COI) is a database measuring and mapping the quality of resources in a child's neighborhood that are important for healthy development. Previous analysis has identified that pediatric patients presenting to the pediatric ED with lower COI had a higher proportion of mortality [24]. In addition, studies have determined that children from lower COI neighborhoods are more likely to be re-admitted to the pediatric intensive care unit after previous discharge, especially those with chronic medical conditions [25].

Thus, our primary aim was to utilize geographic markers to identify AWHUR injury characteristics and demographics in the communities of interest. We additionally aimed to compare census tracts where head injuries are more prevalent based on neighborhood resources utilizing the COI. We hypothesized that there are specific areas (hotspots) where there is a lower incidence of helmet usage amongst children ages 0 to 18 years old engaging in AWHUR within the metropolitan area. We additionally hypothesize that children, who presented after sustaining an injury while unhelmeted and engaging in AWHUR, are more likely to reside in areas with less resources thus having a lower COI score denoting the limitations of their neighborhood resources as defined by COI.

Methods

Study overview

We performed a cross-sectional retrospective chart review of the trauma registry at a Level 1 and at a Level 2 pediatric trauma center within a single pediatric healthcare system serving a major metropolitan area. These emergency departments combined care for approximately 180,000 patients annually. AWHUR injuries were identified through analysis of the trauma registry along with their associated demographics and injury characteristics. AWHUR were defined as activities involving bicycling, scootering (powered and un-powered, including hoverboards), off-road-vehicles (ATVs, go-karts, etc.), skiing, snowboarding, ice skating, roller skating, rollerblading, skateboarding, and equestrian sports. This data was then analyzed employing the COI 2.0 in conjunction with Geographical Information System (GIS) mapping. This study received approval via the Children's Healthcare of Atlanta institutional review board (IRB).

Study population

Children aged 0 to 18 years old who presented or were transferred to the Level 1 and Level 2 trauma center emergency departments from 2018–2022, and were included in the trauma registry, were eligible for the study. The trauma registry inclusion criteria are defined

by the American College of Surgeons National Trauma Standard Data Set. The main patient qualifications to be included in the registry are: one or more traumatic injuries sustained within the previous 14 days of a hospital encounter; direct hospital admission or transferred from another facility via emergency medical services (EMS) or air ambulance; death in the ED; and presentation as a trauma activation requiring surgical presence per hospital guidelines.

Patients from the trauma registry were included in our evaluation based on the following International Classification of Diseases (ICD)–10 codes: S00-S99, T07, T14, and T79.A1-T79.A9 with one of the injuries in the following codes: S00, S10, S20, S30, S40, S50, S60, S70, S80, and S90 (Table 1). Additionally in the initial evaluation, V00-V99 ICD-10 coded patients were included based on their external mechanism while S00-S99 provided us patients based on their presenting injury. Initial patient eligibility was confirmed via brief patient injury summaries found in the trauma registry, and patients queried from the registry via ICD-10 codes without a clear injury mechanism from the trauma registry summary were individually chart reviewed to determine if a patient's presentation was consistent with an AWHUR.

Data abstracted from the trauma registry included demographics such as race, ethnicity, gender, age, insurance status, and home address, as well as injury characteristics including injury severity score (ISS), activity type, helmet use, presence of head injury, neurosurgical consultation, and extent of head injury. Head injuries were identified through the Glasgow Coma Scale (GCS) and ICD codes consistent with a head injury. Race and ethnicity were reported by the caregiver typically. If a child presented with unknown helmet status, and helmet status could not be confirmed via chart review, these patients were included in mechanism analysis, but they were excluded from further injury characteristics such as head injury and helmet status.

Exclusion criteria for this study included patients who were older than 18 years of age, or patients who presented via an injury mechanism not included in abovementioned AWHUR criteria. Children who were not directly participating in the AWHUR were excluded (e.g., a patient struck by another child riding a bicycle). Additionally, children with addresses not in Georgia, as well as those with incomplete addresses, were also removed from the database for standardization of the analysis.

Table 1 Activities where helmet use is recommended ICD-10 codes

ICD 10 Codes	
T07	Inuires involving multiple body regions
T14	Injury of unspecificed body egion
T79	Certain early complications of trauma
S00-S09	Injuries to the head
S10-S19	Injuries to the neck
S20-S29	Injuries to the thorax
S30-S39	Injuries to the abdomen, lower back, lumbar spine, pelvis, and external genitals
S40-S49	Injuries to the shoulder and upper arm
S50-S59	Injuries to the elbow and forearm
S60-S69	Injuries to the wrist, hand, and finger
S70-S79	Injuries to the hip and thigh
S80-S89	Injuires to the knee and lower leg
S90-S99	Injuires to the ankle and foot
V00-V09	Pedestrian injured in transport accident
V10-V19	Pedal cycle rider injuried in transport accident
V20-V29	Motorcycle rider injuried in transport accident
V30-V39	Occupant of three-wheeled motor vehicle injured in transport accident
V60-V69	Occupant of heavy transport vehicle injured in transport accident
V80-V89	Other land transport accidents
V98-V99	Other and unspecified transpo t accidents

This table lists the ICD-10 codes that were used to obtain patients from the trauma registry

Child opportunity index

The COI 2.0 is a measurement of the resources a child has access to in their neighborhood [26]. The COI gives a ranking from highest to lowest for access to resources and healthy opportunities, such as education, healthcare, green space, nutritious food, and socio-economic factors, in the child's neighborhood. The COI has an overall composite score based on 29 community characteristics that comprise the ranking for each neighborhood, and it is then categorized into 3 sub-domains: education, health and/or environment, and social and/or economic.

Census tract level analysis was incorporated to compare our patient home addresses and zip codes with the COI. The COI has 5 main categorizations of the resources in a community ranging from very low to very high. A very low COI indicated that a child's zip code level data places them in the highest community-level vulnerability. Our study compared patient demographics (i.e. race, gender, and insurance status) and injury characteristics in conjunction with the patient's COI score.

Data analysis

Descriptive Statistics were summarized for categorical data using counts and percentages. Group comparisons between the different levels of COI, years, and helmet usage utilized Pearson's Chi-squared test and Fisher's exact test (when cell counts were less than 5). We quantified the association between the primary outcomes—Injury Severity Score (ISS) and helmet use—and the covariates mechanism of injury and activity type using univariate and multivariable logistic regression models. All multivariable analyses were then adjusted for

Table 2 Activities where helmet use is recommended patient characteristics patient demographics

		Overall, n = 1425	2018, n = 239	2019, n = 274	2020, n = 407	2021, n = 273	2022, n = 232	p-value
Age (%)	< =4 yrs	112 (7.8%)	19 (7.9%)	23 (8.4%)	35 (8.6%)	16 (5.9%)	19 (8.2%)	0.009
	5–9 yrs	460 (32.2%)	85 (35.6%)	89 (32.4%)	135 (33.2%)	80 (29.3%)	71 (30.6%)	
	10–14 yrs	694 (48.7%)	120 (50.2%)	144 (52.6%)	192 (47.1%)	132 (48.3%)	106 (45.7%)	
	15–18 yrs	159 (11.3%)	15 (6.3%)	18 (6.6%)	45 (11.1%)	45 (16.5%)	36 (15.5%)	
Gender (%)	Female	449 (31.5%)	87 (36.4%)	84 (30.7%)	142 (34.9%)	80 (29.3%)	56 (24.1%)	0.023
	Male	976 (68.5%)	152 (63.6%)	190 (69.3%)	265 (65.1%)	193 (70.7%)	176 (75.9%)	
Insurance (%)	Public	724 (50.8%)	92 (38.5%)	130 (47.4%)	189 (46.4%)	156 (57.1%)	157 (67.7%)	< 0.001
	Private/commerical insurance	583 (40.9%)	111 (46.4%)	117 (42.7%)	174 (42.8%)	110 (40.3%)	71 (30.6%)	
	Other	118 (8.3%)	36 (15.1%)	27 (9.9%)	44 (10.8%)	7 (2.6%)	4 (1.7%)	
Race (%)	White	883 (62.9%)	158 (66.1%)	173 (63.1%)	255 (63.9%)	154 (58.1%)	143 (63.0%)	0.787
	Black or African American	379 (27.0%)	62 (25.9%)	72 (26.4%)	100 (25.1%)	82 (30.9%)	63 (27.8%)	
	Asian	56 (4.0%)	6 (2.5%)	10 (3.6%)	21 (5.3%)	12 (4.5%)	7 (3.1%)	
	Other Race	86 (6.1%)	13 (5.5%)	19 (6.9%)	23 (5.7%)	17 (6.5%)	14 (6.1%)	
Ethnicity (%)	Hispanic or Latino	173 (12.2%)	28 (11.7%)	40 (14.6%)	50 (12.3%)	31 (11.4%)	24 (10.3%)	0.655
	Not Hispanic or Latino	1250 (87.8%)	211 (88.3%)	234 (85.4%)	356 (87.7%)	241 (88.6%)	208 (89.7%)	
Mechanism (%)	ATV	260 (18.2%)	26 (10.9%)	49 (17.9%)	70 (17.2%)	57 (20.9%)	58 (25.0%)	< 0.001
	Bicycle	484 (34.0%)	88 (36.8%)	100 (36.5%)	164 (40.3%)	78 (28.6%)	54 (23.3%)	
	Dirt bike	106 (7.4%)	17 (7.1%)	15 (5.5%)	23 (5.7%)	26 (9.5%)	25 (10.8%)	
	Electric scooter	25 (1.7%)	4 (1.7%)	5 (1.8%)	5 (1.2%)	7 (2.6%)	4 (1.7%)	
	Go cart	29 (2.0%)	5 (2.1%)	11 (4.0%)	1 (0.2%)	5 (1.8%)	7 (3.0%)	
	Horse	48 (3.4%)	18 (7.5%)	8 (2.9%)	7 (1.7%)	3 (1.1%)	12 (5.2%)	
	Hoverboard	62 (4.4%)	10 (4.2%)	10 (3.6%)	16 (3.9%)	16 (5.9%)	10 (4.3%)	
	Other	35 (2.5%)	10 (4.2%)	3 (1.1%)	6 (1.5%)	9 (3.3%)	7 (3.0%)	
	Roller skating	37 (2.6%)	7 (2.9%)	12 (4.4%)	7 (1.7%)	4 (1.5%)	7 (3.0%)	
	Rollerblading	18 (1.3%)	4 (1.7%)	7 (2.6%)	3 (0.7%)	2 (0.7%)	2 (0.9%)	
	Scooter	131 (9.2%)	22 (9.2%)	21 (7.7%)	45 (11.2%)	21 (7.7%)	22 (9.5%)	
	Skateboard	189 (13.2%)	28 (11.7%)	32 (11.7%)	60 (14.7%)	45 (16.4%)	24 (10.3%)	
	Snowboarding	1 (0.1%)	0 (0.0%)	1 (0.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Helmet usage (%)	Helmet	404 (38.7%)	65 (39.6%)	73 (38.0%)	126 (38.7%)	72 (36.7%)	68 (40.7%)	0.951
	No	641 (61.3%)	99 (60.4%)	119 (62.0%)	200 (61.3%)	124 (63.3%)	99 (59.3%)	

AWHUR table examining patient characteristics over the years of the trauma registry

potential confounders (determined using a priori methods), including race and insurance status. odd ratios (OR) and 95% Confidence Intervals (CI) were provided. All p-values less than 0.05 were considered statistically significant. All data cleaning and statistical testing was performed in R Statistical Software (v4.2.1; R Core Team 2022).

Geographic Information Systems (GIS) mapping

Two trauma centers in metropolitan Atlanta provided home addresses of 1,425 pediatric head trauma patients between 2018–2022. ArcGIS Pro 2.1 was used to geocode these addresses. In addition to home addresses, the injury mechanism, gender, race, ethnicity, insurance status, helmet usage, and other injury characteristics were also included in the database for analytic purposes. Once geocoded, patient locations were spatially joined to county boundaries within the 22-county Atlanta Metropolitan Statistical Area (MSA) to create various aggregate county-level maps, such as injury rates by helmet usage, by injury mechanism, or by visit date. The geocoded addresses were also spatially joined or aggregated to the Child Opportunity Index data layer boundaries, a census tract-level composite index of children's neighborhood opportunity that contains 44 indicators related to education, health, environment, and socioeconomics. This allowed for a direct comparison between the COI index and the aggregated counts of head trauma patients and their trauma registry specific variables at the census tract level.

Table 3 Activities where helmet use is recommended patient characteristics by childhood opportunity index

		Overall, n = 1425	Very Low, n = 210	Low, n = 171	Moderate, n = 260	High, n = 357	Very High, n = 427	p-value
Age (%)	< =4 yrs	112 (7.8)	24 (11.4)	9 (5.2)	28 (10.8)	20 (5.6)	31 (7.3)	0.093
	5–9 yrs	460 (32.2)	77 (36.7)	59 (34.5)	71 (27.3)	115 (32.2)	138 (32.3)	
	10–14 yrs	694 (48.7)	92 (43.8)	88 (51.5)	129 (49.6)	177 (49.6)	208 (48.7)	
	15–18 yrs	159 (11.3)	17 (8.1)	15 (8.8)	32 (12.3)	45 (12.6)	50 (11.7)	
Gender (%)	Female	449 (31.5)	55 (26.2)	46 (26.9)	80 (30.8)	104 (29.1)	164 (38.4)	0.005
	Male	976 (68.5)	155 (73.8)	125 (73.1)	180 (69.2)	253 (70.9)	263 (61.6)	
Insurance (%)	Public	724 (50.8)	172 (81.9)	108 (63.2)	153 (58.8)	187 (52.4)	104 (24.4)	< 0.001
	Other	118 (8.3)	14 (6.7)	13 (7.6)	20 (7.7)	29 (8.1)	42 (9.8)	
	Private or Commerical	583 (40.9)	24 (11.4)	50 (29.2)	87 (33.5)	141 (39.5)	281 (65.8)	
Race (%)	White	883 (62.9)	32 (15.5)	103 (62.0)	170 (66.1)	251 (71.1)	327 (77.7)	
	Black or African American	379 (27.0)	163 (78.7)	50 (30.2)	72 (28.0)	60 (17.0)	34 (8.1)	
	Asian	56 (4.0)	2 (1.0)	2 (1.2)	4 (1.6)	10 (2.8)	38 (9.0)	
	Other Race	86 (6.1)	10 (4.8)	11 (6.6)	11 (4.3)	32 (9.1)	22 (5.2)	
Ethnicity (%)	Hispanic or Latino	173 (12.2)	20 (9.5)	30 (17.5)	20 (7.7)	63 (17.6)	40 (9.4)	< 0.001
	Not Hispanic or Latino	1250 (87.8)	190 (90.5)	141 (82.5)	240 (92.3)	294 (82.4)	385 (90.6)	
Helmet usage (%)	Helmet	404 (38.7)	32 (21.6)	32 (25.2)	76 (37.8)	105 (40.2)	159 (51.6)	< 0.001
	No	641 (61.3)	116 (78.4)	95 (74.8)	125 (62.2)	156 (59.8)	149 (48.4)	
Head injury (%)	Yes	415 (29.1)	64 (30.5)	60 (35.1)	77 (29.6)	101 (28.3)	113 (26.5)	0.314
	No	1010 (70.9)	146 (69.5)	111 (64.9)	183 (70.4)	256 (71.7)	314 (73.5)	
ISS categories (%)	Mild (1–8)	1017 (71.8)	156 (75.7)	116 (67.8)	184 (70.8)	240 (67.4)	321 (75.9)	
	Moderate (9–15)	309 (21.8)	37 (18.0)	42 (24.6)	56 (21.5)	91 (25.6)	83 (19.6)	
	Severe (16–24)	66 (4.7)	8 (3.9)	9 (5.3)	14 (5.4)	19 (5.3)	16 (3.8)	
	Very severe (25—greater)	24 (1.7)	5 (2.4)	4 (2.3)	6 (2.3)	6 (1.7)	3 (0.7)	
Mechanism (%)	ATV	260 (18.2)	34 (16.2)	50 (29.3)	70 (26.9)	63 (17.6)	43 (10.1)	
	Bicycle	484 (34.0)	85 (40.4)	57 (33.3)	68 (26.2)	115 (32.2)	159 (37.2)	
	Dirt bike	106 (7.4)	22 (10.5)	13 (7.6)	27 (10.4)	21 (5.9)	23 (5.4)	
	Electric scooter	25 (1.7)	5 (2.4)	1 (0.6)	5 (1.8)	8 (2.2)	6 (1.4)	
	Go cart	29 (2.0)	7 (3.3)	5 (2.9)	5 (1.8)	7 (2.0)	5 (1.2)	
	Horse	48 (3.4)	2 (1.0)	6 (3.5)	8 (3.1)	7 (2.0)	25 (5.9)	
	Hoverboard	62 (4.4)	11 (5.2)	10 (5.8)	8 (3.1)	12 (3.4)	21 (4.9)	
	Other	35 (2.5)	6 (2.9)	4 (2.3)	8 (3.1)	8 (2.2)	9 (2.1)	
	Roller skating	37 (2.6)	5 (2.4)	3 (1.8)	9 (3.5)	15 (4.2)	5 (1.2)	
	Rollerblading	18 (1.3)	4 (1.9)	0 (0.0)	3 (1.2)	6 (1.7)	5 (1.2)	
	Scooter	131 (9.2)	16 (7.6)	6 (3.5)	21 (8.1)	34 (9.5)	54 (12.6)	
	Skateboard	189 (13.2)	13 (6.2)	16 (9.4)	28 (10.8)	61 (17.1)	71 (16.6)	
	Snowboarding	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.2)	

AWHUR table looking at patient characteristics in relation to their childhood opportunity index resources

Results

AWHUR demographics

Over a 5-year period, 1,425 patients were analyzed from the trauma registry. 288 patients in 2018 up to 347 in 2019, 510 in 2020, 365 in 2021 and 314 in 2022 (Table 2). Over half (68.8%) of the patients who presented more than 5 years after AWHUR were male. One-third of the patients were between 5 and 9 years old, and 49% were between 10 and 14 years of age over the course of the 5 years. Throughout the 5 years, 50.8% of patients were publicly insured, while 40.9% were children with private or commercial insurance. The patient population throughout the study was inclusive, with 62.9% identifying as White, 27% identifying as Black, and 4% as Asian.

Childhood opportunity index demographics

When examining the COI demographics for our study, 381 (26.7%) children resided in low or very low COI neighborhoods, compared to 784 (55%) children in high or very high COI neighborhoods (Table 3). The majority of black patients (78.7%) were in a very low COI, while the majority of white patients (77.7%) were in a very high COI. Most patients in very low and low COI were publicly insured, at 81.9% and 63.2%, respectively, while

65.8% of high COI injured patients were privately insured ($p < 0.001$).

AWHUR injury characteristics

Over the 5-year time, the five most common injury mechanisms (bicycle, ATV, skateboard, scooter, and dirt-bike) accounted for 82.1% of all injuries. The most common injury mechanism was bicycle injuries at 34.0%, followed by ATV injuries at 18.2%, and skateboard related injuries at 13.3%. Additional injury severity characteristics did not find statistically significant results including neurosurgery consultation, Injury Severity Score, Glasgow Coma Scale, and head injury documentation.

Childhood opportunity index injury characteristics

There was a statistically significant difference in helmet usage across different levels of COI ($p < 0.001$). For AWHUR injury patients, those with very low COI had 21.6% helmet usage, low COI had 25.2% utilization, moderate COI had 37.8%, high COI had 40.2%, and very high COI had 51.6% utilization. (Table 3). In the unadjusted models, higher COI tended to show higher helmet usage. Children who lived in very high COI neighborhoods were 3.87 (95% CI 2.49—6.15) times more likely to utilize helmets compared to those with very low COI. However, after adjusting for race and insurance status, this association became insignificant with an OR of 1.33 (95% CI 0.77—2.32). Among those injured while wearing a helmet, the odds of sustaining a higher ISS were 34% lower (OR = 0.66, 95% CI: 0.50—0.89) compared to those who were not wearing a helmet at the time of injury. Figure 1 represents helmet usage in relation to COI for public and private insurance demonstrating the large gap in the parameters.

Geographical information systems mapping

Through GIS mapping, we were able to identify communities at risk for various injury characteristics. By overlapping injury rates for the pediatric population in that community and the percentage of unhelmeted children, we were able to identify high risk communities throughout the years and by top injury mechanisms (Fig. 2).

Overlapping the injury data with the COI was able to determine communities with lower COI measurement in relation to injury characteristics. Figure 3 demonstrates each COI communities in relation to their injury rate by coloration, with the brighter red color demonstrating communities with lower COI and high accident rates for all activities.

Discussion

This study uncovered valuable insights regarding the COI and activities where helmet usage is recommended (AWHUR). The majority of children injured during these activities were between 5–9 years old and 10–14 years old for our extracted data from the trauma registry, and there was not a statistical difference in the age groups for the measurements of COI throughout the years. Males were most often involved in the injury for each COI measurement category. This study found similar patterns to those in previous analyses, indicating that black children in our analysis were more likely to be in communities with lower COI measurements [27]. Similar to previous findings, this helps provide context for health inequities

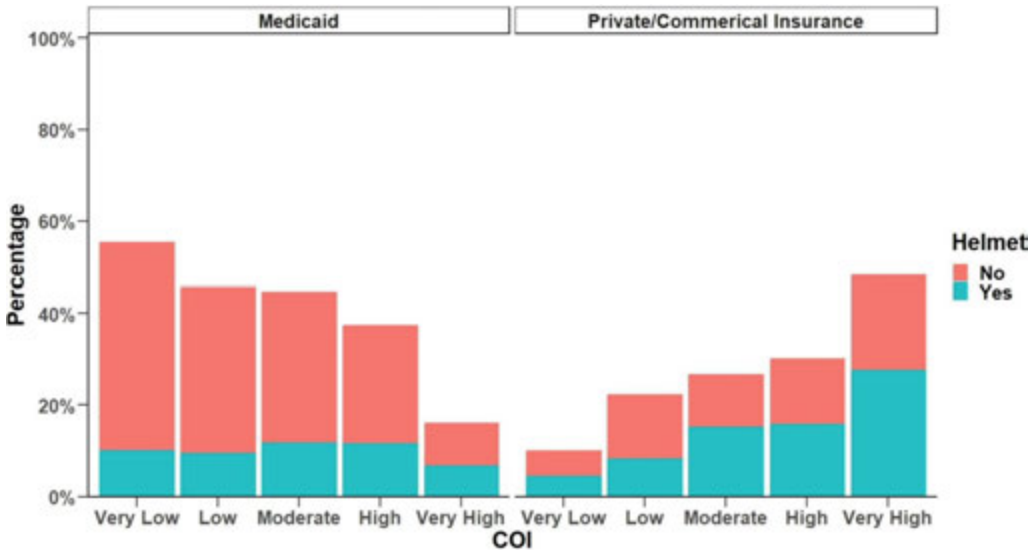

Fig. 1 Helmet usage for each level of childhood opportunity index by insurance type (only medicaid & private/commercial). This graph demonstrates each COI resource category by percentage for public insurance and private/commercial insurance

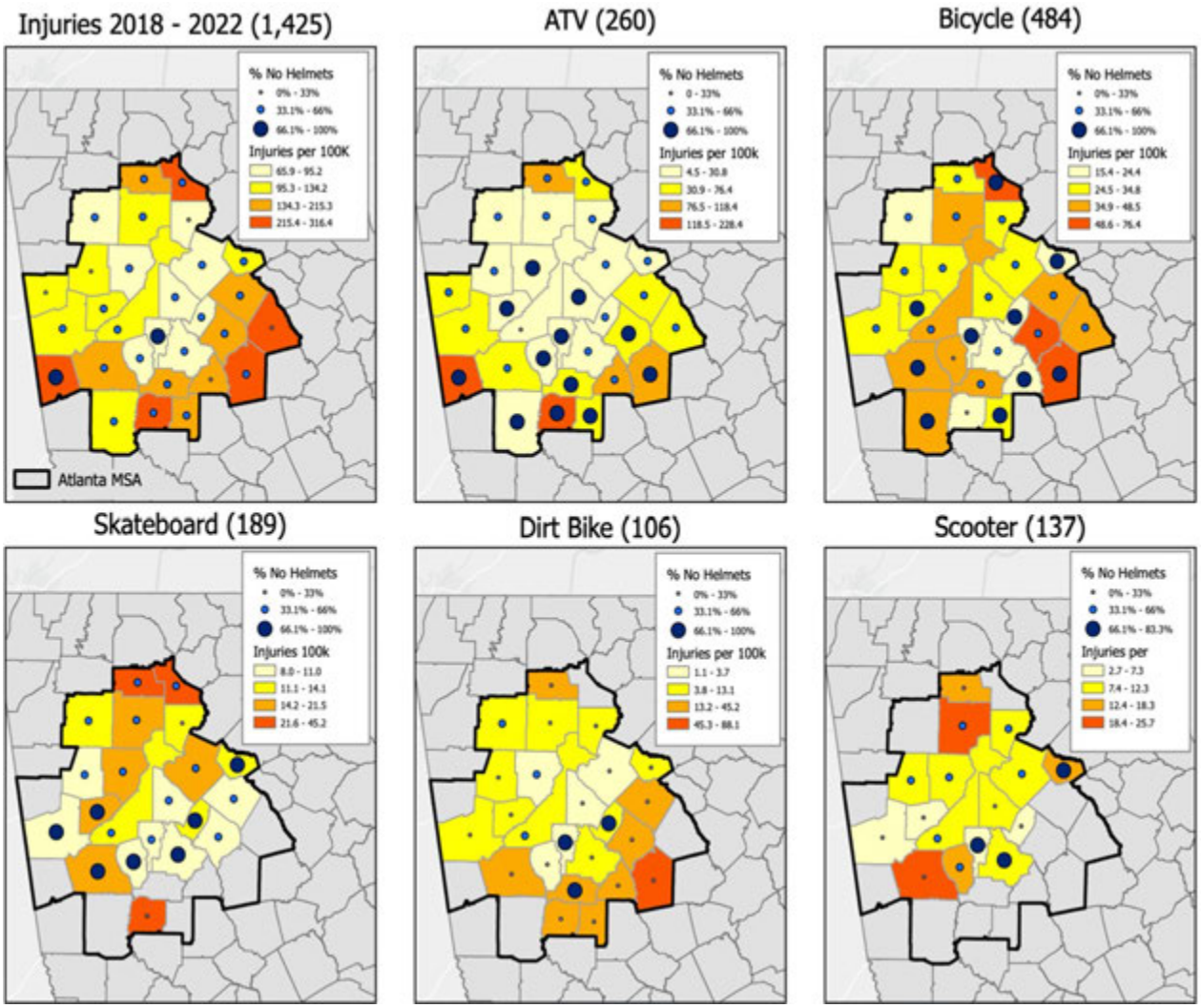

Fig. 2 Activities where helmet use is recommended injury rates by no helmet usage. This map displays injury rates for all counties in the Atlanta Metropolitan area from 2018 to 2022, including overall accidents, and is then broken down by the top injury mechanisms

in these communities and potential future interventions, as discussed below in conjunction with our GIS mapping.

A significant association was discovered in evaluation of insurance status and the COI. We found that 81.9% of patients injured with very low COI were publicly insured compared to 65.8% of patients injured in high COI areas were privately insured children. This finding follows previous studies evaluating the COI that determined public government insurance was more commonly found for lower COI children and private insurance found more often in higher COI areas [28]. This is concerning as we have seen that children on public insurance are less likely to be helmeted at the time of their injury [29]. We found that children with a lower COI measurement were more often unhelmeted at the time of their injury while children with a higher COI were more often to be helmeted at the time of their injury. This is consistent with previous research that found children with lower socioeconomic factors and being publicly insured are more commonly unhelmeted in their injuries [30–32]. Previous analysis has shown the lack of education contributing to helmet utilization and the increased helmet utilization after educational campaigns [31, 32]. We have also seen that children are less adherent with helmet utilization in communities with socioeconomic disparities [33].

However, when looking at other injury characteristics and the COI, such as head injury, neurosurgery consultation, Injury Severity Score, and Glasgow Coma Score, we did not find statistically significant associations. We did discover that for those who wear a helmet, the odds of having a higher Injury Severity Score was 34% less likely than the odds of those who didn't wear a helmet. This is consistent with multiple studies and recommendations from the American Academy of Pediatrics on the usage of helmets during these activities [16]. Overall, though, it is important to consider that socioeconomic factors,

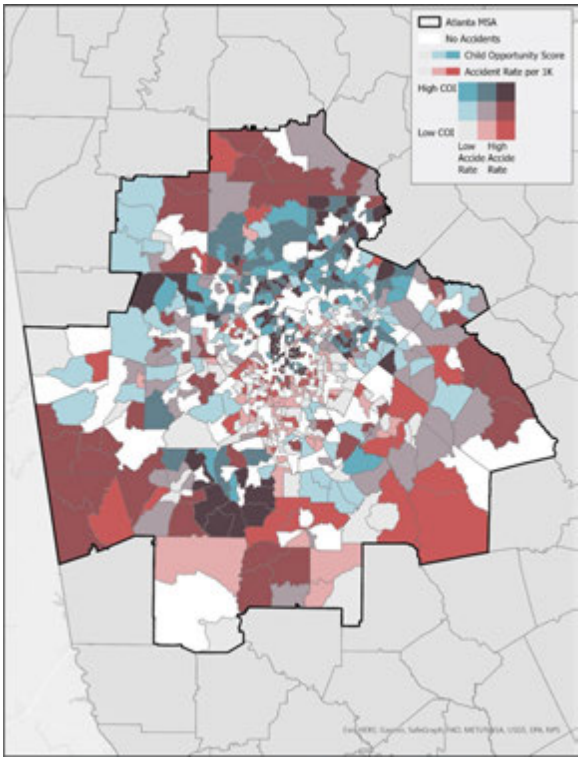

Fig. 3 Activities where helmet use is recommended injury rates by childhood opportunity index. This map demonstrates overlapping the injury rates and Childhood Opportunity Index (COI) to identify areas with high injury rates and low COI

represented by COI, are associated with less access to resources and care to follow up on the injuries in relation to these activities [34].

Previous studies have seen that certain communities lacked community safety programs impacting helmet usage, in particular due to financial constraints, leading to the importance of GIS mapping and the COI [35]. In addition to the above-mentioned trends on injury characteristics and demographics with the COI, GIS mapping was able to identify specific communities with higher injury rates and lower COI. There was an alarming number of communities that were highlighted with lower COI and higher injuries, as seen in Fig. 3 with the lighter red coloration. Concerningly, we also know that communities such as these, without a pediatric trauma center, have been found in prior studies to under triage pediatric patients leading to poor outcomes and significant disparities across geography with regards to race and ethnicity [9, 10]. Additionally important to consider, there were a few communities with high COI and high injury rates, as we do know that higher COI communities were more often helmeted during the injury event from our analysis. Having this valuable data on injury rates and COI can influence where to most effectively initiate injury prevention campaigns in high-risk communities with less resources [10, 22, 23].

Limitations

Our study included patient data from the electronic health record and trauma registry, which is dependent on provider documentation. This was a limiting factor, as provider documentation was variable for injury characteristics, such as helmet usage and mechanism of injury clarification. Additionally, for our patient inclusion criteria via ICD-10 codes, provider documentation is a key component to identifying patients who would meet criteria via our trauma registry and without appropriate documentation eligible patients may not be included in our study population. Further, not all patients who presented with injuries during activities where helmet usage is recommended (AWHUR) are included in the trauma registry, leading to patients likely excluded from the study due to our data extraction methods. Another limiting factor was the location, as it would be beneficial to have the location of the injury, in addition to the patient's home address, used in this study. Additionally, patients not accounted for include those that presented to local emergency departments without referral to our facility, urgent care locations, death prior to the emergency department arrival, or possibly diversion due to saturation of available hospital resources. These potentially unaccounted patients could easily impact a communities' injury characteristics, as only higher acuity patients are likely transferred to our trauma centers. Additionally, through this bias in higher acuity transfers, we may have higher injury severity rates in communities farther away who can typically manage less severe injuries in their community emergency departments and urgent cares.

Conclusion

This study highlights the association that children with a lower COI were more likely to be publicly insured with a lower percentage of helmet usage. Alarmingly, concerning patterns are seen in lower COI communities with these childhood injuries in relation to race and ethnicity. We were also able to identify communities with high injury rates and lower helmet usage via GIS mapping. The benefits of identifying the overlapping injury data and COI can identify high risk communities where low resources can contribute to growing injury severity. Potential future interventions in the communities identified via the COI and GIS mapping can help to more effectively allocate resources and interventions. Further analysis is needed into these communities with higher injury rates to determine additional factors related to community resources and their proximity to pediatric trauma care. Population health interventions and

campaigns are crucial in our most impacted communities to address safety during these common childhood activities.

Abbreviations

TBI	Traumatic brain injury
ED	Emergency department
COI	Childhood opportunity index
AWHUR	Activities when helmet usage is recommended
GIS	Geographical information system
MSA	Metropolitan statistical area
CI	Confidence intervals
OR	Odds ratio
ISS	Injury severity score

Acknowledgements
Thank you to Dr. Claudia Morris and Dr. Chris Rees for their non-financial support for this project. Thank you to the Trauma Registry at Children's Healthcare of Atlanta.

About this supplement
This article has been published as part of Injury Epidemiology Volume 12 Supplement 1, 2025: Proceedings of the 29th Annual Injury Free Coalition for Kids® Conference: Forging New Frontiers: Engineering for Equity. The full contents of the supplement are available online at https://injepijournal.biomedcentral.com/articles/supplements/volume-12-supplement-1.

Author contributions
BT, MA, and KF conceptualized and designed the study, drafted the initial manuscript, and critically reviewed and revised the manuscript. AJ carried out the initial analyses, manuscript review, and final analysis or the manuscript. AL conceptualized and designed the study. AG carried out the Geographical Information Systems Mapping for the project and manuscript discussion of this section. All authors approved the final manusc ipt as submitted and agree to be accountable for all aspects of the work.

Funding
This research was funded by the Warshaw Grant Fellow Research Grant at Emory University School of Medicine and Children's Healthcare of Atlanta. This funding was used to support GIS mapping and statistical support for the study. This funding did not have any role in the design of the study, collection of data, analysis of data, or in writing the manuscript. This project was funded by the Warshaw Grant Fellow Research Grant at Emory University School of Medicine and Children's Healthcare of Atlanta.

Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
IRB approval was obtained for this retrospective chart review.

Consent for publication
Not Applicable

Competing interests
The authors declare that there are no known competing interests or financial relationships relevant to this article to disclose.

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Received: 7 March 2025 / Accepted: 20 June 2025
Published online: 07 July 2025

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Publisher's Note

Askelsen *et al. Injury Epidemiology* (2025) 12:41
https://doi.org/10.1186/s40621-025-00596-8

Injury Epidemiology

RESEARCH Open Access

Rural adolescent attitudes and use of bicycle helmets in Iowa

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Abstract

Background Helmet use significantly dec eases head injuries, the most common cause of bicycle-related fatalities in youth. Our objective was to determine bicycle helmet use by rural adolescents, their attitudes regarding helmets, and associated demographic factors.

Methods A convenience sample of 2022 Iowa FFA (formerly Future Farmers of America) Leadership Conference attendees completed an anonymous electronic or paper survey. After compilation in Qualtrics, descriptive, bivariate and multivariable logistic regression analyses were performed using statistical program, R.

Results 1,331 adolescents 13–18 years participated. Almost three-fi ths (58%) were female; 56% were 16–18 years. One-half lived on a farm, 21% lived in the country/not on a farm and 28% lived in town. 90% of subject households had at least one bicycle. Overall, 78% had ridden a bicycle in the past year. Those from farms had lower proportions that had ridden a bicycle in the past year (73%) than those living elsewhere (83%), $p < 0.001$, and also rode them less frequently. The mean importance (rated 1–10) of wearing a bike helmet was 4.7 (median 4). Males, older teens, non-Hispanic White individuals, and those from farms all ascribed lower bicycle helmet importance than their corresponding peers. Only 15% supported laws requiring bicycle helmet use. Three-quarters (74%) rarely or never wore a helmet; only 13% said they always or mostly wore a helmet. A direct relationship was noted between helmet use and those who rode more frequently, and to those ascribing higher importance to helmet use. Only 12% stated their parents had a strict "no helmet, no riding" rule. However, those with a rule had 18 times greater odds of supporting bicycle helmet laws and had a higher median ascribed bicycle helmet importance as compared to those without a rule (9 vs. 4). Moreover, participants with a strict rule had 32 times higher odds of wearing a bicycle helmet always/most of the time versus those without a rule.

Conclusions Bicycle helmet use is infrequent among rural adolescents. Youth whose parents had a strict "no helmet, no riding" rule placed greater importance on using helmets, were more supportive of bicycle helmet laws, and had significantly reater helmet use.

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Keywords Adolescent, Bicycle, Bike, Farm, Helmet, Rural, Safety, Youth

Background

Bicycling is a popular childhood leisure activity in the United States, with over half of children 3–17 years riding a bike at least once in 2018 [1]. Of those youth who had ridden a bike, the average number of bike riding days was 56 (median 28) [1]. While it serves as both recreation and a mode of transportation, bicycling also introduces significant risks. Among recreational sports, injuries due to bicycles are one of the leading causes of emergency department (ED) visits for youth [2, 3].

Suffering an injury to the brain is one of the greatest risks posed to bicyclists [4–15]. A study of National Electronic Injury Surveillance System data found head injuries accounted for 10% of ED visits and 37% of hospital admissions for injured bicyclists aged 5–14 years [12]. Nationally representative data from the Kid's Inpatient Database showed that one-third of hospitalized bicyclists under 20 years of age suffered a head injury [13]. Moreover, traumatic brain injuries are responsible for 70–80% of pediatric bicycle-related deaths [14, 15].

Helmets are an effective intervention for preventing bicycle-related head trauma [2, 8, 10, 11, 16, 17]. Studies have found that wearing a bicycle helmet can reduce the risk of head injury by 52–85% [8, 11, 18–21]. Those dying in bicycle crashes are about 3 times less likely to be helmeted than survivors [22]. In fact, a study of nearly 3,400 bicyclists treated for head injuries in EDs, including youth, noted that the only significant factor separating survivors from those fatally injured was helmet use [17].

Despite the effectiveness of bicycle helmets in reducing severity and prevalence of head injuries, helmet use among youth remains low [18, 23–25]. Of children < 16 years admitted to the Children's Hospital of West Virginia with bicycle injuries, 88% were not wearing a helmet [18]. In one study, less than half of parents (45%) reported that their oldest child < 16 years always wore a helmet when riding a bicycle [23]. One national study found only 25% of children and adolescents reported always wearing their helmet [26]. Helmets have been described as an inconvenience; they are a burden to locate, take too long to put on and take off, and there is often no easy place to store them [27]. However, studies have found states with laws requiring bicycle helmets for younger riders have significantly higher percentages reporting helmet use than states without such laws [2, 18, 28–33].

Research on bicycle helmet use has predominantly focused on urban settings with very little investigation of rural helmet wearing behaviors. Although rural cycling is perceived as safer than urban cycling, one study found rural youth injured on bikes had higher hospitalization rates [34]. In order to develop effective interventions to increase helmet use among adolescents in rural areas, it is important to understand the underlying attitudes and behaviors that influence helmet use. Previous studies have shown parental estimates of helmet use by their children as generally being higher than the child's report; therefore, it is important to directly ask youth themselves in order to gather more accurate helmet usage data [28, 35]. Our study objectives were to determine rural Iowa adolescents' frequency of bicycle helmet use, and to evaluate their attitudes regarding the importance of wearing helmets and bicycle helmet laws. In addition, we were interested in identifying demographic factors associated with the use or lack of use of helmets, and in particular, the impact of parental "no helmet, no riding" rules.

Methods

Study population

A cross-sectional survey involving a convenience sample of attendees at the 2022 Iowa FFA Leadership Conference in Ames, Iowa, was administered at the University of Iowa Stead Family Children's Hospital (SFCH) injury prevention booth. We estimate that 85–90% of attendees approached near the booth chose to participate.

FFA (previously named Future Farmers of America) is an intra-curricular middle school and high school organization for students interested in agriculture and leadership. There are over 1 million FFA members throughout the fifty states, Puerto Rico and the U.S. Virgin Islands [36]. Iowa accounts for about 20,000 members in 275 chapters and are primarily from rural areas.

Participants completed a survey electronically by cell phone via a Quick Response (QR) code, or by paper which was later entered into the Qualtrics database (Qualtrics International, Incorporated, Provo, Utah). Surveys were filled out anonymously and independently, and reviewed by staff for completeness. Participants received a small prize, which was determined by a Plinko board, as an incentive to participate.

Survey

The survey was developed by the University of Iowa SFCH Injury Prevention Program and members of their Off-Road Vehicle Task Force to help inform their injury prevention activities regarding helmets. The questions explored student's attitudes and beliefs about helmet use on motorcycles, dirt bikes, snowmobiles, horseback riding, all-terrain vehicles (ATVs) and bicycles. The focus of this manuscript is bicycle helmet use.

Demographic variables included sex (male, female, non-binary, other), age (years), race/ethnicity (White, Black/African American, Asian, Latino/Latinx, Other),

and where they lived (on a farm, in the country but not on a farm, in town). The survey queried whether the FFA member's family owned a bicycle, their frequency of bicycle riding in the past year (daily, weekly, monthly, a few times or less, haven't ridden in the past year), and their frequency of bicycle helmet use in the past year (always, most of the time, sometimes, rarely, never, haven't ridden in the past year). In addition, respondents ranked the importance of helmet wearing on a scale from 1 to 10 with 1 being "not at all important" and 10 being "extremely important." Participants also provided their opinion as to whether there should be a law that requires bicyclists to wear a helmet. Lastly, members were asked if their parents/guardians had a strict "no helmet, no riding" rule.

Data analysis

The data were provided to the research team by the SFCH Injury Prevention Program. Since the analysis was performed on an anonymous existing database, the University of Iowa Institutional Review Board considered the study exempt. Frequencies, bivariate analyses with chi-square and Fisher's exact test, and multivariable logistic analyses were performed using the software program, R (https://www.r-project.org/). Missing values were excluded in the analyses and were generally about 5% or less for variables.

Regarding sex, individuals answering "Non-Binary" or "Other" were excluded from analyses due to their small sample size (1%). Because of the limited diversity of the study population, race/ethnicity was dichotomized into "non-Hispanic White" and "Other". While this resulted in significant heterogeneity in the latter, it allowed for race/ethnicity to be included in analyses. To determine difference in medians, the Wilcoxon rank sum test or Kruskal-Wallis test was used depending on the number of groups compared. Significance for statistical tests were set at a value of $p < 0.05$.

Table 1 Demographic variables of survey respondents at the 2022 Iowa FFA leadership conference ($N = 1331$)

Variable	*n* (Col %)[a]
Sex	
Male	543 (41)
Female	770 (58)
Nonbinary	16 (1)
Age	
13 years	66 (5)
14 years	171 (13)
15 years	337 (26)
16 years	300 (23)
17 years	272 (21)
18 years	166 (13)
Race	
Non-Hispanic White	1257 (94)
Black/African American	17 (1)
Asian	8 (1)
Latino/Latinx	35 (3)
Other	13 (1)
Residence	
Farm	670 (50)
Country/Not Farm	285 (21)
Town	376 (28)
Owned a Bicycle	
Yes	1142 (90)
No	125 (10)
Strict "No Helmet, No Riding" Rule[b]	
Yes	115 (12)
No	858 (88)

[a]The sum of n may not equal the total Group N due to missing values

[b]Of those who had ridden a bicycle in the past year ($n = 984$)

Results

Demographics

A total of 1,331 FFA members, 32% of the 4,222 youth attendees, ranging from 13 to 18 years of age participated in the study. Nearly three-fifths (58%) were female, and 56% were between 16 and 18 years old (Table 1). The majority of respondents (94%) were non-Hispanic White. Half lived on a farm, 21% lived in the country/not on a farm, and 28% lived in town. 90% of subject's households had at least one bicycle. 12% reported that their parents had a strict "no helmet, no riding" rule for bicycles.

Ridden a bicycle

Overall, 78% of respondents had ridden a bicycle in the past year (Table 2). Those who lived on farms had lower proportions that had ridden a bicycle in the past year (73%) then those that lived elsewhere (country/not on a farm, 80%; town, 85%), $p < 0.001$. Individuals whose family owned a bicycle had higher percentages that had ridden in the past year than those who did not own a bicycle (82% vs. 37%), $p < 0.001$. Logistic regression analysis showed that those living on a farm were half as likely to have ridden a bicycle in the past year as those from towns, and respondents whose family owned a bicycle had 8 times greater odds of riding a bicycle in the past year than those who did not.

Bicycle riding frequency

Of participants who had ridden in the past year, one-quarter reported riding a bicycle at least weekly, while three-quarters stated they rode about monthly or less (Table 3). Older teens had lower proportions riding at least weekly (18%) as compared to younger teen (32%), $p < 0.001$. Those from farms and from the country but not a farm also had lower proportions that rode at least weekly (21% and 23%, respectively) as compared to those from towns (31%), $p = 0.013$. Logistic regression analysis

Table 2 Bivariate and multivariable logistic regression analyses regarding whether the respondent had ridden a bicycle in the past year among survey respondents at the 2022 Iowa FFA leadership conference (*N* = 1331)

Variable	Bivariate Analysis			Logistic Regression Analysis[a]	
	Ridden Yes n (Row %)[b]	Ridden No n (Row %)[b]	p-value	aOR	95% CI
All	984 (78)	280 (22)			
Sex			0.675		
Male	403 (78)	112 (22)		1.15	0.86–1.55
Female	565 (77)	168 (23)		1.0 (ref)	
Age			0.246		
13–15 years	433 (80)	109 (20)		1.0 (ref)	
16–18 years	542 (77)	162 (23)		0.93	0.69–1.24
Race			0.270		
Non-Hispanic White	935 (78)	261 (22)		1.46	0.78–2.74
Other Races/Ethnicities	48 (72)	19 (28)		1.0 (ref)	
Residence			< 0.001		
Farm	458 (73)	172 (27)		0.51	0.35–0.73
Country/Not Farm	218 (80)	55 (20)		0.64	0.41–1.01
Town	308 (85)	53 (15)		1.0 (ref)	
Bicycle Ownership			< 0.001		
Yes	939 (82)	203 (18)		8.07	5.34–12.20
No	45 (37)	77 (63)		1.0 (ref)	

aOR: Adjusted odds ratio; CI: Confidence interval

[a] The total number of cases used in the logistic regression model was 1,231

[b] The sum of n for a variable may not equal the total Group N due to missing values

Table 3 Bivariate and multivariable logistic regression analyses regarding frequency of riding a bicycle in the past year for those who had ridden in the past year among survey respondents at the 2022 Iowa FFA leadership conference (*N* = 984)

	Bivariate Analysis			Logistic Regression Analysis[a]	
	Ridden Monthly/Few Times a Year or Less n (Row %)[b]	Ridden Daily/Weekly n (Row %)[b]	p-value	aOR	95% CI
All	742 (75)	242 (25)			
Sex			0.009		
Male	287 (71)	116 (29)		1.58	1.17–2.15
Female	445 (79)	120 (21)		1.0 (ref)	
Age			< 0.001		
13–15 years	293 (68)	140 (32)		1.0 (ref)	
16–18 years	443 (82)	99 (18)		0.45	0.33–0.61
Race			0.609		0.83–4.13
Non-Hispanic White	703 (75)	232 (25)		1.85	
Other Races/Ethnicities	38 (79)	10 (21)		1.0 (ref)	
Residence			0.013		
Farm	360 (79)	98 (21)		0.61	0.43–0.86
Country/Not Farm	168 (77)	50 (23)		0.58	0.38–0.88
Town	214 (69)	94 (31)		1.0 (ref)	
Bicycle Ownership			0.878		
Yes	709 (76)	230 (24)		0.98	0.45–2.11
No	33 (73)	12 (27)		1.0 (ref)	

aOR: Adjusted odds ratio; CI: confidence interval

[a] The total number of cases used in the logistic regression model was 960, only includes those that had ridden a bicycle in the past year

[b] The sum of n for a variable may not equal the total Group N due to missing values

demonstrated males were 1.6 times more likely to ride a bicycle at least weekly as compared to females, and older teens were about half as likely as younger teens to ride at least weekly. Additionally, participants from farms and from the country/not a farm had odds that were about 0.6 times less likely to ride a bicycle at least weekly versus those from towns.

Bicycle helmet use

Three-quarters (720/979, 74%) of FFA members reported rarely or never wearing a helmet and 13% (129/979) stated they sometimes wore them. Only 13% said they always or mostly wore a helmet when riding a bicycle (Table 4). Respondents who lived on farms had lower proportions reporting wearing helmets always or most of the time (10%) as compared to those who lived in towns (14%) or in the country/not on a farm (19%), $p = 0.004$. However, multivariate analysis showed no significant difference. A higher proportion of bicycle riders whose parents had a strict "no helmet, no riding" rule reported always/most of the time wearing a helmet (66%) compared to those who didn't have this rule (6%), $p < 0.001$. In fact, those with a strict rule were 32 times more likely to wear bicycle helmets always/most of the time versus those who had no such rule.

Bicycle helmet law beliefs

Overall, 15% of respondents supported a bicycle helmet law (Table 5). Females had higher proportions supporting a helmet law as compared to males (17% vs.12%), $p = 0.030$. Younger teens as compared to older teens (17% vs.12%) had higher proportions that felt there should be a helmet law, $p = 0.021$. Individuals who had not ridden a bicycle in the past year had higher percentages supporting a helmet law versus those who had ridden (23% vs. 13%), $p < 0.001$. Individuals whose parents had a strict "no helmet, no riding" rule had higher percentages who believed there should be a bicycle helmet law as compared to those with no rule (54% vs. 7%), $p < 0.001$. After controlling for other variables, logistic regression analysis revealed that males were nearly half as likely as females to support a bicycle helmet law. Moreover, respondents

Table 4 Bivariate and multivariable logistic regression analyses regarding whether a helmet is worn for those who have ridden a bicycle in the past year among survey respondents at the 2022 Iowa FFA leadership conference ($N = 984$)

Variable	Bivariate Analysis			Logistic Regression Analysis[a]	
	Helmeted Always/Most of the Time n (Row %)[b]	Helmeted Sometimes/ Rarely/Never n (Row %)[b]	p-value	aOR	95% CI
All	130 (13)	849 (87)			
Sex			0.833		
Male	54 (13)	347 (87)		0.98	0.61–1.58
Female	72 (13)	491 (87)		1.0 (ref)	
Age			0.426		
13–15 years	62 (14)	369 (86)		1.0 (ref)	
16–18 years	67 (12)	472 (88)		0.97	0.60–1.57
Race			1.000		
Non-Hispanic White	124 (13)	807 (87)		1.57	0.46–5.33
Other Races/Ethnicitie	6 (13)	41 (87)		1.0 (ref)	
Residence			0.004		
Farm	46 (10)	411 (90)		0.78	0.44–1.39
Country/Not Farm	42 (19)	175 (81)		1.76	0.96–3.21
Town	42 (14)	263 (86)		1.0 (ref)	
Bicycle Ownership			0.129		
Yes	128 (14)	807 (86)		4.84	0.97–24.17
No	2 (5)	42 (95)		1.0 (ref)	
Riding Frequency			0.059		
Few Times a Year/Monthly	89 (12)	650 (88)		1.0 (ref)	
Weekly/Daily	41 (17)	199 (83)		1.28	0.75–2.18
Strict "No Helmet, No Riding" Rule			< 0.001		
Yes	76 (66)	39 (34)		32.17	19.37–53.43
No	52 (6)	805 (94)		1.0 (ref)	

aOR: Adjusted odds ratio; CI: Confidence interval

[a]The total number of cases used in the logistic regression model was 949, only includes those who rode a bicycle in the past year

[b]The sum of n for a variable may not equal the total Group N due to missing values

Table 5 Bivariate and multivariable logistic regression analyses regarding whether the respondent believes there should be a helmet law in place among survey respondents at the 2022 Iowa FFA leadership conference

Variable	Bivariate Analysis			Logistic Regression Analysis[a]	
	Support Helmet Law n (Row %)[b]	Oppose Helmet Law n (Row %)[b]	p-value	aOR	95% CI
All	187 (15)	1070 (85)			
Sex			0.030		
Male	62 (12)	450 (88)		0.56	0.35–0.90
Female	122 (17)	608 (83)		1.0 (ref)	
Age			0.021		
13–15 years	93 (17)	446 (83)		1.0 (ref)	0.44–1.09
16–18 years	87 (12)	613 (88)		0.69	
Race			1.000		
Non-Hispanic White	177 (15)	1014 (85)		1.81	0.54–6.04
Other Races/Ethnicities	10 (15)	55 (85)		1.0 (ref)	
Residence			0.833		
Farm	91 (15)	536 (85)		1.04	0.61–1.78
Country/Not Farm	39 (14)	231 (86)		1.19	0.65–2.18
Town	57 (16)	303 (84)		1.0 (ref)	
Bicycle Ownership			0.862		
Yes	170 (15)	965 (85)		0.99	0.32–3.03
No	17 (14)	105 (86)		1.0 (ref)	
Ridden in Past Year[c]			< 0.001		
Never Ridden	64 (23)	215 (77)		--	--
Ridden	122 (13)	854 (88)		--	--
Riding Frequency			0.195		
Few times/Monthly	86 (12)	652 (88)		1.0 (ref)	0.69–1.93
Weekly/Daily	36 (15)	202 (85)		1.16	
Strict "No Helmet, No Riding" Rule			< 0.001		
Yes	62 (54)	52 (46)		18.11	11.20–29.30
No	59 (7)	798 (93)		1.0 (ref)	

aOR: Adjusted odds ratio; CI: Confidence interval

[a]The total number of cases used in the logistic regression model was 947, only includes those who rode a bicycle in the past year

[b]The sum of n for a variable may not equal the total Group N due to missing values

[c]Not included in logistic regression analysis

whose parents had a "no helmet, no riding" rule had 18 times greater odds of supporting a bicycle helmet law than those without this rule.

Importance of helmet use

The mean importance (rated 1–10) of wearing a helmet on a bike was 4.7 with a median of 4 (Table 6). Males, non-Hispanic White individuals and participants living on farms rated helmet use less important than their peers, all $p < 0.004$. Members who had a strict "no helmet, no riding" rule rated bicycle helmet use more important than those without a rule (median 9 vs. 4), $p < 0.001$. The greater the helmet use, the higher the median helmet importance rating with those always wearing a helmet rating the importance at 10 and those never wearing a helmet having a median importance of 3, $p < 0.001$. Additionally, those who were in favor of a helmet law had higher median helmet importance ratings than those who were against (10 vs. 4), $p < 0.001$.

Discussion

The vast majority of rural adolescents in the study reported their household owned at least one bicycle and nearly four-fifths had ridden a bicycle in the past year. Only 13% reported wearing a bicycle helmet always or most of the time, while three-quarters rarely or never wore one. There was a direct relationship between helmet use and those who ascribed a higher importance to wearing helmets. Respondents' median importance rating regarding helmet use was also indicative of their support for a helmet law. Although bicycle helmet use amongst rural adolescents was infrequent overall, those whose parents had a strict "no helmet, no riding" rule held greater importance to wearing helmets, expressed greater

Table 6 Variable comparisons in the median importance ascribed to wearing a helmet while riding a bicycle among survey respondents at the 2022 Iowa FFA leadership conference

	Median Importance (1–10)[a]	*p*-value
Overall	4	--
Sex		< 0.001
Male	4	
Female	5	
Age		0.077
13–15 years	5	
16–18 years	4	
Race		0.002
Non-Hispanic White	4	
Other Races/Ethnicities	6	
Residence		0.003
Farm	4	
Country/Not Farm	5	
Town	5	
Bicycle Ownership		0.117
Yes	4	
No	4	
Ridden in Past Year		0.118
Yes	4	
No	8	
Riding Frequency[b]		0.843
Few times/Monthly	4	
Weekly/Daily	4	
Helmet Use[b]		< 0.001
Never	3	
Sometime/Rarely	5	
Most of the time	7	
Always	10	
Helmet Law		< 0.001
Support	10	
Against	4	
Strict "No Helmet, No Riding" Rule[b]		< 0.001
Yes	9	
No	4	

[a]Median importance was rated 1-10, with 1 being "not at all important" and 10 being "extremely important"

[b]Only includes those that had ridden a bicycle in the past year

support of helmet laws and had significantly higher bicycle helmet use.

Rural helmet use

Few studies have examined rural adolescent bicycle helmet use or their attitudes towards bicycle helmets. Although low bicycle helmet use among youth has previously been noted, our finding of 14% always/mostly wearing a helmet is lower than most other studies [1, 23–26, 28, 35]. With respect to rural versus non-rural helmet use, a Manitoba study previously found that use was lower in youth from rural areas as compared to their peers across all ages and sex [34]. In addition, we found that youth living on farms had the lowest helmet use and a lower median importance rating for helmet use than those living elsewhere.

A common misconception is that bicycling in rural areas is not as dangerous due to fewer obstacles and less traffic [37]. Rural youth's low helmet use likely reflects this and other misconceptions, as well as other practical and/or cultural differences of rural populations. Additionally, unlike suburban and urban centers, rural areas are less likely to have special events and campaigns educating and promoting helmet use [37]. Injury prevention efforts with the goal of increasing bicycle helmet use among rural youth will need to address these issues.

Parental influen e on helmet use

Only 12% of participants stated their parents had a strict "no helmet, no riding" rule for bicycles. However, 66% of respondents who had this rule reported they always or most of the time wore a helmet as compared to just 6% of adolescents whose family did not have this rule. In fact, those with a rule were 32 times more likely to wear a helmet most or all of the time. Furthermore, youth with this home rule placed greater importance on helmet use and were more supportive of bicycle helmet laws.

Previous studies have found helmet use by youth to be strongly associated with parental rules, parental encouragement, parental involvement and parental use [15, 24, 38–41]. For example, a Swedish study found that 84% of children 8–16 years old who reported using a helmet also reported their parents told them to wear one [39]. Similar to our study, Chicago-area children with a strict rule regarding helmet use had a higher proportion wearing helmets most or all the time (88%) as compared to those with no rule (19%) [15]. Other research shows strict bicycle helmet use rules established by a parent are a strong contributing factor in a youth's decision to wear a helmet [38, 42].

Another important factor in increasing helmet use among youth is for adults to role model this behavior themselves. Research has shown that children's safety behaviors are more likely predicted by their parents' safety practices as compared to having simply received safety information from their parents [43]. Therefore, it is essential that injury prevention efforts addressing bicycle helmet use in children have strong components that target parents. Incorporating a strict "no helmet, no riding" rule is an effective behavioral intervention to increase helmet use. It appears that youth whose parents prioritize safety by establishing such a rule are also more likely to support laws and public policies that enforce similar standards.

Helmet laws

Even after controlling for other variables, rural adolescents who had a strict "no helmet, no riding" rule were more than 18 times more likely to support a bicycle helmet law than those whose families had no rule. Other demographic groups that had higher proportions supporting implementation of a helmet law included younger teens, those who had not ridden a bicycle in the past year and females. However, overall, our study revealed only 15% of rural adolescent respondents supported a helmet law.

State laws and local ordinances have been very effective in increasing helmet use including in Maryland, the first state to mandate helmet use for children [18, 28, 29, 31–33, 44]. Currently, 17 states and the District of Columbia have youth bicycle helmet laws, covering almost half of all US children < 16 years [2]. After enactment of a Georgia helmet law, reported bicycle helmet use increased from 35 to 53% [33]. Similarly, a doubling of helmet use to 49% was observed among youth in Oregon after bicycle helmet law passage [18]. A study found that children in states with laws requiring helmets had higher percentages always wearing helmets than children from states without such laws (47% vs. 39%) [28]. Most importantly, a greater decline in head injuries have been observed in areas where bicycle helmet laws were adopted [30].

Limitations

This study was performed in Iowa, a single rural Midwestern state with a predominantly non-Hispanic White population. Thus, the generalizability of our findings to more racially and ethnically diverse populations may be limited. We also used a convenience sample of FFA members who were mainly from rural areas of Iowa and were specifically recruited at our safety booth. Thus, participants may not fully represent convention attendees overall and/or Iowa youth in general. However, participation among those approached was high, the vast majority of counties in the state were represented, and the survey was conducted primarily to evaluate rural Iowa adolescents. This study also relied on self-reported data which can be subject to bias. By allowing students to complete the surveys anonymously and independently, the social desirability effect was hopefully minimalized.

Conclusions

Rural adolescents in our study infrequently wore bicycle helmets and those from farms had the lowest proportions wearing helmets. This may reflect the lower importance they ascribe to helmet use. Moreover, only a small percentage of participants supported bicycle helmet laws. Rural youth often have less access to helmets, fewer protective cycling regulations, and less exposure to safety education than their peers. However, we found individuals whose households had a strict "no helmet, no riding" rule placed greater importance on helmet use, were more supportive of bicycle helmet laws, and were 32 times more likely to wear a helmet than rural youth who did not have this rule. It may be wise to target parents as a major component of any injury prevention program with goals of increasing bicycle helmet use. Along with passage of bicycle helmet legislation, parents implementing and enforcing a "no helmet, no riding" rule may be the most effective pathway for decreasing pediatric bicycle-related head injuries among both urban and rural youth.

Abbreviations

ATV	All-terrain vehicle
ED	Emergency department
FFA	Formerly Future Farmers of America
QR	Quick response
SFCH	Stead Family Children's Hospital
U.S.	United States

Acknowledgements

We would like to acknowledge and thank the individuals of the University of Iowa SFCH Off- oad Vehicle task force for their assistance in developing and administering the survey from which the data used in this survey was generated, and Gerene Denning for her thoughtful editing of the manuscript. We also want to acknowledge and thank, the University of Iowa Department of Emergency Medicine, the University of Iowa Stead Family Department of Pediatrics, and the University of Iowa Health Care Stead Family Children's Hospital for their support of the Injury Prevention and Outreach Program.

About this supplement

This article has been published as part of Injury Epidemiology Volume 12 Supplement 1, 2025: Proceedings of the 29th Annual Injury Free Coalition for Kids® Conference: Forging New Frontiers: Engineering for Equity. The full contents of the supplement are available online at https://injepijournal.biomedcentral.com/articles/supplements/volume-12-supplement-1.

Author contributions

All authors have read and approved the final manusc ipt. Each author significantly cont ibuted to and takes public responsibility for one or more aspects of the study. Specificall : BLA was involved with interpretation of the results, literature review, and writing and preparation of the manuscript for submission. BJI was involved in survey collection, data compilation and analysis, as well as revision of the manuscript. DES analyzed the data, helped interpret the results and helped edit the final manusc ipt. PVH developed the survey, collected surveys and helped edit the final manusc ipt. BV helped develop and collect the survey, and helped edit the final manusc ipt. CAJ was the primary investigator of the study and had overall responsibility for the analysis of the data and interpretation of the results, and final w iting and preparation of the manuscript for submission.

Funding

Support for this study was provided by the University of Iowa Department of Emergency Medicine, the University of Iowa SFCH Injury Prevention and Outreach Program, and by funding through the University of Iowa Undergraduate Research Fellow Program. Publication costs were funded by the Injury Free Coalition for Kids™. These entities had no specific ole in the research performed.

Data availability

Data and materials are available to other parties for research purposes after a data sharing agreement plan is agreed to and signed. Those interested should contact the corresponding author.

Declarations

Ethics approval and consent to participate
The University of Iowa Institutional Review Board deemed the research exempt as the analysis was performed on an anonymously collected existing dataset.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests or financial relationships relevant to this article to disclose.

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Received: 7 March 2025 / Accepted: 20 June 2025
Published online: 14 July 2025

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Publisher's note

Sternhagen *et al. Injury Epidemiology* (2025) 12:45
https://doi.org/10.1186/s40621-025-00595-9

Injury Epidemiology

RESEARCH Open Access

Utility task vehicle crashes and injuries in Iowa

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Abstract

Background Utility task vehicles (UTVs) are increasing in popularity and have outsold all-terrain vehicles (ATVs) in recent years. However, there are few publications related to UTV crashes and injuries. Our objective was to describe UTV crash and injury epidemiology in the state of Iowa.

Methods A comprehensive database of off-hig way vehicle events from the Iowa Department of Transportation, State Trauma Registry and Department of Natural Resources, as well as from newspaper articles was created and used to evaluate Iowa UTV crashes and injuries from 2002 to 2019. Frequencies and contingency table analysis was performed with IBM SPSS Statistics (Version 27).

Results UTV crashes involving 448 injured individuals of all ages were identified with inc easing numbers over time. Children < 16 years were 31% and those 16–17 years were 8.3%. Among all victims, 69% were male and one-third were passengers. Only 10% and 32% were wearing helmets and seatbelts, respectively. Of those tested, 13% were positive for alcohol. One-fi th involved a collision with another motor vehicle, 11% were collisions with an object, and most (70%) were non-collision events (e.g., rollovers). In nearly two-thirds of cases, the victim was ejected. In a quarter, the person was hit/pinned by the vehicle. Of those with known location, 61% occurred on public roadways. In 6% of cases, the individual died. Children < 16 years had higher proportions than those older of being a passenger (52% vs. 24%, $p < 0.001$), having been in a non-collision event (77% vs. 66%, $p = 0.035$), and of being hit/pinned by the vehicle (41% vs. 19%, $p < 0.001$). Passengers had lower proportions that were wearing seatbelts (23% vs. 36%, $p = 0.029$) and higher proportions involved in non-collision events (90% vs. 59%, $p < 0.001$). Higher proportions in off- oad crashes (55% vs. 9%, $p < 0.001$) and in non-collision events (33% vs. 8%, $p < 0.001$) were hit/pinned by the vehicle. Roadway crashes and ejected victims both had greater percentages with abnormal Glasgow Coma Scale (head injury) scores and intensive care unit admission.

Conclusions UTV crashes and injuries are increasing in frequency and often associated with severe injuries. Driving on public roads and being ejected were both associated with more severe outcomes/injuries.

Keywords Passengers, Recreational off-hig way vehicle, Road, Rollover, Seatbelt, Safety, Side-by-side vehicle, Utility task vehicle, Youth

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Background

Side-by-side vehicles are off-highway vehicles that have become increasingly popular over the past 25 years with escalating crash-related deaths and injuries [1–3]. Unlike all-terrain vehicles (ATVs) which have a straddle seat and handlebars, side-by-side vehicles have bucket/bench seating, a steering wheel, and foot controls for breaking and acceleration. Although they were previously called recreational off-highway vehicles (ROVs), most consumers use the term utility task vehicle (UTV) for side-by-sides and many manufacturers are now following this convention in their marketing. Accordingly, we will also use the term "UTV" when referring to "ROVs" in this manuscript.

Most UTVs travel highway speeds, some up to 85 mph [4], which has helped fuel the vehicle's popularity. UTV sales are now more than double those of ATVs with an estimated 565,00 UTVs versus 240,000 ATVs sold in North America in 2024 [5]. All UTVs that travel at least 30 mph are required to have a roll-over protective structure (ROPS) and either seatbelts or harnesses at each seating position to keep riders within the zone of protection afforded by the ROPS.

Almost all UTVs are designed for operators 16 years of age and older. This is reinforced by manufacturers through vehicle stickers and in owner's manuals. Moreover, manufacturers recommend one should be at least 12 years of age or be able to sit with their back against the seat with their feet flat on the vehicle floor before riding as a passenger in UTVs. Unfortunately, many parents allow their children to operate and ride in these vehicles despite manufacturer warnings. A study of over 4,000 Iowa students 9–18 years old found that more than two-thirds had ridden and/or driven a UTV in the past year with approximately two-fifths riding in a vehicle at least weekly [6].

Unlike ATVs, there have been few studies that have examined UTV crash and injury epidemiology. The U.S. Consumer Product Safety Commission (CPSC) has been tracking ATV-related deaths and estimated injuries for decades but just recently started including data related to UTVs [2]. In their most recent report published in May 2023, the Commission identified 643 deaths due to UTVs from 2017 to 2019, accounting for nearly a third of off-highway vehicle deaths in their database [2]. Other studies have examined UTV data of patients treated at the University of Iowa, collected by the Fatality Analysis Reporting System, and of newspaper clippings from nine Midwest and Great Plains States [1, 3, 7]. Several studies have reviewed specific UTV-related injuries including upper extremity injuries evaluated at the University of Utah [8] and orthopedic injuries treated at Loma Linda University Health [9].

Similar to ATVs after their introduction, the public health concerns related to UTVs have been growing as associated deaths and injuries increase. The trauma experienced by children and adolescents from UTVs has been particularly troubling. Identifying risk factors associated with UTV crashes and the severe injuries they produce is crucial for developing injury prevention strategies. Our objective was to examine the epidemiology of UTV crashes and injuries in Iowa and to identify associated risk factors.

Methods

A retrospective study utilizing our Iowa off-road vehicle (ORV) surveillance database was performed on UTV-related crashes and injuries that occurred from January 1, 2002, to December 31, 2019. The study was approved by the University of Iowa Institutional Review Board.

ORV surveillance database

The Iowa ORV surveillance database was previously created by comprehensively collecting ORV crashes and injuries from the Iowa Department of Transportation (DOT), the Iowa State Trauma Registry (STR) and the Iowa Department of Natural Resources (DNR), as well as from newspaper articles from 2002 to 2019 [10–14]. Data were obtained in compliance with all local, state and federal regulations. Newz Group, a news monitoring service specializing in rural, local and regional coverage, was utilized to obtain press clippings of ORV crashes [7].

A standardized coding system was developed as previously described [10–14]. This included multiple strategies to identify UTV crashes and injuries, methods for standardized coding of each database's narratives, and linking of an individual's data across databases using Link Plus Version 2.0. Finally, a merged dataset was created by identifying matching records in the following sequence: all DOT cases, STR cases without DOT matches, DNR cases without DOT and STR matches, and newspaper clippings without DOT, STR, and DNR matches. All cases identified were included, even if found in just one data source. Only individuals reported as operators or passengers of the vehicle were included in the study; pedestrians were excluded.

Study variables

Demographic variables included sex (male, female) and age (years). For bivariate analysis, age was grouped into two categories; <16 years (not old enough to operate UTVs per manufacturer's recommendations) and ≥16 years. Crash occurrence variables were Weekday (Monday-Thursday) vs. Weekend (Friday-Sunday), and Season including Winter (December-February), Spring (March-May), Summer (June-August), and Fall (September-November). Other variables included Seating Position (operator, passenger), Location (off-road vs. public roadway), Seatbelt Use (yes, no), Helmet Use (yes, no),

and Alcohol Status (tested positive, tested negative). The Light Condition variable reflected light conditions at the time of the crash with Day representing daylight hours and Night including the time from dusk (starting 30 min before sunset) to dawn (30 min after sunrise).

The Crash Mechanism variable included three categories: Motor Vehicle Collision (where the UTV was in a collision with another motor vehicle such as a car, ATV or another UTV), UTV-Object Collision (described as the UTV colliding with an object other than a motor vehicle) and a Non-Collision Event (rollover or primary operator/passenger ejection). Other injury mechanism variables included Ejected from the Vehicle (yes, no) which could occur anytime during a crash event and Hit/Pinned by the Vehicle (yes, no) which entailed the individual being struck by the vehicle and/or pinned underneath.

Injury variables included Death (yes, no), Glasgow Coma Scale (GCS) score, Injury Severity Score (ISS), Days in ICU (0, ≥ 1 day), and Days in Hospital (1, ≥ 2 day). GCS provides an evaluation of a patient's level of consciousness as an indicator of brain injury. The GCS was dichotomized for analysis as GCS = 15 (normal) or GCS < 15 (abnormal). ISS is a commonly used injury severity scoring system for trauma patients for which a score of > 15 indicates a severe injury. For analysis, ISS was dichotomized as ≤ 15 or > 15.

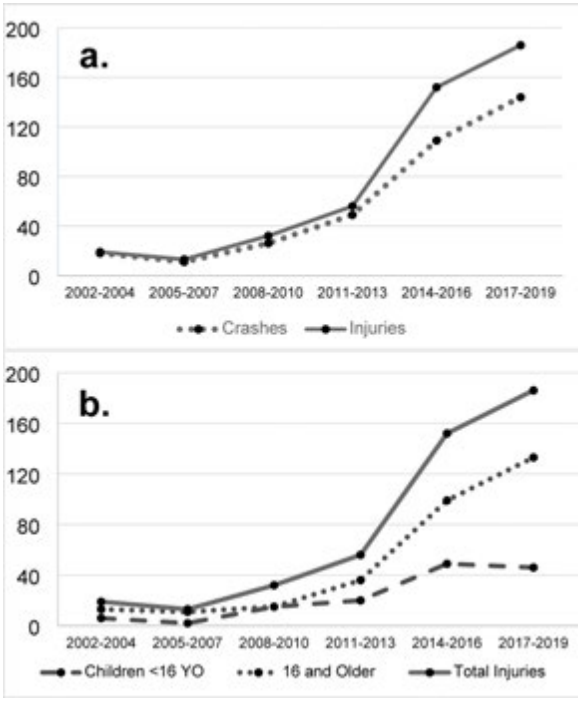

Fig. 1 Graph of (**a**) Iowa UTV-related injuries (solid line) and crashes (dotted line) and (**b**) Iowa UTV-related injuries including total (solid line), those 16 years and older (dotted line) and those < 16 years old (dashed line) from 2002–2019. Values are grouped by three-year intervals. Data are from our Iowa off- oad vehicle (ORV) surveillance database. The database combines data from the Iowa Department of Transportation (DOT), the Iowa State Trauma Registry (STR), the Iowa Department of Natural Resources (DNR) and newspaper clippings of Iowa off- oad vehicle crashes over the study period

Data analysis

Descriptive analyses (frequencies) and contingency table analyses were performed using SPSS (Version 27). Some additional bivariate analysis including chi square and Fisher's exact test were conducted using the Vassar statistical calculations website (http://vassarstats.net/). Fisher's Exact test was performed when expected cell size values were < 5. Simple linear regression was performed with Graphpad prism to evaluate the change in injuries and crashes over time. Results were defined as statistically significant with a two-tailed P-value < 0.05. Missing data were not included in frequency or bivariate analysis.

Results

From 2002 to 2019, 458 injured individuals in 357 UTV crashes were identified in the Iowa ORV Database. Increasing numbers of injuries and crashes occurred during the time period. See Fig. 1. Simple linear regression shows the slopes for injuries to be 36.5 (95% CI 15.0-57.9) and for crashes 27.1 (95% CI 11.9–42.3) indicating the slopes are significantly different from zero and increasing over time ($p = 0.009$ and $p = 0.008$, respectively).

The majority of those injured were male (69%). See Table 1. Nearly two-fifths (39%) were ≤ 17 years, and almost one-third (31%) were 15 years of age and younger. Just over half were injured from Friday-Sunday (51%), and 44% occurred during the summer months (June-August). Of those injured, about two-thirds were operators (67%) while a third (33%) were passengers in the UTV. Over three-fifths (61%) were injured during an event on a public roadway. For those with documentation, over two-thirds of those injured (68%) were not wearing a seatbelt or harness at the time of their crash; 90% were not wearing a helmet. Of those 16 years and older tested (225/309, 73%), 13% (40/225) were positive for alcohol. More than a quarter of injuries (27%) occurred at night. Most (70%) were injured in a non-collision event (e.g., rollover), and the rest were involved in collisions with another motor vehicle (19%) or other objects (11%). For victims where it could be determined, nearly two-thirds (65%) were ejected from the vehicle and over a quarter (26%) were hit or pinned by the UTV. Twenty-eight individuals, 6% of victims, died of their injuries.

Males vs. females

A higher proportion of injured females were UTV passengers as compared to males (50% vs. 24%), $p < 0.001$. See Table 2. Females also had greater percentages injured in non-collision events (78% vs. 66%) and lower

Table 1 Variable frequencies for individuals injured in utility task vehicle (UTV) crashes/events in Iowa from 2002-2019 (N = 458)

	n (Col %)[a]		n (Col %)[a]
Variable (Missing)		Variable (Missing)	
Sex (10)		Seatbelt use (161)	
Male	309 (69)	Yes	95 (32)
Female	139 (31)	No	202 (68)
Age (13)		Helmet use (167)	
<6 YO	14 (3)	Yes	29 (10)
6–11 YO	37 (8)	No	262 (90)
12–15 YO	87 (20)	Alcohol status (157)	
16–17 YO	37 (8)	Positive (Yes)	40 (13)
18–30 YO	111 (25)	Negative (No)	261 (87)
31–45 YO	76 (17)	Light Condition (151)	
45–60 YO	45 (10)	Day	224 (73)
>60 YO	38 (9)	Night	83 (27)
Weekday/weekend (0)		Crash mechanism (36)	
Weekday	224 (49)	Motor vehicle collision	82 (19)
Weekend	234 (51)	UTV-object collision	45 (11)
Season (0)		Non-collision event	295 (70)
Winter	49 (11)	Ejected from vehicle (181)	
Spring	110 (24)	Yes	181 (65)
Summer	202 (44)	No	96 (35)
Fall	97 (21)	Hit/pinned by vehicle (168)	
Seating position (70)		Yes	74 (26)
Operator	259 (67)	No	216 (74)
Passenger	129 (33)	Victim killed (5)	
Location (85)		Yes	28 (6)
Off- oad	146 (39)	No	425 (94)
Public roadway	227 (61)		

[a]The sum of n may not equal the total Group N due to missing values

proportions injured in collisions with other objects (5% vs. 14%), $p = 0.011$.

Children < 16 years vs. 16 years and older

Relative to victims 16 years of age and older, children < 16 years were a higher percentage of those injured on UTVs during the summer months (58% vs. 38%) and of those who were passengers (52% vs. 24%), both $p < 0.001$. See Table 2. However, nearly half (48%) of children < 16 years were operators of the UTV at the time of the crash. Youth < 16 years old also had lower percentages who were injured on a public roadway as compared to those ≥ 16 years (52% vs. 65%), $p = 0.019$; still, over half of children < 16 years were on public roads in a UTV at the time of their injury.

Additionally, as compared to older victims, children < 16 years of age had lower proportions of crashes occurring at night (10% vs. 33%), $p < 0.001$, and under the influence of alcohol (0% vs. 18%), $p < 0.001$. With respect to mechanism, crashes involving youth < 16 years had a higher percentage that were non-collision events (77% vs. 66%) and a lower percentage that were collisions with another motor vehicle (13% vs. 23%), $p = 0.035$. Moreover, children < 16 years had higher proportions that had been hit/pinned by the vehicle relative to victims ≥ 16 years of age (41% vs. 19%), $p < 0.001$.

Passengers vs. operators

In addition to differences seen in the proportion of passengers and operators by sex and by age, higher proportions of passengers than operators were injured in the summer (53% vs. 38%, $p = 0.009$) and were not wearing seatbelts (77% vs. 64%, $p = 0.029$). See Table 3. Passengers also had higher percentages injured in non-collision events as compared to operators (90% vs. 59%), $p < 0.001$.

Off-road vs. public roadways

As stated earlier, lower proportions of injured youth < 16 years were on roadways as compared to those older. See Table 3. In addition, the proportion of all victims wearing a helmet was lower on roadways than off-road (1% vs. 24%), $p < 0.001$. Individuals injured off-road had greater proportions injured in non-collision events (87% vs. 52%) and lower proportions in a crash with another motor vehicle (0% vs. 36%), $p < 0.001$. A higher percentage were-also hit/pinned by the UTV off-road than on public roadways (55% vs. 9%), $p < 0.001$.

Crash mechanisms

In addition to differences seen in the proportions of crash mechanisms by sex, age, seating position and location, those injured in a collision with another motor vehicle had the highest percentage reportedly wearing a seatbelt, but that was still less than half (48%), $p = 0.006$. See Table 4. Helmet use was higher in those injured in a non-collision event than for other crash mechanisms, $p < 0.001$, but that was still only 14%. None of those in a collision with a motor vehicle were positive for alcohol whereas the percentage was higher for those in a non-collision event (16%) and highest in those who collided with an object (26%), $p < 0.001$. Most collisions with a motor vehicle occurred during the day (94%) which was higher than for non-collision events (68%) and for collisions with an object (58%), $p < 0.001$. Non-collision events had the highest proportion of injured individuals struck/pinned by the UTV (33%) which was higher than for collisions with an object (21%) and with another motor vehicle (1%), $p < 0.001$.

Light conditions

As mentioned earlier, injured children < 16 years had lower proportions riding at night than those older. Other significant findings included those injured at night had lower seatbelt use (13/62, 21% vs. 62/155, 40%, $p = 0.008$) and higher proportions positive for alcohol (18/60, 30% vs. 13/187, 7%, $p < 0.001$).

Table 2 Bivariate analyses for age and sex of individuals injured in utility task vehicle (UTV) crashes/events in Iowa from 2002-2019 (N = 458)

	Age			Sex		
	< 16 Years n (Col %)[a]	≥16 Years n (Col %)[a]	p value	Male n (Col %)[a]	Female n (Col %)[a]	p value
Group N	139	309		309	139	
Sex						
Male	93 (68)	214 (70)	0.700	--	--	.
Female	44 (32)	93 (30)		--	--	
Weekday/weekend						
Weekday	70 (50)	147 (48)	0.585	151 (49)	68 (49)	0.992
Weekend	69 (50)	162 (52)		158 (51)	71 (51)	
Season						
Winter	7 (5)	41 (13)	< 0.001	38 (12)	8 (6)	0.050
Spring	29 (21)	78 (25)		80 (26)	28 (20)	
Summer	80 (58)	116 (38)		126 (41)	71 (51)	
Fall	23 (17)	74 (24		65 (21)	32 (23)	
Seating position						
Operator	51 (48)	207 (76)	< 0.001	201 (76)	58 (50)	< 0.001
Passenger	55 (52)	65 (24)		65 (24)	57 (50)	
Location						
Off- oad	52 (48)	89 (35)	0.019	103 (41)	37 (33)	0.173
Public roadway	57 (52)	168 (65)		151 (59)	75 (67)	
Seatbelt use						
Yes	23 (28)	72 (34)	0.307	64 (30)	31 (38)	0.170
No	59 (72)	138 (66)		150 (70)	50 (62)	
Helmet use						
Yes	5 (6)	24 (12)	0.187	21 (10)	8 (10)	0.975
No	74 (94)	183 (88)		189 (90)	71 (90)	
Alcohol status						
Positive (Yes)	0 (0)	40 (18)	< 0.001[b]	31 (16)	9 (9)	0.093
Negative (No)	73 (100)	185 (82)		167 (84)	94 (91)	
Light condition						
Day	71 (90)	146 (67)	< 0.001	138 (70)	79 (79)	0.100
Night	8 (10)	72 (33)		59 (30)	21 (21)	
Crash mechanism						
Motor vehicle collision	16 (13)	66 (23)	0.035	60 (21)	22 (17)	0.011
UTV-object collision	13 (10)	32 (11)		39 (14)	6 (5)	
Non-collision event	99 (77)	189 (66)		189 (66)	100 (78)	
Ejected from vehicle						
Yes	53 (65)	127 (66)	0.920	128 (66)	53 (64)	0.693
No	28 (35)	65 (34)		65 (34)	30 (36)	
Hit/pinned by vehicle						
Yes	32 (41)	40 (19)	< 0.001	52 (27)	21 (22)	0.388
No	46 (59)	168 (81)		142 (73)	74 (78)	

[a]The sum of n for a variable may not equal the total Group N due to missing values

[b]p-value was calculated from Fisher's Exact Test

Injury severity indicators

Injury data were available for 220 hospitalized individuals through the Iowa STR. An abnormal Glasgow Coma Scale (GCS) score (< 15) indicating an altered mental status was identified in 11% of hospitalized victims and a moderate or higher Injury Severity Scale score (> 15) was noted in 12%. See Table 5. Almost two-fifths (37%) required at least one day in the intensive care unit (ICU) and ICU stays ranged from 1 to 30 days. Two-thirds (66%) were hospitalized for more than one day and length of stay ranged from 1 to 80 days.

Those who were ejected from the UTV had higher proportions with an abnormal GCS (19% vs. 0%), $p = 0.045$, and had a higher proportion spending at least one day in

Table 3 Bivariate analyses of seating position and off- oad/public roadway for individuals injured in utility task vehicle (UTV) crashes/events in Iowa from 2002-2019 (N = 458)

	Seating position			Off- oad/public roadway		
	Operator n (Col %)[a]	Passenger n (Col %)[a]	p value	Off- oad n (Col %)[a]	Public roadway n (Col %)[a]	p value
Group N	259	129		146	227	
Sex						
Male	201 (78)	65 (53)	< 0.001	103 (74)	151 (67)	0.173
Female	58 (22)	57 (47)		37 (26)	75 (33)	
Age						
<16 yrs	51 (20)	55 (46)	< 0.001	52 (37)	57 (25)	0.019
16 and older	207 (80)	65 (54)		89 (63)	168 (75)	
Weekday/weekend						
Weekday	122 (47)	71 (55	0.141	70 (48)	112 (49)	0.795
Weekend	137 (53)	58 (45)		76 (52)	115 (51)	
Season						
Winter	34 (13)	6 (5)	0.009	17 (12)	22 (10)	0.853
Spring	67 (26)	28 (22)		38 (26)	54 (24)	
Summer	99 (38)	69 (53)		62 (42)	101 (44)	
Fall	59 (23)	26 (20)		29 (20)	50 (22)	
Location						
Off- oad	78 (36)	34 (34)	0.758	--	--	--
Public roadway	140 (64)	66 (66)		--	--	
Seatbelt use						
Yes	67 (36)	20 (23)	0.029	22 (27)	48 (29)	0.795
No	118 (64)	67 (77)		59 (73)	119 (71)	
Helmet use						
Yes	18 (10)	6 (7)	0.420	19 (24)	2 (1)	< 0.001[b]
No	166 (90)	82 (93)		59 (76)	167 (99)	
Alcohol status						
Positive	24 (13)	12 (14)	0.823	8 (14)	21 (11)	0.591
Negative	159 (87)	73 (86)		51 (86)	170 (89)	
Light condition						
Day	138 (72)	71 (74)	0.759	47 (65)	142 (76)	0.097
Night	53 (28)	25 (26)		25 (35)	46 (24)	
Crash mechanism						
Motor vehicle collision	69 (28)	5 (4)	< 0.001	0 (0)	79 (36)	< 0.001
UTV-object collision	31 (13)	7 (6)		17 (13)	24 (11)	
Non-collision event	144 (59)	110 (90)		117 (87)	115 (52)	
Ejected from vehicle						
Yes	119 (68)	45 (62)	0.335	42 (58)	111 (68)	0.132
No	56 (32)	28 (38)		31 (42)	53 (32)	
Hit/pinned by vehicle						
Yes	34 (19)	22 (25)	0.298	37 (55)	17 (9)	< 0.001
No	141 (81)	66 (75)		30 (45)	175 (91)	

[a]The sum of n for a variable may not equal the total Group N due to missing values

[b]p-value was calculated from Fisher's Exact Test

the ICU (58% vs. 8%), $p = 0.027$. See Table 5. In addition, patients whose injury occurred on a public roadway had higher percentages with an abnormal GCS (25% vs. 6%), $p = 0.008$, and had greater percentages that had at least one day in the ICU (82% vs. 27%), $p = 0.003$.

Discussion

Our study examined the epidemiology of UTV crashes and injuries in Iowa utilizing our unique statewide ORV surveillance database. There was a striking increase in crashes and injuries over the study period, similar to that observed by other investigators [1–3]. Seatbelt and helmet use, critical for preventing serious injury in UTV

Table 4 Bivariate analyses of crash mechanisms for individuals injured in utility task vehicle (UTV) crashes/events in Iowa from 2002-2019 (N = 458)

	Motor vehicle collision *n* (Col %)[a]	UTV-object collision *n* (Col %)[a]	Non-collision event *n* (Col %)[a]	*p* value
Group N	82	45	295	
Sex				
Male	60 (73)	39 (87)	189 (65)	0.011
Female	22 (27)	6 (17)	100 (35)	
Age				
<16 yrs old	16 (20)	13 (29)	99 (34)	0.035
16 yrs and older	66 (80)	32 (71)	189 (66)	
Weekday/weekend				
Weekday	46 (56)	26 (58)	136 (46)	0.134
Weekend	36 (44)	19 (42)	159 (54)	
Season				
Winter	12 (15)	4 (9)	31 (11)	0.647
Spring	17 (21)	10 (22)	79 (27)	
Summer	33 (40)	20 (44)	131 (44)	
Fall	20 (24)	11 (24)	54 (18)	
Seating position				
Operator	69 (93)	31 (82)	144 (57)	<0.001
Passenger	5 (7)	7 (18)	110 (43)	
Location				
Off- oad	0 (0)	17 (41)	117 (50)	<0.001
Public roadway	79 (100)	24 (59)	115 (50)	
Seatbelt use				
Yes	31 (48)	9 (29)	50 (27)	0.006
No	33 (52)	22 (71)	136 (73)	
Helmet use				
Yes	1 (2)	1 (3)	25 (14)	0.005[b]
No	63 (98)	28 (97)	158 (86)	
Alcohol status				
Positive	0 (0)	9 (26)	29 (16)	<0.001[b]
Negative	72 (100)	26 (74)	148 (84)	
Light condition				
Day	68 (94)	21 (58)	123 (68)	< 0.001
Night	4 (6)	15 (14)	57 (32)	
Ejected from vehicle				
Yes	42 (63)	22 (69)	113 (65)	0.839
No	25 (37)	10 (31)	61 (35)	
Hit/pinned by vehicle				
Yes	1 (1)	7 (21)	66 (33)	< 0.001
No	69 (99)	26 (79)	114 (67)	

[a]The sum of n for a variable may not equal the total Group N due to missing values

[b]p-value was calculated from Fisher's Exact Test

crashes, were very limited. Most individuals were injured in non-collision events, two-thirds were ejected and one-quarter were struck/pinned by the vehicle. Over three-fifths were injured on public roadways. Passengers made up a significant proportion of those injured. UTV-related injuries were often severe and associated with prolonged ICU and hospital stays, as well as fatalities. A particular concern was the high proportion of those injured being children.

Youth

Overall, about two-fifths of UTV-injured individuals were youth < 18 years. Moreover, almost one-third were < 16 years of age and, of these, nearly half were the UTV operator at the time of the injury. UTV manufacturers warn that these vehicles should not be operated by anyone under 16 years and that passengers be at least 12 years of age. However, it is not clear to what extent the high levels of unsafe behavior result from parents being unaware of these warnings, or aware but not heeding them.

Other studies have also noted significant proportions of injured crash victims being children < 16 years [1, 7, 15]. Children are reportedly only 14-18% of all UTV drivers yet make up a third to half of UTV injuries [1, 3, 7, 16]. Of the more than two-thirds of Iowa students that had ridden in a UTV in the past year, 29% reported having at least one crash during that time [6]. A newspaper report study of nine Midwest and Great Plains states showed UTV crashes were about 2.5 times more likely to involve a child than ATV crashes [7].

Rollovers

Children < 16 years had higher proportions than adults injured in non-collision events, mostly rollovers. This may partially explain why children had greater percentages than adults who were hit/pinned by the vehicle, even though their seatbelt use was not significantly different. UTVs typically weigh 1000–2000 pounds and are challenging to lift off pinned individuals. Victims can die of traumatic injuries to the head or vital organs, by compressive asphyxiation, and/or can suffer extremity amputations [3, 8, 9, 17].

Other studies have similarly found that rollovers account for the majority of UTV crashes [1, 3, 15]. CPSC data from 2003 to 2011 showed that rollovers frequently occur while turning and at speeds < 20 mph [15, 18]. Although a rollover can be initiated through a collision or when traveling on slopes, of the two-thirds of CPSC fatalities ($N = 224$) involving rollovers, 38% occurred on flat terrain [15]. Similar to ATVs, UTVs have a relatively high center of gravity and narrow track making them highly susceptible to rollovers [15, 19, 20].

Proper restraint

Two-thirds of those injured in UTV crashes were ejected from the vehicle. Ejected victims had significantly higher percentages with an abnormal GCS and ICU admission. A CPSC database study of UTV fatalities found that

Table 5 Bivariate analyses of injury severity indicators in relationship to being ejected from the vehicle and the location of the crash event for individuals injured in utility task vehicle (UTV) crashes/events in Iowa from 2002-2019 (N = 220 from Iowa Trauma Registry)

	Total	Ejected from vehicle			Location		
	n (Col %)[a]	Yes n (Col %)[a]	No n (Col %)[a]	p value	Off- oad n (Col %)[a]	Public Roadway n (Col %)[a]	p value
Group N		58	34		101	41	
GCS							
GCS = 15	144 (89)	34 (81)	25 (100)	0.045[b]	66 (94)	24 (75)	0.008[b]
GCS < 15	18 (11)	8 (19)	0 (0)		4 (6)	8 (25)	
ISS							
ISS ≤ 15	186 (88)	48 (84)	30 (94)	0.315[b]	85 (89)	31 (79)	0.124
ISS > 15	26 (12)	9 (16)	2 (6)		10 (11)	8 (21)	
Days in ICU							
0 days	42 (63)	5 (42)	11 (92)	0.027[b]	22 (73)	2 (18)	0.003[b]
1 or more days	25 (37)	7 (58)	1 (8)		8 (27)	9 (82)	
Days in hospital							
1 day	31 (34)	4 (21)	3 (25)	1.000[b]	11 (28)	10 (48)	0.133
2 or more days	59 (66)	15 (79)	9 (75)		28 (72)	11 (52)	

GCS: Glasgow Coma Scale, ISS: Injury Severity Score

[a]The sum of n for a variable may not equal the total Group N due to missing values

[b]p-value was calculated from Fisher's Exact Test

86% of victims were partially or fully ejected with three-quarters being struck by the vehicle and high proportions being pinned [15]. Other studies have similarly shown high proportions of patients being ejected and struck/pinned by the UTV [1, 3, 7].

Our study found that just 32% of those injured were wearing a seatbelt at the time of the crash. Other studies have found even lower proportions, ranging from 7 to 28% [1, 3, 7, 8, 15, 17]. A study of Iowa adolescent students found 37% reporting they never or almost never wore a seatbelt while in UTVs [6]. Proper restraint for every person during every ride is a critical UTV safety behavior. However, UTV seatbelts are not designed for children under 12 years and are not tested for use with child safety seats and booster seats limiting their protective function for youth.

Public roadways

UTVs are not designed for public roadways. Their off-road design includes low pressure tires with knobby treads meant to grab off-road terrain and they can have very unpredictable interactions with public roadway surfaces. Manufacturers strongly recommend against riding UTVs on public roadways [21] and warn consumers in the owner's manuals and with stickers on the vehicles.

However, where location could be determined, over 60% of study crashes occurred on public roadways. For children < 16 years of age, one quarter were injured on public roads. Other studies have found significant proportions of UTV-related injuries occurring on public roadways, ranging from 29 to 56% [1, 3, 7]. In addition, the majority of UTV roadway injuries in our study did not involve a collision with another motor vehicle. Other studies have shown that about four-fifths of UTV-related public roadway crashes were single vehicle crashes not involving another motor vehicle [1, 7]. Moreover, victims injured on public roads in our study had higher percentages with abnormal GCS scores and hospitalizations requiring ICU care.

The public needs to be better educated about the hazards of UTV roadway riding. Unfortunately, there has been a disturbing trend across the U.S. of cities, counties and states passing legislation allowing the recreational and transportation-related use of ORVs (including ATVs and UTVs) on public roads [14, 22, 23]. An Iowa study showed that counties passing ordinances allowing ORVs on public roads had a nearly 60% higher crash rate as compared to before it was passed and as compared to counties that had never passed a law [14]. Instead of passing legislation against manufacturer's recommendations that make the public less safe, all those interested in preventing ORV-related deaths and injuries should be advocating for the passage and enforcement of laws that prohibit ORVs on public roads.

Limitations

Limitations of our study include incomplete capture of crash and injury records as well as missing and/or incomplete documentation of study variables in our database which may have impacted our results. Another limitation is that moderate and severe crashes and injuries have a greater probability of being included in the data sources used in the study as compared to less severe crashes and injuries that did not require medical attention or were treated in the outpatient setting. Deaths that occurred but were not treated at a medical facility may

also be missing. We identified some potential sampling bias in alcohol testing with higher proportions of UTV operators on public roads being tested, so the involvement of alcohol may be underestimated in the study due to these and other limitations. Moreover, lack of vehicle information and confusion on the terminology of ORVs might have led some UTVs being misidentified as ATVs and excluded from the study. Narratives were carefully examined to correctly categorize ORVs in the database in order to minimize this limitation. In addition, our study was limited to UTV victims injured in the state of Iowa and does not necessarily reflect the experience of other states. Despite these limitations and the uncertain generalizability of our results, many of our findings are similar to that of the few UTV reports published and builds on the highly limited information currently available.

Conclusions

UTV crashes and injuries are increasing in frequency and are often associated with severe injuries. Injured victims in the study were often violating basic UTV safety rules. Children < 16 years and < 12 years who are not recommended by manufacturers to be UTV operators and passengers, respectively, were nearly one-third of those injured. Ejected UTV occupants and those driving on public roads had more severe outcomes. Decreasing UTV-related deaths and injuries will require widespread efforts to educate the public on UTV safety, and the passage and enforcement of evidence-based safety legislation including seatbelt use requirements, youth age restrictions, and the prohibition of UTVs (except for occupational purposes) on public roads.

Abbreviations

ATV	All-terrain vehicle
CPSC	Consumer Product Safety Commission
DNR	Department of Natural Resources
DOT	Department of Transportation
ED	Emergency department
e.g.	Exempli gratia (for example)
GCS	Glasgow Coma Scale
ISS	Injury severity score
ICU	Intensive care unit
ORV	Off- oad vehicle
ROV	Recreational off-hig way vehicle
ROPS	Roll-over protective structure
STR	State Trauma Registry
SPSS	Statistical Package for the Social Sciences
UTV	Utility task vehicle

Acknowledgements

We would like to acknowledge and thank all the individuals that assisted in the coding of data and linkage of records in the creation of the Iowa ORV surveillance database including Nicholas Stange, Evelyn Qin, Carolyn Wadman, David Ellis, AnnaMarie Fjeld, and Luke Sampson. We also want to acknowledge and thank the University of Iowa Stead Family Department of Pediatrics and the University of Iowa Health Care Stead Family Children's Hospital for its support of the Injury Prevention Program.

About this supplement

This article has been published as part of Injury Epidemiology Volume 12 Supplement 1, 2025: Proceedings of the 29th Annual Injury Free Coalition for Kids® Conference: Forging New Frontiers: Engineering for Equity. The full contents of the supplement are available online at https://injepijournal.biomedcentral.com/articles/supplements/volume-12-supplement-1.

Author contributions

All authors have read and approved the final manusc ipt. Each author significantly cont ibuted to and takes public responsibility for one or more aspects of the study. Specificall : PRS was involved with interpretation and analysis of the results, literature review, and writing and preparation of the manuscript for submission. CDM was involved in data compilation, organization and analysis as well as revision of the manuscript. GMD was instrumental in developing and creating the Iowa ORV surveillance database used in the study, obtaining access to data sources, coding data, supervising students involved in database entry, matching cases from multiple sources, assisting in analysis of the data and editing the final manusc ipt. CAJ was the primary investigator of the study and had overall responsibility for the development of the Iowa ORV surveillance database used in the study, interpretation and analysis of the results, and final w iting and preparation of the manuscript for submission.

Funding

Support for this study was provided by the University of Iowa Department of Emergency Medicine and by funding through the University of Iowa Undergraduate Research Fellow Program. Publication costs were funded by the Injury Free Coalition for Kids™. These entities had no specific ole in the research performed.

Data availability

Data and materials are available to other parties for research purposes after a data sharing agreement plan is agreed to and signed. Those interested should contact the corresponding author.

Declarations

Ethics approval and consent to participate

The University of Iowa Institutional Review Board approved this study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests or financial relationships relevant to this article to disclose.

Received: 3 March 2025 / Accepted: 20 June 2025
Published online: 29 July 2025

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Publisher's note

Lazarus *et al. Injury Epidemiology* (2025) 12:58
https://doi.org/10.1186/s40621-025-00619-4

Injury Epidemiology

RESEARCH Open Access

Cradle to grave: how social vulnerability correlates with leading causes of injury-related mortality among children and youth

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Abstract

Background A higher degree of social vulnerability is associated with greater overall injury risk. However, the overlap of social vulnerability with various injury modalities for mortality has been less explored.

Methods We conducted a cross-sectional study utilizing Georgia death certifica es from 2011 to 2021 in youth aged 0–24 years. Mortality rates from fi earms, motor vehicle collisions (MVCs), sudden unexpected infant death (SUID), poisonings, and drownings, with census-level social vulnerability index (SVI) categories were evaluated. A negative binomial regression model was created to identify relationships between injury-related cause of death and SVI.

Results There were 26,362 total deaths from 2011 to 2021 among children and youth. Of these, 10,643 (40%) were due to the top fi e injury mechanisms causing fatalities in ages 0–24 years in Georgia over the study period. Children and youth with the least advantage in the socioeconomic and minority and language SVIs had higher rates of injury-related mortality from fi earm-related deaths, MVCs, and SUID. However, poisonings were most common in the most advantaged quartiles. Differences in number of fi earm-related deaths per population were largest in the minority and language status SVI theme.

Conclusions Children and youth with greater social vulnerability had higher rates of injury-related mortality, except for those due to poisonings. Tailored resources for injury prevention should be focused on least advantaged communities, while poisoning prevention may be best targeted to children and youth in communities with higher SVI. In addition, the impact of systemic investments in healthcare, education, and neighborhood safety on injury-related mortality across SVIs warrants additional investigation.

Keywords Injury prevention, Social vulnerability, SUID, Firearm, Drownings

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Background

Unintentional injuries are the leading cause of child and youth mortality in the United States [1, 2]. Despite outreach, education, and interventions to decrease injuries over the past decade, pediatric injury-related mortality rates have recently increased [3]. Injury-related morbidity and mortality do not affect children equally and are influenced by racial, geographic, and socioeconomic disparities [2, 4–6]. To advocate for legislative, social, and environmental changes, a clear understanding of these disparities is necessary to reduce injury-related mortality among children and youth [4].

The five most common injury-related causes of death in the state of Georgia in the United States among children and youth aged 0–24 years were firearm-related injury, motor vehicle collisions (MVCs), sudden-unexpected infant death (SUID), poisonings, and drownings [1, 7]. These five injury patterns consistently ranked in the top five causes of injury death for individuals aged 0–24 years, based on data from Georgia's Online Analytical Statistical Information System (OASIS), which compiles information from state death certificates. To date, there has not been a comprehensive exploration of the intersection of geographic, social, and economic disparities in injury-related mortality among children and youth in Georgia. Such an understanding may inform targeted interventions and similar analyses and interventions in other states.

To this end, our objectives were to (1) delineate the common causes of pediatric and young adult injury mortality in Georgia and (2) determine the association between social vulnerability and injury-related mortality among children and youth in Georgia.

Methods

Study design

We performed a retrospective analysis of death certificates for children and youth who died from the five leading causes of injury-related mortality in Georgia, including injuries from firearms, motor vehicle collisions (MVCs), sudden unexpected infant death (SUID), poisoning, and drownings [1, 7]. For SUID, we included children aged < 12 months as this injury is specific to infants [8]. For other injury modalities, we included children and youth aged 0–24 years who died in Georgia from January 1st, 2011 through December 31st, 2021. All relevant variables, including race and location of death were consistently recorded. No records contained missing or incomplete data. We focused our analyses on the five most common causes of injury-related death to assess the relationship between social vulnerability and the most common causes of death and inform potential interventions to prevent future injury-related deaths. We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines. The study was deemed exempt from ethical review by Children's Healthcare of Atlanta due to the use of de-identified and publicly available data.

Study setting

The state of Georgia is located in the southeastern United States. Georgia's population is approximately 10.7 million [8]. Georgia has 159 counties with a mixture of urban and rural designations (120 [75.4%] are rural, yet only 21% of the state's population lives in a rural area) [9]. Overall, 13.6% of inhabitants live in poverty. Of Georgia's population, 59% identify as White, 33% as Black, 5% as Asian, 3% as Mixed Race, < 1% as Native Hawaiian/Pacific Islander, and < 1% as American Indian [10]. The KIDS COUNT® Data Book uses 16 indicators to rank each state across four domains: health, education, economic well-being, and family/community to assess well-being [11]. Georgia ranked 37th overall for child well-being, 32nd in economic well-being, 31st in education, 43rd in health, and 42nd in family/community (i.e., a composite measure of children living in high-poverty areas, teen births, and children in single-parent families) [12].

Variables

Data from Georgia death certificates were obtained from the Georgia Department of Public Health. Data for denominators to determine the number of injury-related deaths were obtained from the US census tract utilizing the 2020 American Community Survey [9]. Georgia death certificates were reviewed for basic demographic data such as sex, race, and the decedent's age and place of residence at the time of death, which was then used to evaluate the decedent's Social Vulnerability Index (SVI). SVI utilizes census-tract level data to determine markers of social vulnerability and has historically been used for disaster preparedness for 16 factors, such as poverty, lack of vehicle access, and crowded housing [13]. These 16 factors are then grouped into four themes: (1) socioeconomic status (i.e., rates of poverty/unemployment, income, and educational attainment), (2) household composition/disability (i.e., single-parent households, percentage of persons ≥ 65 years or < 18 years of age), (3) minority status/language (i.e., percentages of individuals who are members of racial/ethnic minority groups), and (4) housing type/transportation (i.e., housing in structures with > 10 units, mobile homes, households without vehicles) [14]. SVI has been shown to be impactful in the evaluation of various injury patterns throughout the United States [5, 13, 15–19].

Analyses

Decedent demographics were compared using chi-square (or Fisher's exact tests when appropriate) and two sample

t-tests to assess for homogeneity of the included population. Non-parametric tests (i.e., Wilcoxon rank-sum tests) were used for data that were not normally distributed. Descriptive statistics were summarized using means, standard deviations or medians, and interquartile ranges for continuous data. Counts and percentages were used for categorical data. Using these methods, bias was minimized. For SVI, we evaluated the four central themes and 16 associated variables to determine associations between the mortality mechanism and the four SVI themes [14]. A negative binomial regression model was created to identify relationships between the outcome of injury-related number of deaths per population and SVI quartiles by each of the four SVI themes. Comparisons in the negative binomial regression model were adjusted for all included components of SVI scales. Statistical analysis was completed using SAS 9.4 (Cary, NC).

Results

There were 26,362 deaths in children and youth aged 0–24 years from 2011 to 2021 with 10,643 (40%) being due to the top 5 injury-related causes and were thus included in our analyses. All deaths eligible were included for analysis. Most injury-related deaths were in youth aged 15–24 years ($n=7,662$, 72%; Table 1). The median age of those affected by firearms was 20 years (interquartile range [IQR] 18, 22), for MVCs 20 years (IQR 16, 22), for poisonings 22 years (IQR 20, 23), and for drownings 9 years (IQR 3, 18). All injury-related mechanisms of death affected males ($n=7,845$, 74% of overall deaths) more than females, with the greatest difference in firearm-related mortality (male 87%, female 13%). Injury-related mortality affected Non-Hispanic Black children (49%) and White children (49%) almost equally, followed by Asian children (1%) and Multi-Racial children (1%) (Table 1). Both Native-American and Pacific-Islander children made up only approximately 0.01% of all deaths. SUID and firearm injury-related deaths affected Black children and youth more than other races (i.e., 56% of SUID deaths and 66% of firearm-related deaths occurred among Black children and youth). White children comprised the majority of drowning-related deaths (53%), MVC-related deaths (59%), and poisoning-related deaths (82%).

Di erences in Injury-Related deaths by SVI

In each of the four SVI themes, there were higher mortality rates among the most socially vulnerable groups ($P<0.001$, Table 2). The SVI socioeconomic status theme had the largest disparities between those least and most advantaged, with 18.1% of deaths ($n=1,925$) among the most advantaged quartile and 32% of deaths

Table 1 Demographics and injury characteristics for included injury-related deaths (*N*=10,643)

	Total	Drowning	Poison/Noxious Exposure	Firearm	MVC	SIDS
Age groups						
<1 year	1811 (17)	12 (2.3)	5 (0.4)	5 (0.1)	52 (1.5)	1737 (100)
1–4 years	425 (4)	184 (34.7)	14 (1.2)	42 (1.1)	185 (5.4)	0 (0)
5–9 years	305 (2.9)	75 (14.1)	9 (0.8)	42 (1.1)	179 (5.2)	0 (0)
10–14 years	440 (4.1)	52 (9.8)	13 (1.1)	164 (4.3)	211 (6.2)	0 (0)
15–24 years	7662 (72)	208 (39.2)	1122 (96.5)	3545 (93.3)	2787 (81.6)	0 (0)
Sex						
Female	2798 (26.3)	121 (22.8)	330 (28.4)	493 (13)	1064 (31.2)	790 (45.5)
Male	7845 (73.7)	410 (77.2)	833 (71.6)	3305 (87)	2350 (68.8)	947 (54.5)
Race						
Native American	5 (<0.01)	0 (0)	1 (0.1)	2 (0.1)	2 (0.1)	0 (0)
Asian	147 (1.4)	13 (2.4)	15 (1.3)	49 (1.3)	54 (1.6)	16 (0.9)
Black	5166 (48.5)	226 (42.6)	183 (15.7)	2499 (65.8)	1289 (37.8)	969 (55.8)
Multiracial	114 (1.1)	9 (1.7)	7 (0.6)	30 (0.8)	33 (1)	35 (2)
Pacific Islande	14 (0.1)	1 (0.2)	0 (0)	4 (0.1)	7 (0.2)	2 (0.1)
White	5197 (48.8)	282 (53.1)	957 (82.3)	1214 (32)	2029 (59.4)	715 (41.2)
Ethnicity						
Hispanic	817 (7.7)	64 (12.1)	77 (6.6)	213 (5.6)	365 (10.7)	98 (5.6)
Non-Hispanic	9815 (92.2)	467 (87.9)	1086 (93.4)	3582 (94.3)	3042 (89.1)	1638 (94.3)
Unknown	11 (0.1)	0 (0)	0 (0)	3 (0.1)	7 (0.2)	1 (0.1)
Cause of Death						
Drowning	531 (5)	–	–	–	–	–
Firearm	3798 (35.7)	–	–	–	–	–
Motor vehicle collision	3414 (32.1)	–	–	–	–	–
Poisoning	1163 (10.9)	–	–	–	–	–
Sudden unexplained infant death	1737 (16.3)	–	–	–	–	–

Table 2 Comparison of the proportion of injury-related deaths by social vulnerability index (SVI) themes

SVI Theme	*n* (%)	*P* value
Socioeconomic (N=10,643)		<0.001
Lowest quartile (most advantaged)	1,925 (18.1)	
Second quartile	2,415 (22.7)	
Third quartile	2,862 (26.9)	
Fourth quartile (most disadvantaged)	3,441 (32.3)	
Household Composition/Disability (N=10,643)		<0.001
Lowest quartile (most advantaged)	2,015 (18.9)	
Second quartile	2,577 (24.2)	
Third quartile	2,722 (25.6)	
Fourth quartile (most disadvantaged)	3,329 (31.3)	
Minority/Language (N=10,643)		<0.001
Lowest quartile (most advantaged)	2,202 (20.7)	
Second quartile	2,301 (21.6)	
Third quartile	2,437 (22.9)	
Fourth quartile (most disadvantaged)	3,703 (34.8)	
Housing Type/Transportation (N=10,643)		<0.001
Lowest quartile (most advantaged)	2,127 (20.0)	
Second quartile	2,576 (24.2)	
Third quartile	2,867 (26.9)	
Fourth quartile (most disadvantaged)	3,073 (28.9)	

($n = 3,441$) among the most disadvantaged quartile. This was closely followed by the minority status/language SVI, with 20.7% of deaths ($n = 2,202$) among the most advantaged quartile, and 34.8% of deaths ($n = 3,703$) from the most disadvantaged quartile. In the household composition/disability SVI, 18.9% of deaths ($n = 2,015$) occurred among the most advantaged quartile and 31.3% of deaths ($n = 3,329$) occurred among the most disadvantaged quartile (Table 2).

Firearm-Related deaths

Firearm-related deaths were the most common type of injury mortality ($n = 3,798$, 36% of all injury-related deaths). The unadjusted number of firearm-related deaths per population was larger in the least advantaged quartile population in each of the four SVI themes (Fig. 1). The minority status and language theme had the largest difference in the number of firearm-related deaths per population between the least and most advantaged quartiles. However, in adjusted analyses, firearm-related deaths was only more common in the least advantaged groups by socioeconomic and minority status/language SVI themes (Table 3).

MVC-related deaths

MVC-related deaths were the second most common cause of injury-related deaths ($n = 3,414$, 32%). The number of MVC-related deaths per population was higher in the least advantaged quartiles for all SVI themes except for the minority status/language theme in unadjusted comparisons (Fig. 1). In adjusted analyses, the number of MVC-related deaths per population was higher in less advantaged quartiles in the socioeconomic theme and the household composition/disability SVI theme (Table 3). However, the adjusted number of deaths per population from MVCs was less common in more advantaged quartiles in the minority status and language theme. The number of MVC-related deaths per population did not differ by quartile in analyses of the housing and transportation SVI theme.

SUID

There were 1,737 deaths from SUID, comprising 16% of the total injury-related deaths. The number of SUIDs per population was higher in the least advantaged quartiles across all four SVI themes in unadjusted comparisons (Fig. 1). The number of SUIDs per population was higher in less advantaged quartiles by the socioeconomic and housing and transportation SVIs, but the same pattern was not observed in adjusted analyses in the household composition/disability SVI and the minority status and language SVI (Table 3).

Poisoning-related deaths

There were 1,163 poisoning deaths, comprising 11% of all injury-related deaths. Poisoning-related deaths defied the trends of other injury-related deaths as the unadjusted number of deaths per population from poisonings was higher in the most advantaged quartiles in each of the four SVI themes (Fig. 1). However, this relationship was lost in adjusted analyses except for the minority status and language SVI theme, in which adjusted poisoning-related deaths were less common among more disadvantaged quartiles (Table 3).

Drowning-related deaths

Drowning-related deaths comprised only 5% ($n = 531$) of injury-related deaths included in our analyses. The unadjusted number of drowning deaths per population was higher among children and youth in the least advantaged quartiles in all SVI themes except for the minority status and language SVI, in which the unadjusted drowning-related deaths did not differ substantially among the quartiles (Fig. 1). Like most injury-related deaths, drowning-related deaths were more common in less advantaged quartiles in the household composition and disability and housing and transportation SVI themes (Table 3).

Discussion

Overall, in our analyses that included > 10,000 deaths among children and youth, when looking at the unadjusted number of injury-related deaths per population, there were more deaths among those from the most disadvantaged quartiles in all SVI themes in the state of Georgia. This was especially the case among the

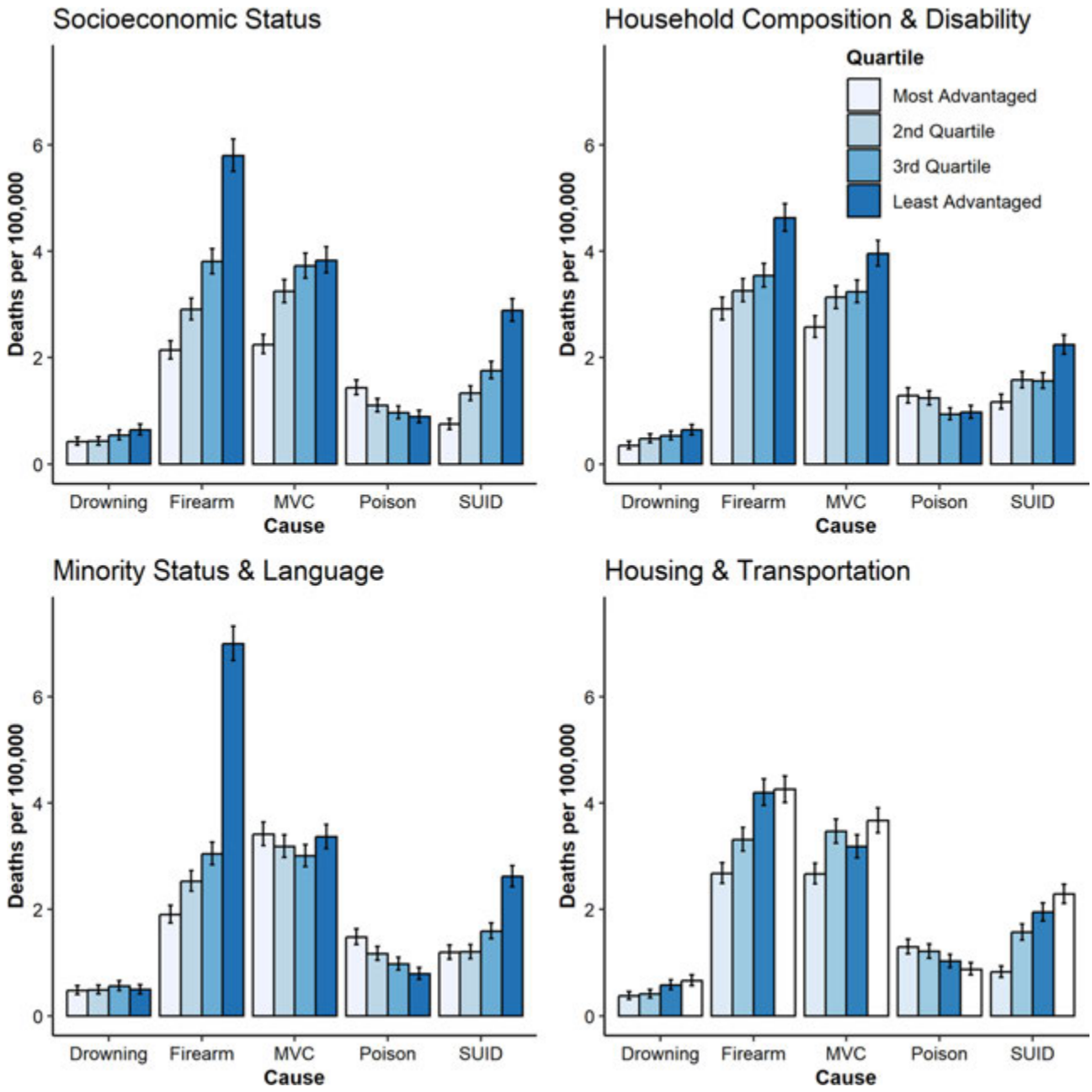

Fig. 1 Unadjusted incident injury-related deaths by injury mechanism and social vulnerability index quartile

socioeconomic and minority status/language themes. These differences, however, did not necessarily follow a dose-response by quartile. Poisonings, in contrast, were more common among more advantaged groups.

Our study is the first, to our knowledge, to evaluate mortality among children and youth from five of the most common injury mechanisms by SVI. Drowning and poisonings are infrequently referenced in injury prevention literature. Other studies have focused on multiple injury mechanisms in ages 1–45, but did not separate injury-related mortality by mechanism to determine the SVIs most associated specific injury mechanisms and did not focus specifically on children and youth injuries [16]. A more granular assessment of injury-related number of deaths per population can inform targeted injury prevention approaches for children and youth.

Since 2017, firearm-related injuries have shown a substantial increase, becoming the leading cause of death for children and youth aged 0–24 years [20]. Our findings from the state of Georgia aligned with this disturbing trend. Moreover, our findings are similar to other emerging literature showing a strong relationship between

Table 3 Negative binomial regression models to assess the association between incident injury-related deaths and social vulnerability index themes and quartile*

		Socioeconomic		Household composition and disability		Minority Status and Language		Housing and Transportation	
		Rate Ratio (95% CI)	*P* value	Rate Ratio (95% CI)	*P* value	Rate Ratio (95% CI)	*P* value	Rate Ratio (95% CI)	*P* value
Firearms	Most advantaged	*Referent*		*Referent*		*Referent*		*Referent*	
	Quartile 2	1.55 (1.27–1.89)	**<0.001**	1.04 (0.89–1.22)	0.63	3.06 (2.60–3.61)	**<0.001**	1.00 (0.84–1.19)	0.99
	Quartile 3	1.35 (1.14–1.61)	**<0.001**	0.94 (0.80–1.09)	0.4	1.45 (1.23–1.70)	**<0.001**	1.1 (0.93–1.30)	0.25
	Least advantaged	1.16 (0.99–1.37)	0.07	0.98 (0.84–1.14)	0.76	1.30 (1.11–1.53)	**0.001**	1.07 (0.91–1.25)	0.43
Motor Vehicle Collisions	Most advantaged	*Referent*		*Referent*		*Referent*		*Referent*	
	Quartile 2	1.76 (1.45–2.15)	**<0.001**	1.34 (1.14–1.58)	**<0.001**	0.77 (0.65–0.90)	**0.001**	1.00 (0.84–1.19)	0.98
	Quartile 3	1.70 (1.43–2.02)	**<0.001**	1.17 (1.00–1.36)	0.05	0.74 (0.64–0.87)	**<0.001**	0.93 (0.79–1.09)	0.37
	Least advantaged	1.46 (1.25–1.70)	**<0.001**	1.18 (1.02–1.38)	**0.03**	0.89 (0.77–1.03)	0.11	1.10 (0.94–1.29)	0.22
Sudden Unexplained Infant Deaths	Most advantaged	*Referent*		*Referent*		*Referent*		*Referent*	
	Quartile 2	2.60 (2.00–3.30)	**<0.001**	1.09 (0.90–1.33)	0.38	1.40 (1.15–1.71)	**<0.001**	1.59 (1.27–1.99)	**<0.001**
	Quartile 3	1.79 (1.43–2.25)	**<0.001**	0.97 (0.80–1.18)	0.74	1.02(0.84–1.24)	0.86	1.57 (1.27–2.0)	**<0.001**
	Least advantaged	1.52 (1.23–1.88)	**<0.001**	1.16 (0.96–1.41)	0.13	0.90 (0.74–1.10)	0.31	1.53 (1.24–1.89)	**<0.001**
Poisonings	Most advantaged	*Referent*		*Referent*		*Referent*		*Referent*	
	Quartile 2	0.89 (0.68–1.16)	0.39	0.95 (0.77–1.19)	0.67	0.59 (0.47–0.74)	**<0.001**	0.86 (0.67–1.09)	0.2
	Quartile 3	0.81 (0.65–1.01)	0.06	0.85 (0.69–1.04)	0.12	0.71 (0.58–0.86)	**<0.001**	0.95 (0.76–1.18)	0.63
	Least advantaged	0.83 (0.68–1.01)	0.06	1.04 (0.86–1.27)	0.67	0.80 (0.67–0.97)	**0.02**	1.03 (0.84–1.26)	0.78
Drownings	Most advantaged	*Referent*		*Referent*		*Referent*		*Referent*	
	Quartile 2	1.11 (0.77–1.59)	0.59	1.58 (1.12–2.15)	**0.004**	0.77 (0.57–1.04)	0.09	1.56 (1.12–2.16)	**0.008**
	Quartile 3	1.00 (0.73–1.37)	0.99	1.40 (1.04–1.89)	**0.03**	0.94 (0.71–1.24)	0.67	1.44 (1.06–1.95)	**0.02**
	Least advantaged	0.89 (0.66–1.20)	0.45	1.35 (1.00–1.82)	0.05	0.90 (0.68–1.18)	0.44	1.06 (0.78–1.44)	0.73

Clinically significant with a *p*-value of ≤0.05 are shown in bold

*Models adjusted for all included components of social vulnerability index scales

greater social vulnerability and greater risk of firearm-related injuries and deaths [5, 6, 15, 16, 18]. Our study expands these findings by providing a more granular view of which aspects of social vulnerability may place children and youth at risk for greater risk of firearm-related deaths. We found that children and youth in the least advantaged minority status and language SVI had the greatest rates of number of deaths per population due to firearms. Other studies have demonstrated that Black male youth are as much as 18 times more likely to die from firearm-related violence than White youth [21]. The reasons for this disparity are likely multifactorial, but residential segregation could lead to increased firearm violence, even in segregated areas without income disparities [22]. Number of deaths per population due to firearms also differed by the socioeconomic SVI quartiles. This aligns with other studies that suggest counties with the highest levels of poverty also have highest rates of youth firearm homicides, suicides, and unintentional firearm deaths [6]. Inequities begin early in life and early childhood development programs, more generous health policies, enhancing employment opportunities, improved wage, and civil rights policies and equity-focused legislation may help address racial and socioeconomic disparities, which in turn may reduce firearm-related deaths among children and youth [23].

MVC deaths have decreased approximately 40% from 2000 to 2020 [20]. However, these deaths are not equally distributed across all groups. In our study, MVC-related deaths were most common among children and youth in the least advantaged socioeconomic SVIs. Prior research suggests that children with less socioeconomic advantage may be less likely to be properly restrained [24]. However, we also observed higher rates of MVC-related deaths among more advantaged children and youth in the housing/transportation theme and minority status/language theme (Fig. 1). Racial and socioeconomic factors play a part in whether a teen is given opportunities to drive. Previous studies suggest that teens are less likely to drive when they are from households with less financial resources for a vehicle, driver's education, and automobile insurance. Thus, more socioeconomically advantaged children may drive at a younger age [25]. In addition, as ride-sharing increases, there are inconsistent recommendations and laws regarding restraint use in ride-sharing programs, with an unclear impact on MVC deaths [26, 27]. Further studies are warranted to understand the reasons for inconsistent rates of MVC-related deaths among both advantaged and disadvantaged groups.

SUID is a leading cause of death in children aged < 1 year and is strongly associated with modifiable sleep environments. Since 1999, rates of SUID have remained

relatively unchanged, and vary widely by state [8, 28]. Similar to prior studies that suggest that child abuse-related fatalities are more common among socioeconomically disadvantaged populations, our study showed that children in the least advantaged socioeconomic group had the highest rates of SUID-related deaths compared to those in the most advantaged socioeconomic SVI quartile [29]. Findings from Georgia suggest that Medicaid-enrolled families have four times greater risk of SUID than children with any other insurance type [7]. Furthermore, prior studies suggest that SUID rates are twice as high among Black infants compared to White infants, and in some states has been reported to be as high as 12x that of White infants [30, 31]. In at least one other study, factors such as education level and insurance status, along with race, were found to significantly influence SUID rates, with individuals who had lower educational attainment or public insurance experiencing higher rates of SUID. Urbanicity, prematurity status and maternal complications had less of an impact on SUID rates [32]. Disparities have widened following the COVID-19 pandemic, with even larger increases in SUID for infants of mothers who are publicly insured, have attained less education, and non-Hispanic Black mothers [33]. Although our study was not designed to elucidate reasons for such disparities, concerted efforts to promote safe sleeping patterns are urgently needed for high-risk groups to prevent future SUID.

Regarding poisonings, other studies suggest that population density (housing type and transportation), minority status, and household composition/disability are most associated with poisoning-related deaths, with those least advantaged most likely to die from fatal drug overdoses than those who lived in more advantaged neighborhoods [34]. Our study differs this previous finding. To our knowledge, there is only one previous study demonstrating that poisoning-related deaths may be more common in certain affluent populations [35]. Greater mortality in those of higher advantage could be due to increased prescription medication access due to more liberal prescription practices in children of higher advantage, which eventually can increase the risk of use and misuse, or that alcohol and marijuana use may be associated with higher economic status, which may be a gateway for opioids or other more lethal drugs [36]. Ultimately, additional studies are warranted to elucidate the reason that poisoning-related mortality was most common among more advantaged populations in Georgia. It is important to track future overdose deaths and to determine if these poisonings were intentional or not to inform further interventions.

Limitations

Our study had several limitations. We reviewed the SVI where the patient's address was on the death certificate, not the location of death, which may not reflect residence at the time of death. Although the SVI provides a multifaceted assessment of social well-being, it does not provide granularity on what elements in the household or environment may be driving such disparities in injury-related deaths. In addition, because our data utilized death certificate data which may not always involve a complete diagnostic autopsy, the true cause of death may not have always been captured. However, as the included causes of death are injury-related, discrepancies between death certificate and the actual causes of death may have been less frequent. Our study is limited to state-wide data and not a national dataset, and only assessed SVI and basic demographics, and not the overall community breakdown, and could not account for other unmeasured behavioral, social, and environmental factors that may contribute to injury-related mortality. However, these methods can be adapted for a multi-state or national analysis. Lastly, it is important to note that although race and ethnicity comprise an SVI theme, racial disparities are not the result of race itself, but are shaped by institutional and historical injustices and our findings should be interpreted with the acknowledgement of race as a social construct [37].

Conclusions

Our results support previous studies showing that SUID and firearm-related mortality are more common among children and youth who live in more disadvantaged neighborhoods. Conversely, poisonings were more common among children and youth who lived in more advantaged neighborhoods. Further exploration of shared risk and protective factors across social vulnerability themes and injury-related mortality could help identify key opportunities for policy changes and targeted interventions to reduce mortality and morbidity in children and youth from preventable causes of death.

Abbreviations

MVC	Motor vehicle collision
SUID	Sudden unexpected infant death
SVI	Social vulnerability index

Acknowledgements

Not applicable.

Author contributions

SGL conceptualized the study and was the corresponding author. SC provided edits and assistance with driving statistical analysis. TPM provided statistical analysis and table/figu e design. TM provided access to Georgia DPH data and assisted with conceptualization of design. KFD and CD provided editing assistance. KD assisted with finding eferences and formatting references. CAR was the supervising author and provided significant edits and verarching guidance, reformatting of the manuscript and steerage of data analysis. All authors have read and approve the final manusc ipt.

Funding
Chris A. Rees was supported by the National Institutes of Health (K23HL173694).

Data availability
All data used in this study can be accessed through reasonable request to the Georgia Department of Public Health, Office of Health ndicators for Planning; Centers for Disease Control and Prevention, Agency for Toxic Substances and Disease Registry and US census bureau.

Declarations

About this supplement
This article has been published as part of Injury Epidemiology Volume 12 Supplement 1, 2025: Proceedings of the 29th Annual Injury Free Coalition for Kids® Conference: Forging New Frontiers: Engineering for Equity. The full contents of the supplement are available online at https://injepijournal.biomedcentral.com/articles/supplements/volume-12-supplement-1.

Ethical approval/informed consent
Not required due to the utilization of de-identified and publicly vailable data, which was deemed non-human research. Deemed exempt by the Children's Healthcare of Atlanta IRB.

Consent for publication
Not applicable.

Competing interests
The authors declare they have no competing interests.

Received: 27 February 2025 / Accepted: 1 September 2025
Published online: 23 September 2025

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Publisher's note

Injury Epidemiology

RESEARCH Open Access

Safe system approach to preventing cyclist fatalities: safety by design for urban and rural environments

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Abstract

Background Cyclists are vulnerable road users, with preventable deaths increasing by 48% over the past decade. This study aimed to review the epidemiology of cyclist fatalities to identify risk factors for targeted interventions through a safe system approach, with a focus on urban and rural environments.

Methods Data on fatal cyclist and motor vehicle collisions (CMVC) and injuries were collected from the Office o the Chief Coroner (2013-19), including selected crash investigations and expert reviews by a multidisciplinary team. Descriptive analyses were conducted, and urban vs. rural CMVC were compared using Pearson chi-square and Mann-Whitney U tests.

Results There were 83 fatal cyclist collisions (81% male), with 6% children, 13% youth, 69% adults, and 12% seniors (median age = 48, ISS = 75). The head was the most severely injured body region across all age groups (median AIS = 5), except for children, whose thoracic injuries were more severe. Overall, 62% of cyclists were not wearing helmets, and 24% were impaired. Expert review found that 60% of child cyclist fatalities were run over, all of whom were ≤ 6 years. Distractions from cell phones (1%) or headphones (8%) may have contributed to CMVC. Urban collisions (49 cyclists; 59%) accounted for all child deaths and had significantly mo e collisions involving intersections (57% vs. 6%; $p < 0.001$), low-speed crashes (33% vs. 0%; $p < 0.001$), bike lanes (29% vs. 0%; $p < 0.001$), and heavy vehicles (31% vs. 6%; $p = 0.006$). Rural collisions were associated with higher speeds (> 50 km/h, 94% vs. 49%; $p < 0.001$), dark lighting (44% vs. 4%; $p < 0.001$), and riding on the roadway with traffic (56% . 16%; $p < 0.001$). No rural CMVCs had sidewalks or bike lanes (0% vs. 84%; 0% vs. 33%; $p < 0.001$).

Conclusion Cyclists face severe injury and death risks in both urban and rural settings. A safe system approach recognizes human vulnerability and the inevitability of mistakes. Engineering countermeasures, such as road separation, better lighting in rural areas, traffic calmi , and vehicle safety features (i.e., guard rails, advanced headlights, and cyclist detection), support CMVC prevention. Public health campaigns and legislative action, along with equitable implementation across urban and rural areas, facilitate improving cyclists' safety.

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Keywords Cyclists, Fatalities, Motor vehicle collisions, Injury prevention, Urban environment, Rural environment, Road safety

Background

Cycling is an active and sustainable mode of transport and recreational activity that has many health, societal, economic, and environmental benefits including physical activity, inexpensive transportation, as well as reduced greenhouse gas emissions [1, 2]. It is an important means of transportation, recreation and fitness, which became even more popular during the COVID-19 pandemic, given proximity issues with public transportation and a halt put to many other types of recreational activities [3, 4]. Despite all its benefits, cycling can have dire consequences, particularly when cycling occurs on roadways in close proximity to traffic [5]. According to the World Health Organization, 41,000 cyclists die annually in road traffic-related incidents worldwide [1].

Unlike motor vehicle occupant injuries, which have been consistently on the decline in North American for several decades, except for increases during the COVID-19 pandemic [3, 6], cycling crashes are on the rise, comprising an increasing proportion of road traffic injuries and deaths [7, 8]. Without the protection of a vehicle, cyclists are a particularly vulnerable road user (VRU), killed at higher rates than other types of road users [9]. The risk of injury and death has been estimated to be higher for those riding a bicycle than for those driving a car on roadways [10]. One study found cyclists to be 12 times more likely to be killed while traveling on roadways compared with motor vehicle occupants [11]. This results in a disproportional overrepresentation of cyclists in serious and fatal road traffic injury when riding on the roadways compared to vehicle occupants [2].

According to National Highway Traffic Safety Administration, the number of preventable cyclist deaths have increased 47.5% over the past decade, with $n = 749$ fatalities in 2013 and a total of $n = 1{,}105$ cyclist fatalities in 2022 [12]. In Canada, the number of cyclist deaths have remained fairly constant in recent years, with only 2 less deaths in 2022 compared to 2018 ($n = 46$ and $n = 48$, respectively), with the number of cycling fatalities peaking in 2020 ($n = 51$), coinciding with the onset of the COVID-19 pandemic over this 5-year time period [8].

Cycling crashes and injuries do not impact individuals and communities equally. Demographic and socioeconomic factors, along with neighbourhood environments and urban planning features have been found to correlate to cyclist injury [3, 13]. Who you are, where you live and where you cycle impacts your likelihood of crashing and sustaining an injury on a bicycle. An individual's neighbourhood is increasingly acknowledged as a key factor in determining health, as residential areas have both physical and social characteristics that have the potential to influence a person's health and well-being [13, 14]. Since place of residence is heavily influenced by social status and ethnicity, the characteristics and features of neighbourhoods may play a significant role in contributing to health disparities [14].

In terms of cycling, low-income and other marginalized groups are less likely to own a vehicle and therefore, rely more on public and active forms of transportation. Previous research using census tracts in Texas found that poverty rates were associated with more frequent trips by bicycle, which in turn lead to an increase in cycling crashes [15]. Inadequate urban planning and access to transportation and cycling infrastructure, (i.e., bike lanes, cycle tracks and shared paths), which differs in urban and rural environments, can significantly disadvantage groups and neighboourhoods, leading to more cycling collisions, injuries and fatalities in those areas [13]. A recent pediatric study found low-income neighbourhoods and areas near major roadways had the highest risk for cycling collision. Additionally, helmet access and use were very low among these children, contributing to high rates of traumatic brain injuries [16]. A safe and equitable transportation system needs to be designed that mitigates crash risk in all communities and protects all including cyclists, a very VRU, via a safe system approach [17, 18]. The key principles of a safe system approach acknowledge that all road users will make mistakes, so the transportation system must be designed to account for these inevitable human errors, with an emphasis on a shared responsibility to prevent serious injury and deaths [17, 18].

Cyclists are particularly vulnerable because they lack a vehicle to protect their bodies, which has a finite capacity to withstand the forces experienced in a collision. So, designing safer roads, whether in urban or rural settings, is crucial in minimizing serious injury and deaths. Well-designed roadways can proactively manage vehicle speeds, simplify traffic flow and guide all road users to make safer decisions and reduce the crash forces on individuals to prevent serious injury [18].

The objective of this study was to examine the epidemiology of cycling fatalities in Ontario, with a focus on urban and rural environments, to identify key risk factors for targeting through a safe system approach. Potential countermeasures for reducing CMVC will be discussed and recommended, based on best practice in each setting via this holistic, proactive approach [18, 19], which can be used as part of a road safety strategy to mitigate potential crash hazards for cyclists and prioritize safe mobility for these VRU.

Methods

The study was approved by the Western University Health Science Research Ethics Board (Project ID: 113440; Lawson Health Research Institute approval number: R-19-066). The Board agreed to waive the requirement to obtain informed consent because in accordance with Tri-Council Policy Statement 2, Article 3.7 A as the research involved no more than minimal risk to the participants who were deceased; the alteration to consent requirements was unlikely to adversely affect their welfare; and it would have been impossible to carry out the research and to address the research question properly, given the research design, if prior consent of the participants was required.

Data

Fatal cyclist collision and injury data were collected from the Office of the Chief Coroner for Ontario from 2013 to 19. Data investigation reports from the Coroner's Office were reviewed, data abstracted and entered into a VRU injury crash database [20]. These reports were comprised of the coroner's investigation statement, postmortem examination and forensic toxicology reports, along with reports from police and other agencies. Based on these data, the injuries were summarized and coded with the Abbreviated Injury Scale (AIS), 2015 version and Injury Severity Score (ISS) calculated to determine the overall injury severity [21]. An anonymized version of the crash and injury cyclist data is presented in Additional file 1.

The collision data included vehicle details and type, speed limits, impact speed, intersection type and controls, location type, road surface conditions, lighting, collision configurations, pre-crash and avoidance action, with VRU kinematics, position, action, contact and runover status, as well as other details on the VRU and driver of the vehicle [20]. A select subset of all VRU cases (43/703 = 6.1%) underwent in-depth prospective and retrospective field investigations conducted by our crash investigation team. These investigations included collection and review of extensive on-scene collision information and crash reconstruction from local and regional supporting police services. Media information from news articles and collision images were included in the database, used to supplement any data element missing in the Coroner's database such as vehicle information, confirming weather or lighting conditions, along with scene maps and street view images from Google Maps [22] based on crash location data, as available. These data were important for classifying CMVC as urban or rural, as defined below, as well as determining the presence of infrastructure at the crash scene including bike lanes or the type of crosswalk. Electronic reports were developed for each VRU collision and linked to the injury crash database [20]. Cyclists were the only type of VRU included in this analysis.

Urban and rural crash locations were classified by the following definitions, according to Statistics Canada definitions based on population size and census data. Urban areas were areas situated within a city or town characterized by higher population density and infrastructure development, specifically defined as continuously built-up areas having a minimum population concentration of 1,000 persons and a population density of at least 400 persons per square kilometer based on the previous census [23]. Rural areas have concentrations or densities below the thresholds used to define urban areas [23]. They are areas situated outside urban centers and characterized by lower population density, often with vast expanses of open land areas.

Analysis

Descriptive analyses were undertaken including counts, proportions, mean, median, standard deviation and interquartile range (25th – 75th quartiles). A subgroup analysis by the classification of the crash location as either urban or rural, as defined above, for cyclist and motor vehicle collisions (CMVC) was undertaken, with proportions and medians compared with Pearson chi square and non-parametric Mann Whitney U tests, respectively. All analyses were performed using IBM® SPSS® Statistics for Windows, Version 29.0.2.0 (Armonk, NY: IBM Corp).

Results

Of the 703 VRU deaths in the VRU crash database, there were 83 unintentional cyclist fatalities over the study period, predominantly male cyclists ($n = 67$, 80.7%). The median (IQR) age was 48 (27.0–58.0) years, with the majority ($n = 57$, 68.7%) of cyclists in the adult age group (25–64 years old). A breakdown of cyclist fatalities by age and sex is presented in Fig. 1. Table 1 provides a summary of crash variables for all cycling fatalities, as well as comparing cycling crashes in a rural versus urban environment.

For all cyclists, just over half of cyclist ($n = 42/83$, 50.6%) fatalities occurred in the summer months from June to August, with fall, from September to November, the next most common time of year for cyclist fatalities ($n = 22/83$, 26.5%). Thursday was the most common day of the week for cyclist fatalities ($n = 15/83$, 18.1%), more than double the cyclist fatalities on Mondays ($n = 7/83$, 8.4%), the least common day of the week for these collisions. Fatal cyclist crashes occurred at every hour throughout the day, with 6 o'clock am and pm being the two most common hours of occurrence ($n = 10/83$, 12.0% and $n = 7/83$, 8.4% for 06:00–06:59 and 18:00–18:59, respectively). The majority of fatalities occurred in the daylight ($n = 50/83$, 60.2%),

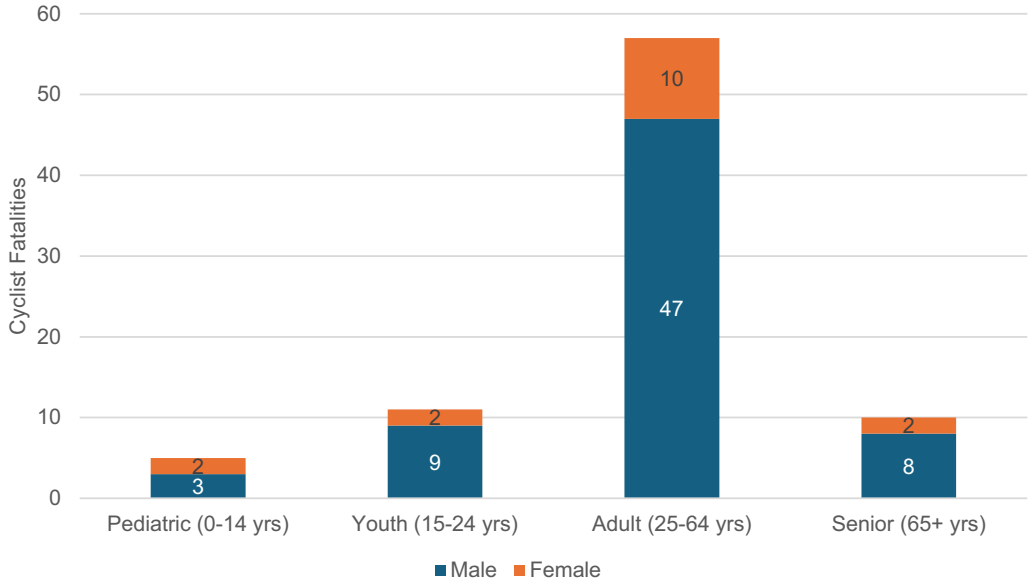

Fig. 1 The breakdown of age groups for cyclist fatalities in Ontario

with clear/probable clear weather conditions ($n = 74/83$, 60.2%) and dry ($n = 68$, 81.9%) or probable dry ($n = 2$, 2.4%) road conditions.

Over two-thirds of collisions were at high speeds [> 50 km per hour (km/h); $n = 56/83$, 67.5%], with 39.8% ($n = 33/83$) at very high speeds in excess of 70 km/h. The vehicle was most often a light truck or van (LTV)/SUV ($n = 34/82$, 41.5%), going ahead ($n = 54/83$, 65.1%) or turning ($n = 14/83$, 16.9%). Over one-third of CMVC were intersection-related ($n = 30/83$, 36.1%). The leading cyclist pre-crash actions were riding on the roadway with traffic ($n = 27/83$, 32.5%), crossing the roadway ($n = 15/83$, 18.1%) and riding of the shoulder of the roadway ($n = 11/83$, 13.3%).

The median AIS by body region for all cyclist fatalities is presented in Fig. 2. When examining the injuries sustained by cyclists, the head was found to be the most often and most severely injured body region overall with 91.6% of cyclists sustaining a head injury with a median (IQR) AIS of 5 (4–6) representing a critical injury [21]. It was the most severely injured body region for each age group, except for children with thorax (median [IQR] AIS of 4.5 [3.75-5.0]) most severely injured. Expert review found that 60% of child cyclist fatalities were run over, all of whom were ≤ 6 years. The median AIS of the thorax was higher at 5, signifying a critical injury [21], for the children runover compared to those not runover with a median AIS thorax = 3.5 representing a serious to severe injury [21]. The overall injury severity, as measured by the ISS, was very high, with the median (IQR) ISS = 75 (45–75), representing maximum injury [21].

A review of possible contributing factors in these deaths found for cyclists with helmet use known, nearly 2/3 of cyclists (62.2%) were not wearing a helmet. Helmet use ranged from 10.0% in youth, 38.8% in adults, 40.0% in children, followed by seniors with the highest helmet use at 60.0%. For those with conspicuity data entered, 64.7% ($n = 22/34$) had a lack of conspicuity including dark clothing and no lights or reflective material. When toxicology reports were available, 24.1% were found to be impaired at the time of the crash, testing positive to a variety of drugs. Of these impaired cases, THC ($n = 8/19$, 41.2%) was the most common drug used, most often taken on its own without other substances. The median blood alcohol concentration (BAC) was 147 mg/100 mL for cyclists positive for alcohol. Distraction from cell phones ($n = 1/83$, 1.2%) or headphones ($n = 7/83$, 8.4%) found at the scene, on or with the cyclist, may have contributed to CMVC.

Urban versus rural cyclist fatalities

There were 49 (59%) cyclists killed in an urban environment (Table 1). The median (IQR) age was 44.0 (24.0-56.5) years. All child cyclist deaths occurred in an urban environment. Comparing urban CMVC to rural, urban collisions had a significantly higher proportion of collisions involving an intersection and a crosswalk (57.1% vs. 5.9% and 23.9% vs. 0.0%, respectively; both $p < 0.001$). Urban cyclists were significantly more frequently crossing the roadway (30.6% vs. 0.0%; $p < 0.001$) when fatally struck. One-third of urban CMVC occurred at very low speed (15 km/h or less) compared to none in a rural environment (33% vs. 0%; $p < 0.001$). Urban cyclist fatalities were significantly more likely to be on a bike lane or shared path (28.6% vs., 0%; $p < 0.001$; with 9/14 of them, 64.3%, struck by a heavy truck while using this cycling

Table 1 Summary of crash variables, for all cycling fatalities, and comparing cycling crashes in a rural versus urban environment

Variables	Total Population Proportion of valued (%)	Rural Proportion of valued (%)	Urban Proportion of valued (%)	*P* value[1]
TEMPORAL VARIABLES				
Time of Day				0.065
Daytime (6:00–17:59)	49/83 (59.0%)	16/34 (47.1%)	33/49 (67.3%)	
Day of Week				**0.025**
Weekday (Monday-Friday)	64/83 (77.1%)	22/34 (64.7%)	42/49 (85.7%)	
Weekend (Saturday-Sunday)	19/83 (22.9%)	12/34 (35.3%)	7/49 (14.3%)	
Seasons				0.175
Spring (MAM)	11/83 (13.33%)	5/34 (14.7%)	6/49 (12.2%)	
Summer (JJA)	42/83 (50.6%)	21/34 (61.8%)	21/49 (42.9%)	
Autumn (SON)	22/83 (26.5%)	7/34 (20.6%)	15/49 (30.6%)	
Winter (DJF)	8/83 (9.6%)	1/34 (2.9%)	7/49 (14.3%)	
CYCLIST STRUCK				
By Vehicle Type				
Car	31/82 (37.8%)	13/32 (40.6%)	18/49 (36.7%)	0.889
Light Trucks & Vans/SUV [2]	34/82 (41.5%)	18/32 (56.3%)	16/49 (32.7%)	0.065
Heavy Truck/Bus	17/82 (20.7%)	2/32 (6.3%)	15/49 (30.6%)	**0.006**
In Intersection	30/83 (36.1%)	2/34 (5.9%)	28/49 (57.1%)	**< 0.001**
In Crosswalk	11/80 (13.8%)	0/34 (0.0%)	11/46 (23.9%)	**0.002**
Runover/Drag	27/83 (32.5%)	3/34 (8.8%)	24/49 (49.0%)	**< 0.001**
VEHICLE INITIAL ACTION				
Vehicle Going Ahead	65/83 (78.3%)	33/34 (97.1%)	32/49 (65.3%)	**< 0.001**
Slowed or stopped	17/83 (20.5%)	1/34 (2.9%)	16/49 (32.7%)	**< 0.001**
Changing Lanes	1/83 (1.2%)	0/34 (0.0%)	1/49 (2.0%)	0.402
VEHICLE PRE-CRASH MANEUVER				
Vehicle Going Ahead	54/83 (65.1%)	26/34 (76.5%)	28/49 (57.1%)	0.069
Vehicle Turning	14/83 (16.9%)	1/34 (2.9%)	13/49 (26.5%)	**0.005**
Overtaking/Changing Lanes	7/83 (8.4%)	4/34 (11.8%)	3/49 (6.1%)	0.363
Vehicle Lost Control	5/83 (6.0%)	3/34 (8.8%)	2/49 (4.1%)	0.372
Other (Prior Collision or Reversing)	3/83 (3.6%)	0/34 (0.0%)	3/49 (6.1%)	0.142
CYCLING PRE-CRASH ACTIONS				
Riding on Roadway with Traffic	27/83 (32.5%)	19/34 (55.9%)	8/49 (16.3%)	**< 0.001**
While Crossing roadway	15/83 (18.1%)	0/34 (0.0%)	15/49 (30.6%)	**< 0.001**
Riding on Shoulder of Road	11/83 (13.30%)	8/34 (23.5%)	3/49 (6.1%)	**0.044**
Lost Control/Fell	5/83 (6.0%)	1/34 (2.0%)	4/49 (8.2%)	0.402
Riding on Roadway against Traffic	3/83 (3.6%)	3/34 (8.8%)	0/49 (0.0%)	0.065
Other Cyclist Action[3]	20/83 (24.1%)	3/34 (8.8%)	17/49 (34.7%)	**0.007**
CYCLING INFRASTRUCTURE				
Bike Lane or Shared Path Available	16/83 (19.3%)	0/34 (0.0%)	16/49 (32.7%)	**< 0.001**
Struck on Bike Lane/Shared Path	14/83 (16.9%)	0/34 (0.0%)	14/49 (28.6%)	**< 0.001**
Sidewalk Available	41/83 (49.4%)	0/34 (0.0%)	41/49 (83.7%)	**< 0.001**
Struck on Sidewalk	11/83 (13.3%)	0/34 (0.0%)	11/49 (22.4%)	**0.002**
IMPACT SPEED				
Very Low Speed (< = 15 km/h)	16/83 (19.3%)	0/34 (0.0%)	16/49 (32.7%)	**< 0.001**
High Speed (> 50 km/h)	56/83 (67.5%)	32/34 (94.1%)	24/49 (49.0%)	**< 0.001**
Very High Speed (> 70 km/h)	33/83 (39.8%)	21/34 (61.8%)	12/49 (24.5%)	**< 0.001**
Median (IQR) estimated impact speed (km/h)	60 (45–80)	80 (60–80)	50 (15-72.5)	**< 0.001**
ENVIRONMENTAL CONDITIONS				
Road Surface				0.236
Dry	70/83 (84.3%)	26/34 (76.5%)	44/49 (89.8%)	
Wet/Snow	9/83 (10.8%)	5/34 (14.7%)	4/49 (8.2%)	
Unknown	4/83 (4.8%)	3/34 (8.8%)	1/49 (2.0%)	

Table 1 (continued)

Variables	Total Population Proportion of valued (%)	Rural Proportion of valued (%)	Urban Proportion of valued (%)	*P* value[1]
Weather Conditions				0.200
Clear/Probable Clear	74/80 (92.5%)	27/31 (87.1%)	47/49 (95.9%)	
Rain/Snow/Fog	6/80 (7.5%)	4/31 (12.9%)	2/49 (4.1%)	
Lighting				**< 0.001**
Daylight	50/83 (60.2%)	17/34 (50.0%)	33/49 (67.3%)	
Dark	31/83 (37.3%)	15/34 (44.1%)	2/49 (4.1%)	
Dark with Artificial Ligh	17/83 (20.5%)	0/34 (0.0%)	11/49 (22.4%)	
Dark Unknown Lighting	3/83 (3.6%)	0/34 (0.0%)	3/49 (6.1%)	
Dusk	2/83 (2.4%)	2/34 (5.9%)	0/49 (0.0%)	
CYCLING BEHAVIUR CONTRIBUTING FACTORS				
Helmet Used	17/73 (38.4%)	12/32 (37.5%)	16/41 (39.0%)	0.894
Lack of Conspicuity/Dark Cyclist[4]	22/34 (64.7%)	13/17 (76.5%)	9/17 (52.9%)	0.151
Impaired/Positive Toxicology[5]	19/77 (24.1%)	11/33 (33.3%)	8/44 (18.2%)	0.127
Type of impairment				0.141
Alcohol only	5/19 (26.3%)	1/11 (9.1%)	4/8 (50.0%)	
THC only	8/19 (42.1%)	5/11 (45.5%)	3/8 (37.5%)	
Multiple Drugs	6/19 (31.6%)	5/11 (45.5%)	1/8 (12.5%)	
BAC[6] Median (IQR) mg/100 mL	147.0 (118.0-268.0)	121.00 (118.0-.)	207.50 (79.5-341.5)	1.000

[1] P value of the difference in proportions between rural and urban crash environments based on Pearson Chi-Square or Fisher's Exact Test results. Statistically significant results are **bolded**

[2] Light Trucks & Vans (LTV) = Pick up/Van/Mini Van/SUV (Sports Utility Vehicle)

[3] Other cyclists' actions include going ahead, turning, riding on sidewalk, swerving, changing lanes, stopped, pulling away from curb/shoulder, unknown action

[4] When Conspicuity noted on report

[5] Reported only when toxicology report was available

[6] BAC = Blood alcohol concentration

infrastructure), struck by a heavy vehicle (30.6% vs. 6.3%; $p = 0.006$), turning (26.5% vs. 2.9%; $p = 0.005$) and run-over/dragged (49.0% vs. 8.8%; $p < 0.001$).

Cyclists in fatal collisions in rural areas were older than urban cyclist fatalities with a median (IQR) age of 49.0 (33.25-62.0) years compared to 44.0 (24.0-56.5; $p = 0.345$). Rural collisions were associated with a significantly higher median estimated impact speed of 80 (60–80) km/h (vs. 50 [15-72.5]km/h), as well as a higher proportion of crashes at high speeds in excess of 50 km/h (94.1% vs. 49.0%; $p < 0.001$) (Table 1). Cyclists in rural areas were significantly more often riding on roadways with traffic (55.9% vs. 16.3%; $p < 0.001$) or on the shoulder of the road (23.5% vs. 6.1%); $p = 0.044$) in dark conditions (44.1% vs. 4.1%; $p < 0.001$). No rural CMVC had a sidewalk or bike lane/share path available (0.0% vs. 83.7%; 0.0% vs. 32.7%; $p < 0.001$).

Discussion

This descriptive study examined the epidemiology of cycling fatalities in Ontario over a 7-year period and found 83 unintentional, predominantly male cyclist fatalities, most often occurring in the summer months, during daylight hours. The majority of cyclists were not wearing a helmet at the time of their fatal collision resulting in the head as the most severely injured body region. Possible distraction from the use of headphones and cell phones, along with alcohol and drug impairment, were other contributing factors in these cyclist fatalities. Environmental characteristics including urban and rural environments, cycling infrastructure and other aspects of the built environment can increase the risk of collisions and sustaining injuries [15]. Our analysis identified different risk factors and associations based on crash location including speed, intersections, turning with the involvement of heavy vehicles, lighting conditions, and cycling infrastructure, which will be discussed herein.

Our epidemiologic description of fatal cycling collisions is consistent with the previously reported literature from North America and other developed countries [2, 24–27]. Males have been reported to have a higher likelihood of sustaining more severe injures compared to female cyclists [27]. Our fatalities had a 4:1 male: female ratio, consistent with the 81% to 88% male cyclist fatalities reported in earlier studies [2, 24–26], with the adults aged 35 to 64 years being the most common age group of cyclists [2]. Previous research reported a median age of 47 years [25], similar to the median age of 48 years found in our study. Confirming these demographics of cyclist fatalities in our geographic regions is vital in defining the population that prevention initiatives need to be targeted to, but to determine what those countermeasures should

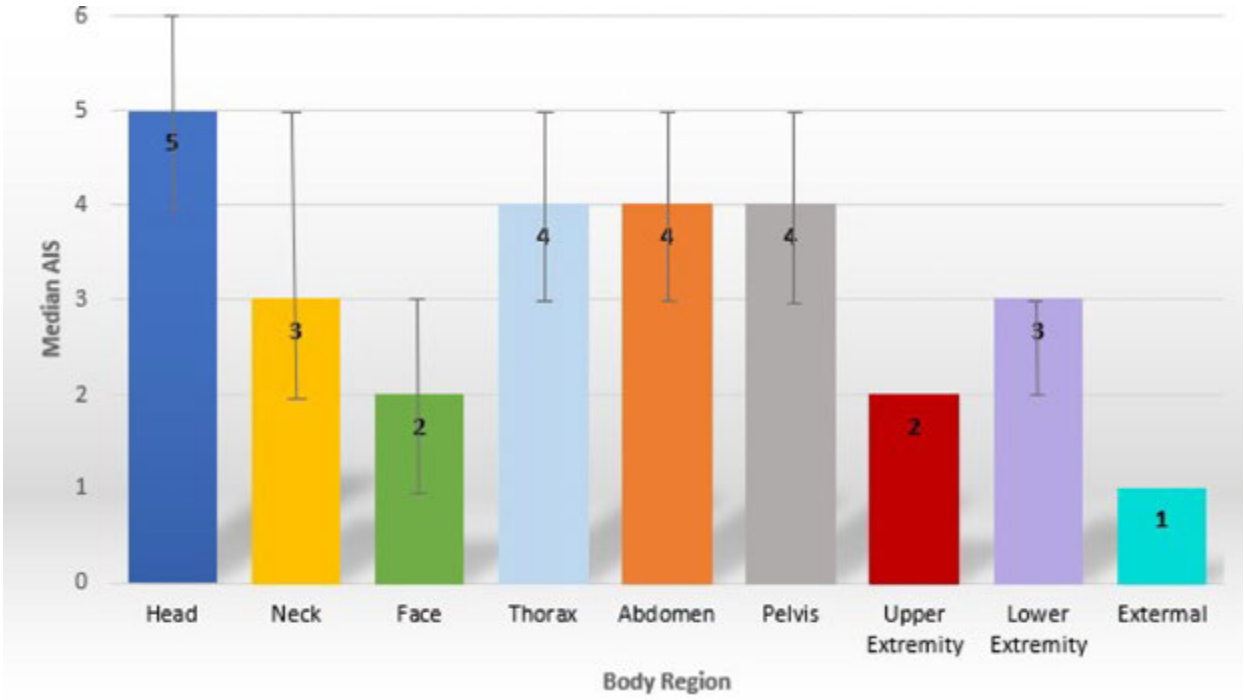

Fig. 2 Median Abbreviated Injury Scale (AIS) by body region for all cyclist fatalities in Ontario. An AIS of 1 = minor, 2 = moderate, 3 = serious, 4 = severe, 5 = critical and 6 = maximal, currently untreatable injury [21]. The error bars represent the 1st to the 3rd quartiles of the interquartile range

be, a safe system approach to cycling safety is needed to help reduce serious cycling injury and deaths, aligning with Vision Zero action plans throughout the world.

Vision Zero is a strategy to eliminate traffic fatalities and severe injuries. Initiated in Sweden in 1997, it has since become a global, long-term strategic road safety goal for all road users [17, 18, 28–30]. It offers a paradigm for the reduction cyclist deaths through a safe system approach, while promoting safe, equitable mobility options for all [29]. A safe system approach recognizes that people make mistakes, and focuses on a shared responsibility for influencing system-wide practices, policies, and designs to roadways and vehicles to lessen the occurrence and severity of crashes [17]. In order to determine the recommendations to change practice for the prevention of cyclist serious injury and deaths, regional risk factors associated with these CMVC need to be identified.

Previous research has established bike lanes, the use of alcohol, available lighting or riding at night, vehicle speed, location of crash, and the use of helmets as factors found to influence the level of injury severity of CMVC [31–33]. These factors were also identified in our analysis associated with cycling fatalities which need to be addressed through layered countermeasures for safer roads, safer speed and safer vehicles as part of a safe system approach to mitigate risk and reduce serious cycling injuries and fatalities [18].

Almost two-thirds of cyclists in our study were not wearing a helmet at the time of their fatal collision resulting in nearly all cyclists sustaining a severe head injury. The efficacy of bicycle helmets has long been established, with the use of bicycle helmets estimated to reduce the risk of head injury for cyclists by 60% and brain injury by 58% [34]. A more recent meta-analysis confirmed these results, finding helmet use resulted in an estimated head injury reduction of 48% among all age groups [35]. The lack of helmet use may have contributed to sustaining a fatal injury for the unhelmeted cyclists in our study, as it was the most severely injured body region, similar to a recent national study of cyclists [4]. Worldwide, 28 countries have been identified as having bicycle helmet legislation, with most countries applying this legislation to children and adolescents below a certain age [36]. In the US, there are 22 states, the District of Columbia and more than 200 local jurisdictions that have bicycle helmet laws in effect [37]. In Canada, approximately two-thirds (8 out of 13) of provinces and territories have bicycle helmet legislations: 5 for all ages, and 3 for less than 18 years of age [38]. There are opportunities for improvement with helmet legislation, enforcement, and incentives to promote helmet use among cyclists, a known effective

intervention to reduce head injuries and save lives, particularly for CMVC.

Distractions and unsafe, risky cycling behaviours are both common risk factors contributing to fatalities and severe injuries, regardless of environment [27, 39, 40]. Given the extreme physical vulnerability of cyclists on the roadways with traffic, distraction substantially increases the odds of suffering a severe injury or death [40]. During police and crash investigation of our cyclist deaths, headphones or cell phones were found at the scene or on the deceased's body, as reported in the post-mortem, in nearly 10% of CMVC that may have contributed to the crash. Cycling can be distracted by technology, especially the use of cellphones, headphones, and navigators [40]. A study in New York City found rates of technology-related distraction were relatively low, with headphone/earbud use being the most prevalent type of distraction device observed in 2–6% of cyclists. Talking on your cell phone or looking at the screen was less common noted in < 1% of cyclists [41]. Other distractions, while more difficult to quantify, can occur for cyclists, particularly in busy, urban areas [40]. Avenues for countermeasures include bicycle safety policies, legislation and health promotion/social media campaigns to raise public awareness on the dangers of distractions and using technology while cycling [41].

Another cyclist high risk behaviour found in our study in both urban and rural areas, was the use of drugs and alcohol. These substances impair the cyclists' physical ability to operate their bicycle, along with the negative effects on human perception and decision-making, increasing the likelihood of crashing and sustaining severe or even fatal injuries [27]. Previous research has demonstrated positive associations with alcohol and/or drug use for severe and fatal collisions involving cyclists and other VRU [2, 24, 25, 31, 42]. Nearly one-quarter of our cyclist deaths had a positive toxicology report with THC as the most common drug, followed by multiple drugs and/or alcohol. This is consistent with previous reports demonstrating drugs at a higher level of involvement than alcohol among VRU, but to a higher level than in our study, with 43.4% and 39.7% of VRU testing positive for drugs and alcohol, respectively [12]. A study of fatal and serious VRU injuries in Canada found higher rates of positive drug use for bicyclists (31.4%), than for alcohol with 25.2% and 9.0% of fatally injured male and female cyclists having consumed alcohol, respectively. Of drinking cyclist fatalities, over three-quarter (76.5%) had BAC over 80 mg/dL [42]. As with other risky and unsafe behaviours of cyclists, implementation of prevention initiatives such as public health/social media campaigns relating to the dangers of impairment is recommended, as well as enforcement of current legislation and the development of stricter legislation and policies [25].

Urban versus rural cyclist fatalities

Our analysis also found significant differences in risk factors associated with cyclist fatalities depending on whether the collision occurred in either an urban or a rural environment. Urban areas are characterized as communities with higher population density, more land use mix, and greater connectivity, which has been found to be correlated to active transportation such as walking and cycling [43]. A Swedish study found more than 80% of serious injuries on urban road involved cyclist and pedestrians [28]. Factors including socioeconomic status, ethnicity, and the built environment (including cycling infrastructure and street lighting, for example) differ in urban and rural areas which can have an impact on the likelihood of crashing and sustaining injuries [15, 26, 44]. As a result, examining the urban and rural differences in cycling road traffic fatalities is necessary to better understand, target and implement prevention strategies within these very different types of environments [44].

Urban Environment

Urban cyclist fatalities had significantly more collisions in an intersection, on a bike lane/share path, and while crossing the roadway. Cyclists in the urban environment had significantly more vehicles slowed or stopped, often making a turn, resulting in being struck more often at a very low speed. There was also a higher likelihood of involving a heavy truck and being swept under the vehicle and run over. Our findings are expected given dense urban environments with people biking or walking as their primary form of transportation, sharing the roadway with vehicles in congested areas on streets with high levels of traffic. Urban arterial roads are designed with more lanes, intersections, crosswalks, bike lanes, traffic signals, and are closer to business areas, resulting in higher safety risks of crossing behaviours [27].

One of the most critical and common crash configurations in urban areas occurs when motorists turn right at an intersection and cyclists cross the road, often resulting in severe injuries for cyclists [45, 46]. The consequences are more dire when a heavy vehicle is involved due to the design of large trucks that presents inherent safety challenges including blind spots on trucks and the common occurrence of 'side underride', when a pedestrian or cyclist is swept under the rear tires of a truck after side impact and runover [47]. We found this occurred in our urban cyclist fatalities, with nearly one-third of urban CMVC fatalities involving heavy trucks. Large vehicles, including buses, waste disposal and utility trucks, make up a small proportion of vehicles on urban streets, but are disproportionately involved in fatal crashes, particularly involving cyclists and pedestrians [47]. For example, in NYC, large trucks comprise 3.6% of the traffic vehicles, yet they are involved in 32% of cyclist fatalities, similar

to our results [47]. Utilizing a safe system lens, several layers of safety interventions can be implemented to collectively address this safety issue for cyclists and other VRU. Suggested interventions include driver training, education, and policy changes at the municipality level including restricting access to large vehicles on streets that prioritize active modes of transportation like walking and cycling, such as near schools [47, 48]. Additionally, design features and safety devices on the vehicle that can be retroactively installed on large trucks such as cross-over and convex mirrors, cameras and side guards, which have demonstrated success in averting underride incidences and decreasing fatalities [47].

New technology can also be designed into vehicles including Advanced Driver Assistance Systems (ADAS). A recent study found that drivers considerably reduced their speed and stopped their vehicle further away from the intersection when a VRU was present [49]. ADAS that warns drivers about the presence of a cyclist traveling in parallel direction (i.e., Blind Spot Information Systems, BLIS) or turn collision warning system for heavy commercial vehicles can detect VRU in the vehicle's blind spots and alert the driver before making a turn, allowing adequate time for the driver to react and take action to prevent collisions [50]. Another ADAS feature that can intervene to avoid a collision with a cyclist or a pedestrian is the Automatic Emergency Braking Systems (AEBS) triggered to stop the vehicle when a VRU is detected. These design features may play a crucial role in reducing cyclist fatalities in urban environments, where the risk of CMVC is heightened.

Improving roadway infrastructure design such as traffic calming measures including pedestrian islands and curb extensions have been found to be effective, with a focus on ensuring infrastructure changes are targeted to high-risk intersections in urban areas [26]. A recent study in NYC found prioritizing traffic calming at intersections that abut long street segments to be the most effective to prevent high speed crashes and fatalities that are more likely on longer roads [51]. Additionally, improved traffic light sequence and installing crosswalks for cyclists away from intersections can help separate and control the movement of cyclists and vehicles in space and time on the roadways. Utilizing urban planning and roadway design has the potential to reduce the occurrence of the dangerous intersection interactions between cyclists and all vehicles, large and small [47, 48, 51].

While cycling infrastructure including bike lanes, or cycle tracks, for dedicated lanes with a physical separation or barrier between cyclists and motor vehicles have been found to increase safety for cyclist [5], in our study several cyclists were killed in the bike lane. However, all 8 of these cyclists were struck by a heavy vehicle while cycling in a bike lane. The hazards associated with heavy vehicles, particularly when turning right, often through the bike lane, outweigh the protective effect of the cyclist tracks. Cyclists need to be aware of these dangers and not get a false sense of security while using them.

While not present in our study population, an emerging trend that needs to be considered when designing roadways and active transportation infrastructure is the growing use of micromobility devices, particularly in the urban environment. These electrical vehicles (EV) including e-scooter, e-bikes and hoverboards have gained popularity as a sustainable, relatively low-cost urban transportation personal device and shared device through vehicle sharing platforms now available in many major North American cities and pose a new risk to pedal cyclists [52, 53]. Ridership has increased more than 50-fold in the past decade and with that a surge in ED visits for injuries, increases as high as 600% in recent years reported, due in part to the fast acceleration of these machines with novice drivers [52, 53]. E-bikes and e-scooters have been found to have differences in characteristics of riders, risk factors, use of the vehicle and injury patterns than traditional bicycles [52, 54, 55]. EV riders were more likely to engage in risky behaviours like intoxication and riding without a helmet, with e-bike-related injuries to be more than three times more likely than pedal bicycles to involve a collision with a pedestrian (OR = 3.3, 95% CI 0.5 to 23.6) [56]. EV sharing bike lanes or roadways with traditional bicycles and pedestrians pose a threat to the safety of these other VRU. It has been suggested that changes to active transportation infrastructure (i.e., traffic calming, protected bike lanes, EV lanes, wider sidewalks, docking stations) to accommodate EV may be warranted, along with changes to education, policies and legislation for micromobility devices to ensure the safety of all road users [52, 55, 56].

Rural Environment

Cyclists face different risk factors when cycling in a rural environment. Very high speeds and dark lighting conditions, while riding on the roadway with traffic were factors significantly associated with rural cyclist fatalities. The majority of both vehicles and cyclists were going forward together on the roadway at the time of the collision, as these rural collision locations lacked cycling infrastructure, which is often the case in rural areas [27]. Previous research has demonstrated decreases in CMVC rates after the installation of cycle tracks in streets previously without cycling infrastructure, up to 70% in one Canadian study [5, 57]. This effectiveness of bike lanes/cycle tracks may be attributed to physical separation, allowing for an increased distance between cyclists and motor vehicles [5]. Given their protective benefit, rural areas could benefit from this type of cycle infrastructure to provide more sufficient riding space and/or a physical

Fig. 3 Schematic of countermeasures in the rural and urban environments for the reduction of cycling collisions, serious injuries and deaths

barrier to allow cyclists to more comfortably and safely cycle while alleviating interactions between bicycles and motor vehicles [5, 26, 27].

High speed is a known risk factor for CMVC [26, 33], especially on rural roads where motor vehicles and cyclists are often traveling at higher speeds than in urban areas [27]. A recent study of e-bikes quantified the fatality risk by crash impact speed. This analysis found risk of death for riders exponentially increasing from approximately 2.9% at vehicle impact speed of 30 km/h to 23% at 50 km/h, 50% at 60 km/h, and 90% at 80 km/h [58]. Given the median crash impact speed for rural cyclists in our study was 80 km/h, countermeasures for speed reductions including roundabouts and speed humps could be an effective means to mitigate the impact of high speeds on rural road [26]. Previous research has found an inequity of speed hump installation with communities with higher socioeconomic status, more engaged in the political process for advocating for their installation, having more of these traffic calming measures installed on their roadways [59]. Selection of sites for traffic calming measures should be based on need, in high crash-risk areas, in both rural and urban communities.

Given that nearly half of rural crashes occurred in dark conditions, lack of visibility of the cyclist was a significant factor contributing to CMVC in our study. Over three-quarters of rural cyclists in our analysis had a lack of conspicuity. Public awareness, policy, or legislative changes surrounding the use of reflective clothing or bike lights would increase cyclists' visibility and may save lives. Because a safe system approach embodies a shared responsibility [17, 18, 60], the influences of other factors such as roadway and vehicle should be considered in addition to the cyclists' behaviour and responsibility to be visible. This includes the installation of rural street lighting, particularly at curves in the roads or areas identified as high-risk [27]. Higher performance vehicle headlights are another vehicle design strategy as vehicle headlights are the primary method of increasing the illumination available to drivers at night to improve visibility and allow them to see VRU and other objects on the side of the roadway, such as deer and other wildlife, common alongside rural roadways [61, 62]. These lighting strategies for roadways and vehicles are recommended to improve driver and cyclist visibility, especially in rural environments that more often have CMVC in dark conditions. A schematic of the countermeasures suggested in the rural and urban environments for the reduction of cycling collisions, serious injuries and deaths is presented in Fig. 3.

A limitation of this study is the small sample size of 83 cyclist fatalities, which raises concern of the

representativeness of the sample. However, our study population consists of all cyclist fatalities that had a post-mortem performed at the Office of the Chief Coroner in Ontario, comprising over half (59%) of all cyclist fatalities in the province. While there is a relatively small number of deaths in this study, they represent the majority of cycling fatalities in the region. This makes it highly likely that our results resemble what would be expected in the target population and therefore, increase their generalizability [63]. To provide further support for this notion, our study population was found to be representative of other CMVC fatality studies in the literature with similar reported characteristics and risk factors [2, 25, 26, 64]. Despite this, our study may not represent cyclist deaths in all other regions, or less severe CMVC as only fatalities were included in these analyses. So, prior to implementing a prevention initiative for the reduction of CMVC, injuries and deaths, it is recommended that investigators utilize their own local data from urban and rural areas in their region to determine if the same risk factors are present in their communities to determine the appropriateness of interventions presented herein.

Conclusion

Cycling in traffic puts cyclists at risk for severe injury and death, in both urban and rural environments. A safe system approach recognizes that people are vulnerable and inevitably make mistakes, while promoting a shared safety responsibility. Urban planners, public health advocates and road safety specialists need to develop multiple layers of passive and active safety systems to protect cyclists from death in CMVC [26]. Incorporating engineering countermeasures into the design of roadways to separate the cyclist from the vehicle, lighting in rural areas, and traffic calming measures help to reduce cyclists' risk. Vehicle safety features include guard rails and cameras on heavy vehicles, higher rated vehicle headlight performance, along with ADAS to detect cyclists in blind spots or AEBS may be able to play important roles in the prevention of CMVC. Public health campaigns to raise awareness, as well as policy and legislative action for substance use and technology-related distractions can potentially improve the safety of the transportation system by mitigating crash risk. To be equitable, it is suggested that these countermeasures, essential for improving cyclists' safety, be implemented in all high-risk areas, including urban and rural environments.

Abbreviations

ADAS	Advanced Driver Assistance Systems
AEBS	Automatic Emergency Braking Systems
AIS	Abbreviated Injury Scale
BAC	Blood Alcohol Concentration
BLIS	Blind Spot Information Systems
CMVC	Cyclist and Motor Vehicle Collision
IBM®	International Business Machines Corporation
IQR	Interquartile Range
ISS	Injury Severity Score
Km/h	Kilometers per hour
LTV	Light Trucks and Vans
OCC	Office of the Chief oroner
SPSS®	Statistical Package for Social Sciences
SUV	Sports Utility Vehicle
THC	Tetrahydrocannabinol
VRU	Vulnerable Road User

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40621-025-00621-w.

Supplementary Material 1

Acknowledgements

The authors gratefully acknowledge the Office of the Chief oroner of Ontario, the Provincial Forensic Pathology Unit, the Ontario Provincial Police, and the London Police Service for their valuable support on this project to assist with gathering the data vital to the success of this project. Special acknowledgement to teams members Moheem Halari and Allision Pellar for their countless hours spent to collect and enter the crash and injury data into the database. Our sincere appreciation to Transport Canada for supporting the development of the database that was used for this and other road safety projects, as well as supporting crash investigations in Canada. The authors would like to acknowledge that this work was presented at the 29th Annual Conference of the Injury Free Coalition for Kids Conference, Fort Lauderdale, FL, December 2024.

Authors' contributions

Study conception and design: MS, TCS, AP, MH, KM; Acquisition of the data: MS, TCS, AP, MH, KM; Data collection and cleaning: MH, AP; Injury Severity Scoring: MH, TCS; Statistical expertise and Analysis: TCS; Interpretation of the data and results: All authors; Drafting of the article and Literature search: TCS; Critical revision of the article for important intellectual content: All authors; Read and approved the final manusc ipt: All authors; Acquisition of funding: PV, KM, MS.

Funding

Support for this study provided by Transport Canada. Note, Transport Canada provided funding for the development of the crash database and to financially support the collection of the data used in this and other road safety projects. This funding body had no further role in the study and was not involved in the design, analysis, interpretation or writing the manuscript.

Data availability

All data used and analyzed during this study are included in this published article in Additional file 1

Declarations

About this supplement

This article has been published as part of Injury Epidemiology Volume 12 Supplement 1, 2025: Proceedings of the 29th Annual Injury Free Coalition for Kids® Conference: Forging New Frontiers: Engineering for Equity. The full contents of the supplement are available online at https://injepijournal.biomedcentral.com/articles/supplements/volume-12-supplement-1.

Ethics approval and consent to participate

The study was approved by the Western University Health Science Research Ethics Board (Project ID: 113440; Lawson Health Research Institute approval number: R-19-066). The Board agreed to waive the requirement to obtain informed consent, in accordance with Tri-Council Policy Statement 2, Article 3.7A, as the research involved no more than minimal risk to the participants who were deceased; the alteration to consent requirements was unlikely to adversely affect their welfare; and it would have been impossible to carry out the research and to address the research question properly, given the research design, if prior consent of the participants was required.

Consent for publication
Not applicable.

Competing interests
The authors have no competing interests and no confli t of interest to disclose.

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Received: 13 March 2025 / Accepted: 5 September 2025
Published online: 24 October 2025

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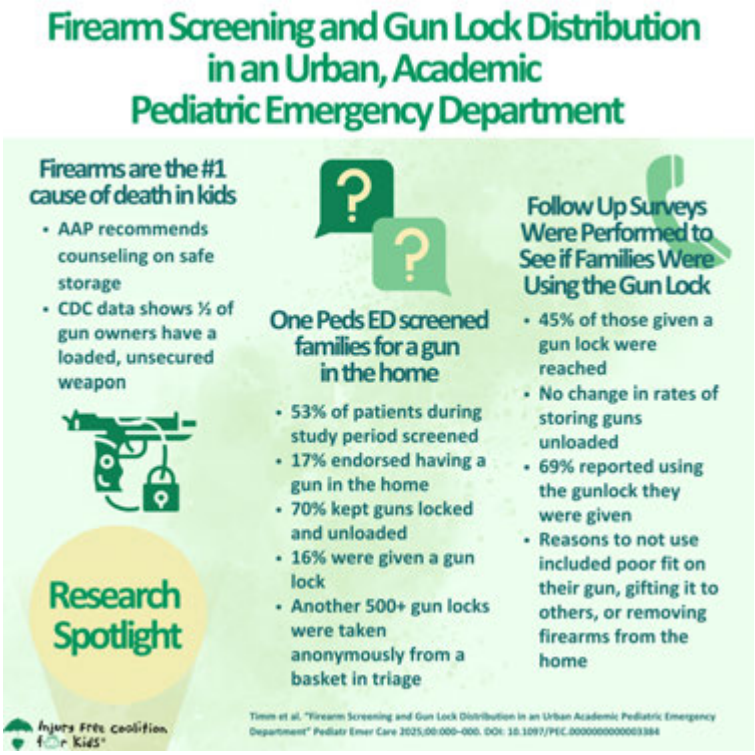

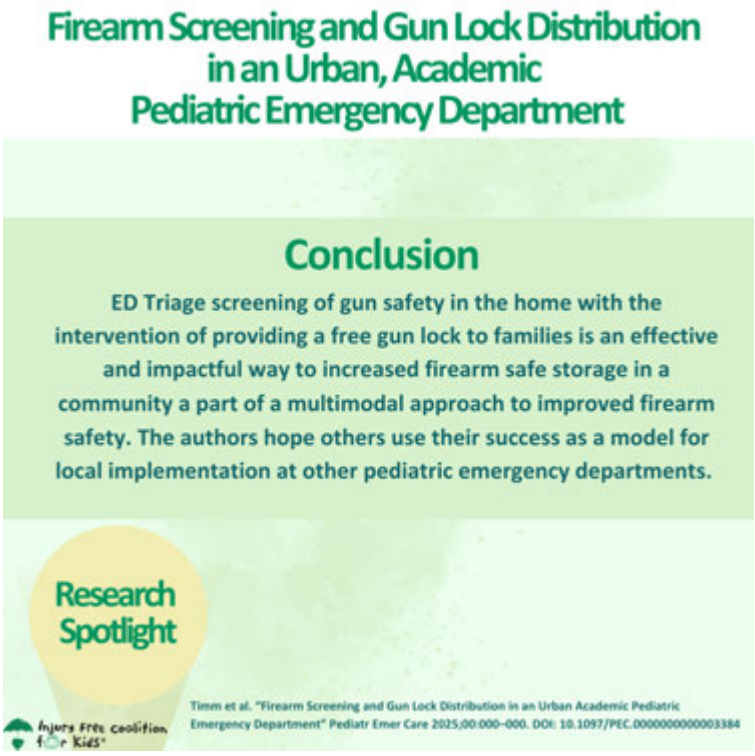

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- Awards Committee
- National Injury Prevention Day
- Early Career Investigator Program (ECIP)
- Early Career Coordinator Group
- Social Media Committee
- Firearm Injury Prevention Committee
- Child Passenger Safety Committee
- Safe Sleep Committee
- ATV Safety Committee

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Please make sure to stop by the exhibition booths during the conference!