



Strategies for Reducing Motorcyclist Injuries:
Engaging Stakeholders to Apply Evidence-Based
Countermeasures that Work

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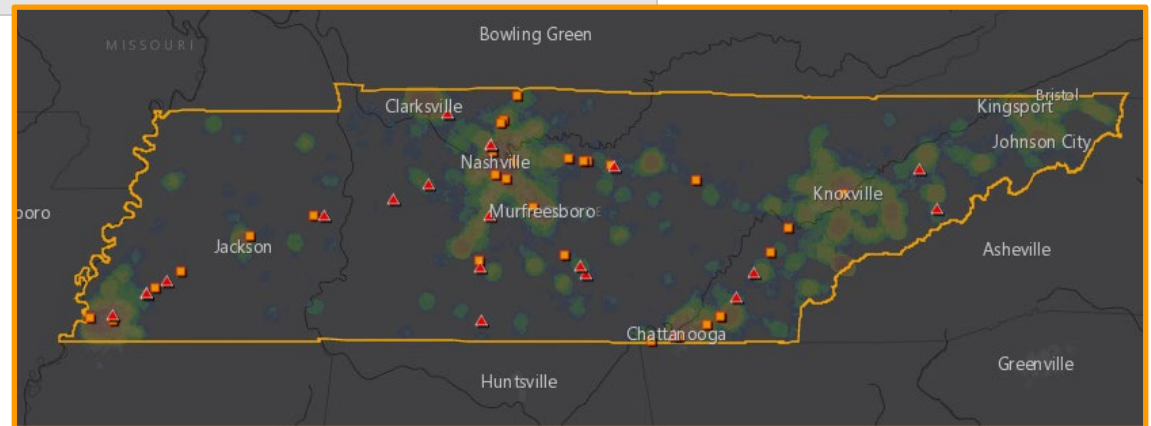
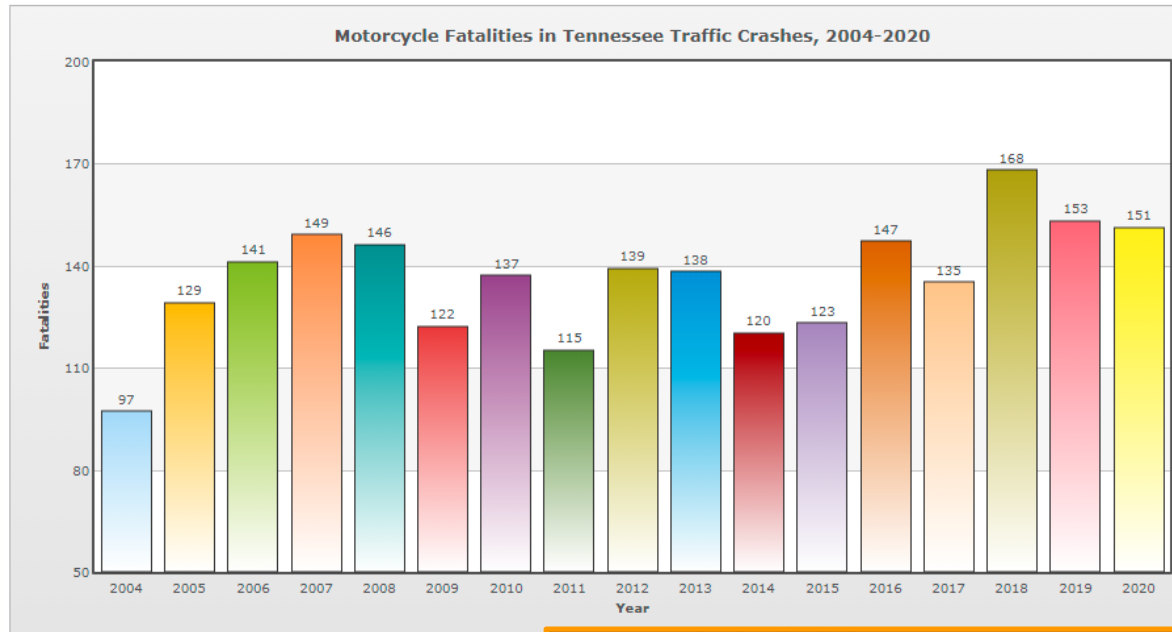


Introduction

- Motorcycles lack the protection features of enclosed vehicles.
- When controlled for exposure (per mile traveled), the annual number of motorcycle fatalities is nearly **30 times** that of passenger vehicle fatalities (NHTSA, 2019).



Introduction



Spatial Distribution of Motorcycle Crashes in Tennessee (Jan 1st 2016 to Dec 31st 2019)

■ indicates suspected or serious injuries; ▲ indicates fatality

Introduction

2015 Tennessee Motorcycle Safety Strategic Plan (MSSP)

| | | |
|---|---|--------------------------------|
| 1. Motorcycle Operation Under the Influence of Alcohol and/or Other Drugs | 2. Rider Education and Training | 3. Law Enforcement |
| 4. Operator Licensing | 5. Rider Conspicuity and Motorist Awareness | 6. Highway Engineering* |
| 7. Personal Protective Equipment | 8. Legislation/Policy | 9. Program Evaluation and Data |

- Red = Information available in TN Motorcycle Crash data
- CSCRS research explores most of above factors + rider injury given a crash
- * includes roadway functional classes, roadway types (divided/undivided)

Summary of Tasks

| Task | Milestone (M) or deliverable (D) |
|--|----------------------------------|
| A: Motorcycle research translation into practice <ul style="list-style-type: none">• Compile information about statewide stakeholders, safety advocacy groups, researchers, & practitioners• Develop practice-oriented materials to:<ul style="list-style-type: none">• Obtain critical information about motorcycle safety issues• Enable the translation of research findings into practice• Package new content that provide options for flexible presentation and dissemination of research findings to practice | Milestone |
| B: Synthesis of motorcycle literature and analysis of TN data <ul style="list-style-type: none">• Crash frequency• Injury severity given a crash• Contributing factors related to frequency and severity | Milestone |
| C: MCCS data processing & analysis | Milestone |
| D: Final report | Deliverable |

Relevant Publications

Accident Analysis and Prevention 119 (2018) 202–214



Contents lists available at ScienceDirect
Accident Analysis and Prevention

journal homepage: www.elsevier.com/locate/aap



A heterogeneity based case-control analysis of motorcyclist's injury crashes: Evidence from motorcycle crash causation study



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ARTICLE INFO

Keywords:
Motorcycle crash causation
Case-control analysis
Observed and unobserved heterogeneity
Crash propensity
Random parameters
Heterogeneity-in-means

ABSTRACT

The main objective of this study is to quantify how different "policy-sensitive" factors are associated with risk of motorcycle injury crashes, while controlling for rider-specific, psycho-physiological, and other observed/unobserved factors. The analysis utilizes data from a matched case-control design collected through the FHWA's Motorcycle Crash Causation Study. In particular, 351 cases (motorcyclists involved in injury crashes) are analyzed vis-à-vis similarly-at-risk 702 matched controls (motorcyclists not involved in crashes). Unlike traditional conditional estimation of relative risks, the paper presents heterogeneity based statistical analysis that accounts for the possibility of both within and between matched case-control variations. Overall, the correlations between key risk factors and injury crash propensity exhibit significant observed and unobserved heterogeneity. The results of best-fit random parameters logit model with heterogeneity-in-means show that riders with partial helmet coverage (U.S. DOT compliant helmets with partial coverage, least intrusive covering only the top half of the cranium) have a significantly lower risk of injury crash involvement. Lack of motorcycle rider conspicuity captured by dark (red) upper body clothing is associated with significantly higher injury crash risk (odds ratio 3.87, 95% CI: 1.63, 9.61). Importantly, a rider's motorcycle-oriented lower clothing (e.g., cannot easily get stuck in the machinery) significantly lowers the odds of injury crash involvement. Regarding the effectiveness of training, formal motorcycle driving training in recent years was associated with lower injury crash propensity. Finally, riders with less sleep prior to crash/interview exhibited 1.97 times higher odds of crash involvement compared to riders who had more than 5 h of sleep. Methodologically, the conclusion is that the correlations of several rider, exposure, apparel, and riding history related factors with crash risk are not homogeneous and in fact vary in magnitude as well as direction. The study results indicate the need to develop appropriate countermeasures, such as refresher motorcycle training courses, prevention of sleep-deprived/fatigued riding, and riding under the influence of alcohol and drugs.



Contents lists available at ScienceDirect
Accident Analysis and Prevention

journal homepage: www.elsevier.com/locate/aap



Examining correlations between motorcyclist's conspicuity, apparel related factors and injury severity score: Evidence from new motorcycle crash causation study



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ARTICLE INFO

Keywords:
Motorcycle crash causation
Injury severity score
Correlated and uncorrelated random parameters
Tobit model
Conspicuity and apparel

ABSTRACT

Motorcyclists are vulnerable road users at a particularly high risk of serious injury or death when involved in a crash. In order to evaluate key risk factors in motorcycle crashes, this study quantifies how different "policy-sensitive" factors correlate with injury severity, while controlling for rider and crash specific factors as well as other observed/unobserved factors. The study analyzes data from 321 motorcycle injury crashes from a comprehensive US DOT FHWA's Motorcycle Crash Causation Study (MCCS). These were all non-fatal injury crashes that are representative of the vast majority (82%) of motorcycle crashes. An anatomical injury severity scoring system, termed as Injury Severity Score (ISS), is analyzed providing an overall score by accounting for the possibility of multiple injuries to different body parts of a rider. An ISS ranges from 1 to 75, averaging at 10.32 for this sample (above 9 is considered serious injury), with a spike at 1 (very minor injury). Preliminary cross-tabulation analysis mapped ISS to the Abbreviated Injury Scale (AIS) injury classification and examined the strength of associations between the two. While the study finds a strong correlation between AIS and ISS classification (Kendall's tau of 0.911), significant contrasts are observed in that, when compared to ISS, AIS tends to underestimate the severity of an injury sustained by a rider. For modeling, fixed and random parameter Tobit modeling frameworks were used in a corner-solution setting to account for the left-tail spike in the distribution of ISS and to account for unobserved heterogeneity. The developed random parameters Tobit framework additionally accounts for the interactive effects of key risk factors, allowing for possible correlations among random parameters. A correlated random parameter Tobit model significantly outperformed the uncorrelated random parameter Tobit and fixed parameter Tobit models. While controlling for various other factors, we found that motorcycle-specific shoes and retro-reflective upper body clothing correlate with lower ISS on average by 5.94 and 1.88 units respectively. Riders with only partial helmet coverage on-average sustained more severe injuries, whereas, riders with acceptable helmet fit had lower ISS. Methodologically, not only do the individual effects of several key risk factors vary significantly across observations in the form of random parameters, but the interactions between unobserved factors characterizing random parameters significantly influence the injury severity score as well. The implications of the findings are discussed.

Journal of Safety Research 80 (2022) 175–189



Contents lists available at ScienceDirect

Journal of Safety Research

journal homepage: www.elsevier.com/locate/jsr



Toward better measurement of traffic injuries – Comparison of anatomical injury measures in predicting the clinical outcomes in motorcycle crashes



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Injury severity score
New injury severity score
Trauma
Mortality
Trauma status
Discrete and ordered models

ABSTRACT

Introduction: Little evidence exists in the literature regarding the discrimination power of better anatomical injury measures in differentiating clinical outcomes in motorcycle crashes. Furthermore, multiple injuries to different body parts of the rider are seldom analyzed. This study focuses on comparing anatomical injury measures such as the injury severity score (ISS) and the new injury severity score (NISS) in capturing injuries of multiple injured riders and examining the discriminatory capabilities of the ISS and NISS in predicting clinical outcomes post motorcycle crash. **Methods:** The study harnessed unique and comprehensive injury data on 322 riders from the US DOT Federal Highway Administration's Motorcycle Crash Causation Study (MCCS). Detailed exploratory analysis is performed and discrete/ordered statistical models are estimated for three clinical outcomes: mortality risk, trauma risk, and trauma status. **Results:** Around 5% of the riders died and 45% of the riders had injuries. Around 36% of the riders were hospitalized, disabled, or institutionalized. While a very strong dependence was found between ISS and NISS, ISS underestimated injuries sustained by riders. Statistical models for mortality risk revealed that a unit increase in the ISS and NISS was correlated with a 1.18 and 1.17 times increase in the odds of mortality, respectively. Moreover, a unit increase in ISS and NISS values was correlated with a higher trauma risk by 1.48 and 1.36 times, respectively. Our analysis reveals that the probability of a rider being hospitalized or disabled/institutionalized increases with an increase in the NISS. **Conclusions and practical applications:** The NISS exhibits significantly better calibration and discriminatory ability in differentiating survivors and non-survivors and in predicting trauma status – underscoring the importance of accounting for microscopic body-part-level injury data in motorcycle crashes. We consider that compared with the KABCO scale, the ISS and NISS are more nuanced scores that can better measure the overall injury intensity and can lead to more targeted countermeasures.

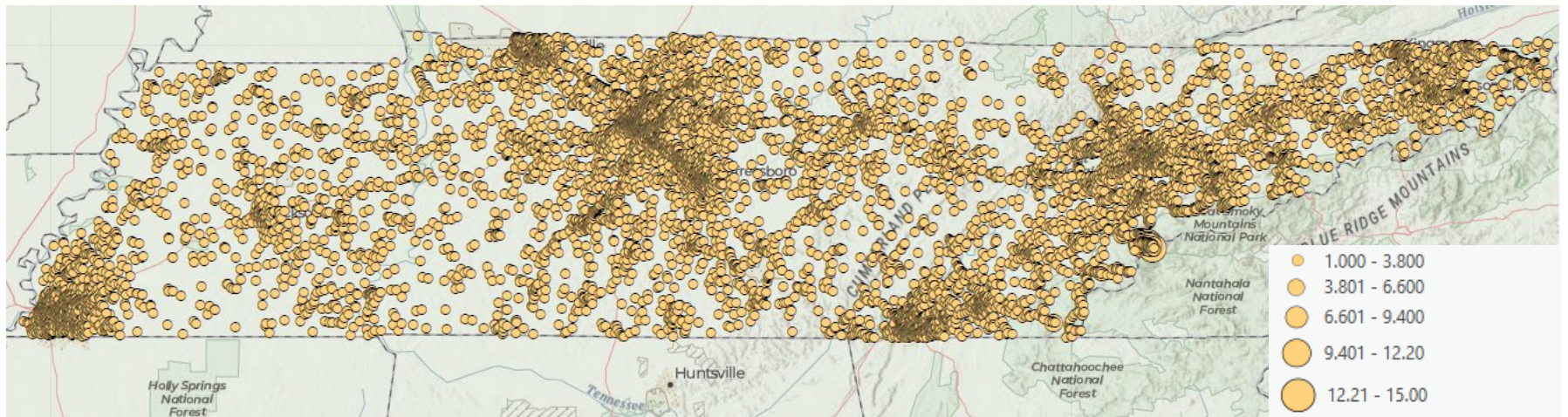
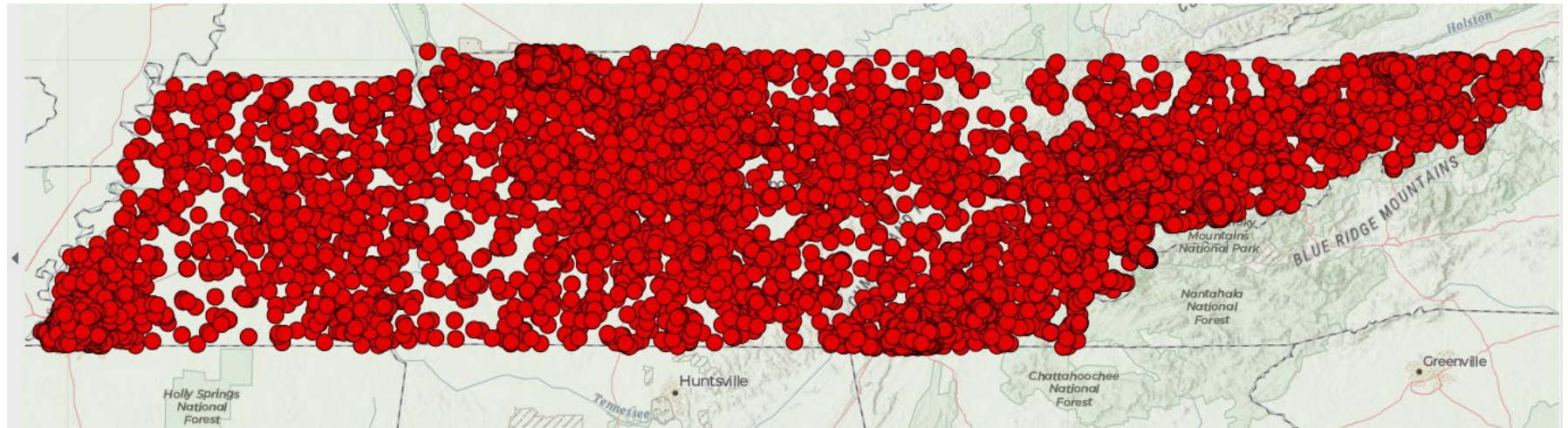
Stakeholder Involvement

Practitioner Meetings

| | |
|---------------------|--|
| Stakeholders | Staff members of Tennessee Highway Safety Office (THSO) Research team of University of Tennessee, Knoxville (UTK) |
| Agenda | <ul style="list-style-type: none">• Motorcycle safety challenges in TN• Existing countermeasures• Existing data/resources• Efforts underway |
| Takeaways | <ul style="list-style-type: none">• Pilot enforcement effort was being revised to target daylight hours and weekends.• A small social media campaign was being planned.• No immediate plans to update 2015 Tennessee Motorcycle Safety Strategic Plan.• The state's motorcycle safety coalition was no longer active.• The state did not have a one-stop shop where motorcycle safety practitioners and researchers can easily share information, data, insights and experiences.• NHTSA funds for motorcycle safety were largely required. |

Hotspot Locations (Motorcycle Crashes in TN)

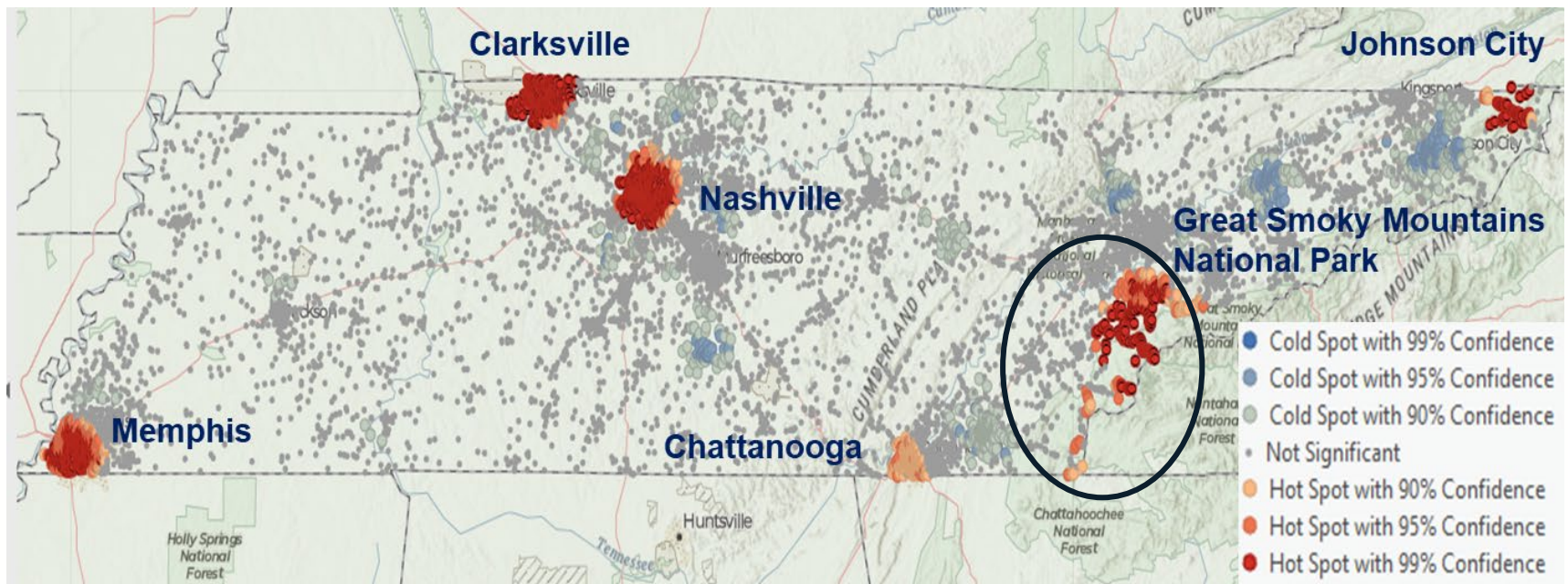
Motorcycle Crashes (2016-2020) in TN



- Top map shows motorcycle crash locations (N = 13,433) – for which geocodes are available.
- Bottom map shows motorcycle crash density with one-mile buffer zone.

Motorcycle Crashes (2016-2020) in TN

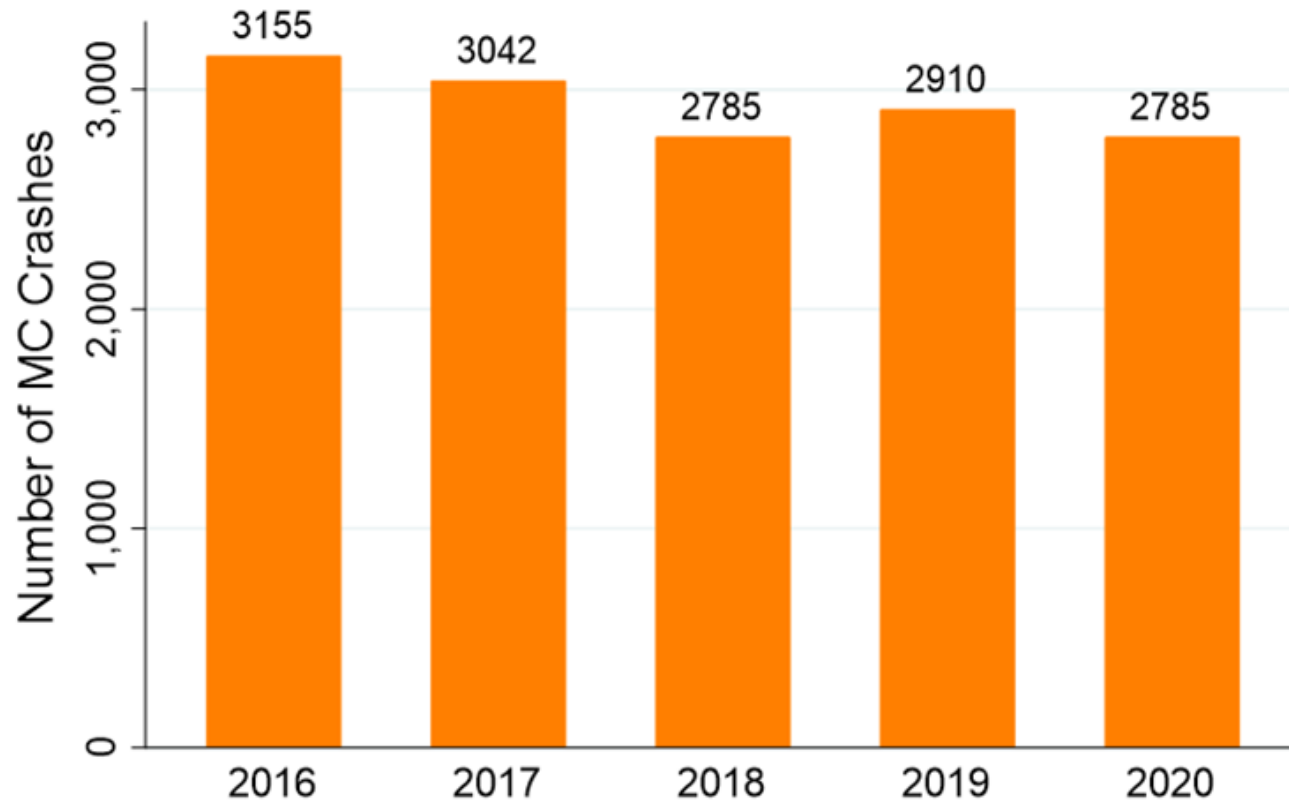
- **Six hotspot areas:** (1) Memphis, (2) Clarksville, (3) Nashville, (4) Johnson City, (5) Chattanooga, and (6) Great Smoky Mountains National Park.
- The Tail of the Dragon (Route 129) has a curvy and scenic road considered thrilling by motorcyclists.



A Motorcycle Crashes in TN (2016-2020)

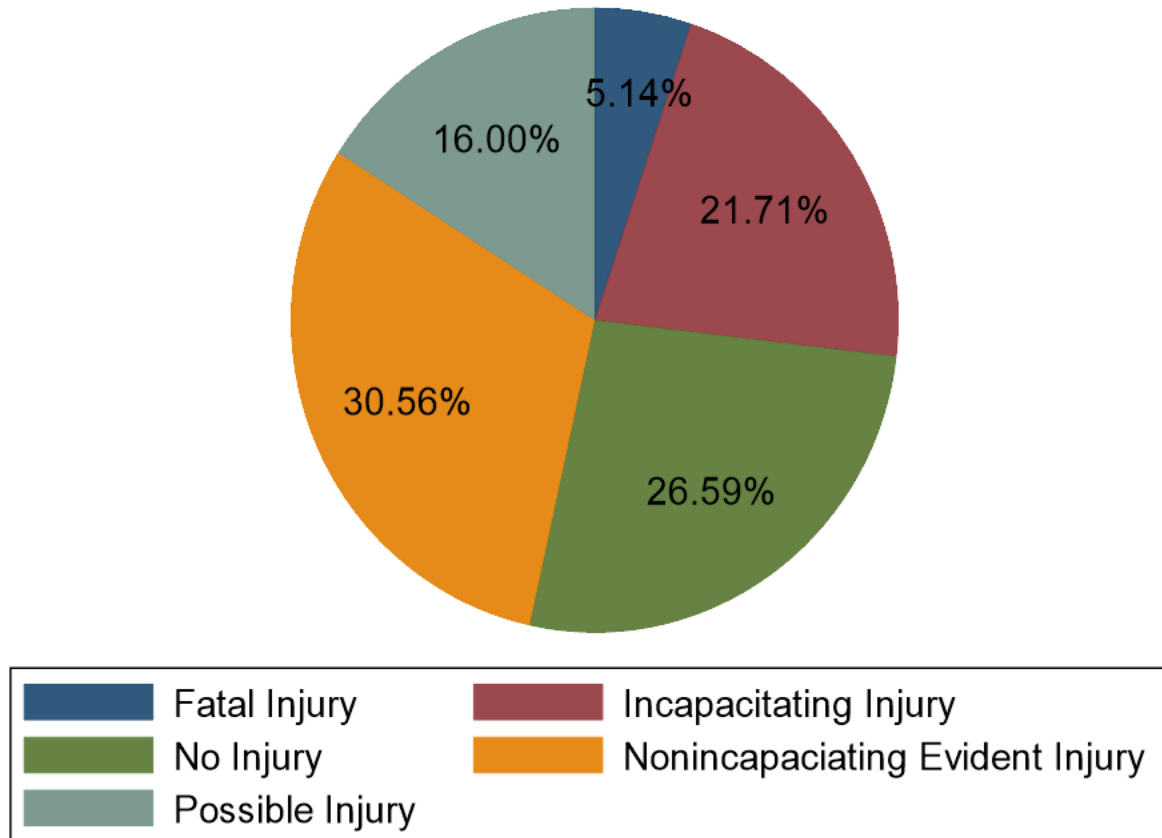
Year-wise Distribution of MC Crashes in TN

- Tennessee had 14,677 motorcycle crashes from 2016 to 2020.



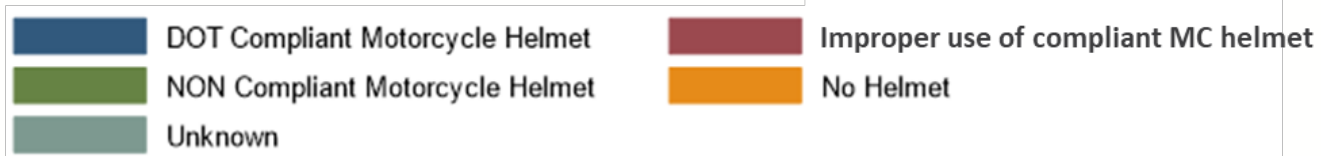
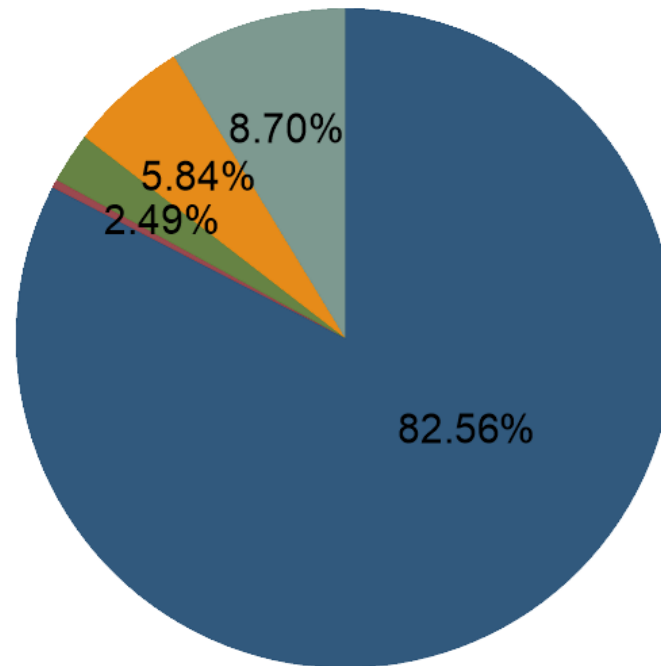
Motorcycle Crash and Rider Injury (2016-2020)

- Riders were killed in 5.1% of motorcycle crashes.



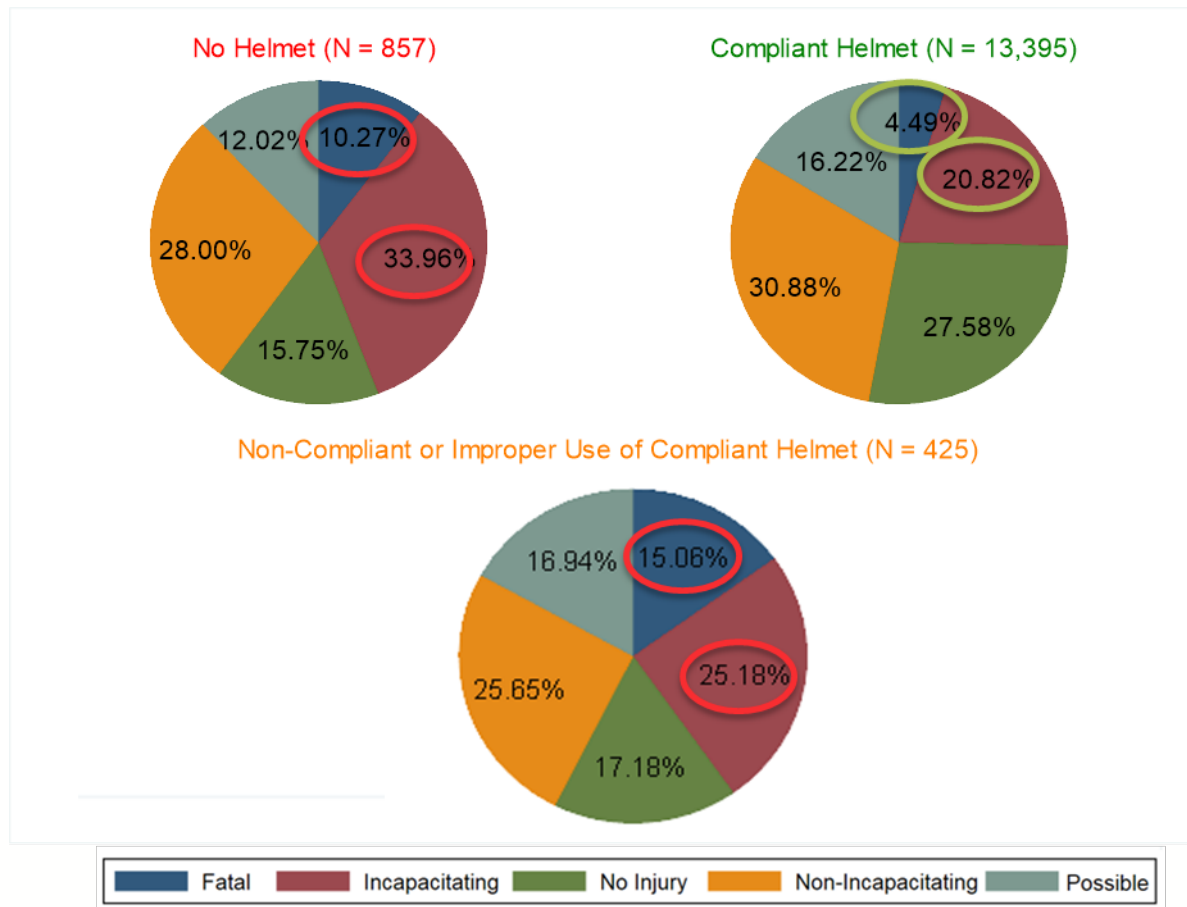
Motorcycle Crash and Helmet Use (2016-2020)

- In 5.8% of motorcycle crashes, riders were not wearing a helmet.
- In 2.5% of motorcycle crashes, riders were wearing a non-compliant helmet.



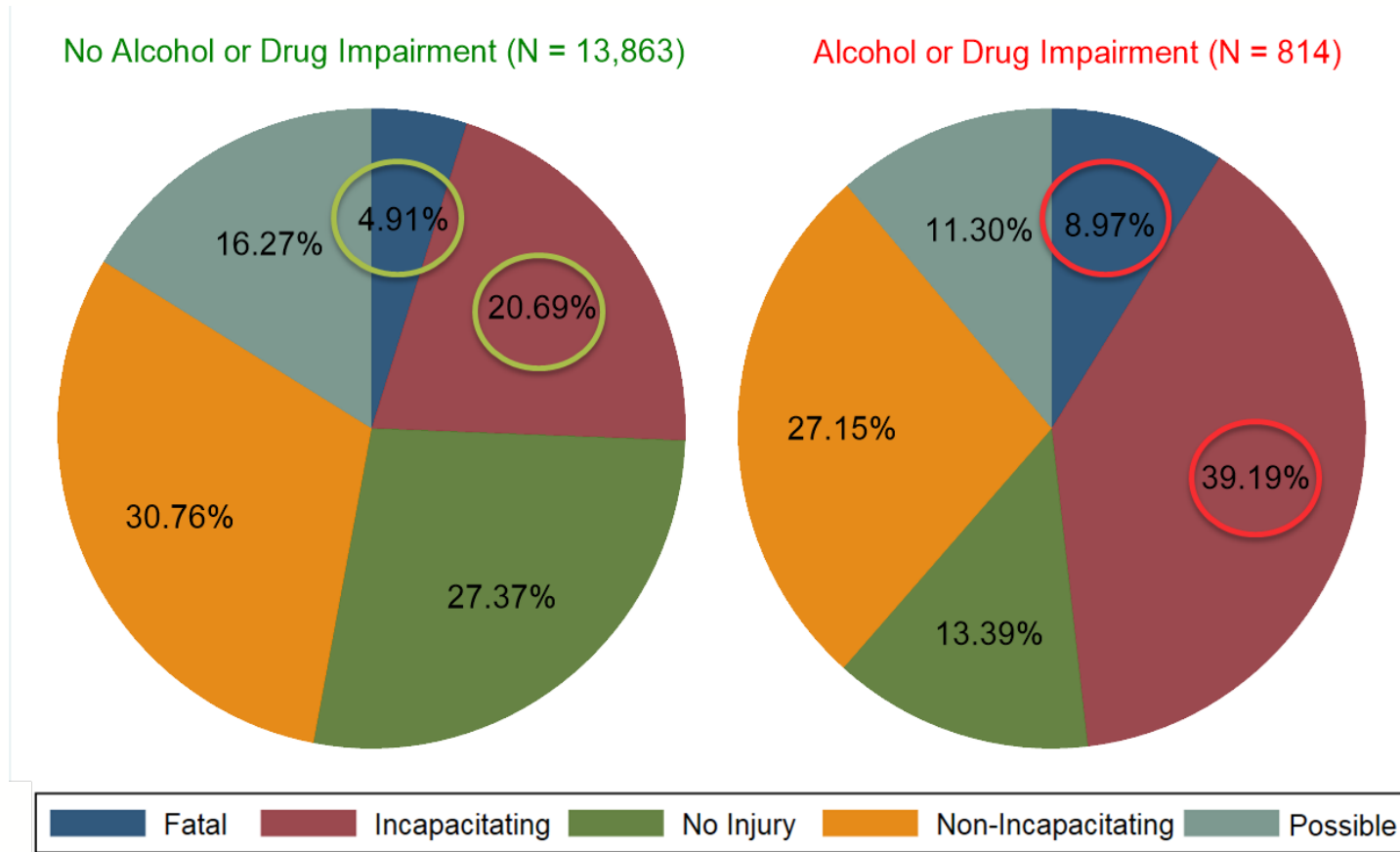
Rider Injury and Helmet Use (2016-2020)

- Rider injury severity would be increased by not wearing a helmet, wearing a non-compliant helmet, or improper use of a compliant helmet.



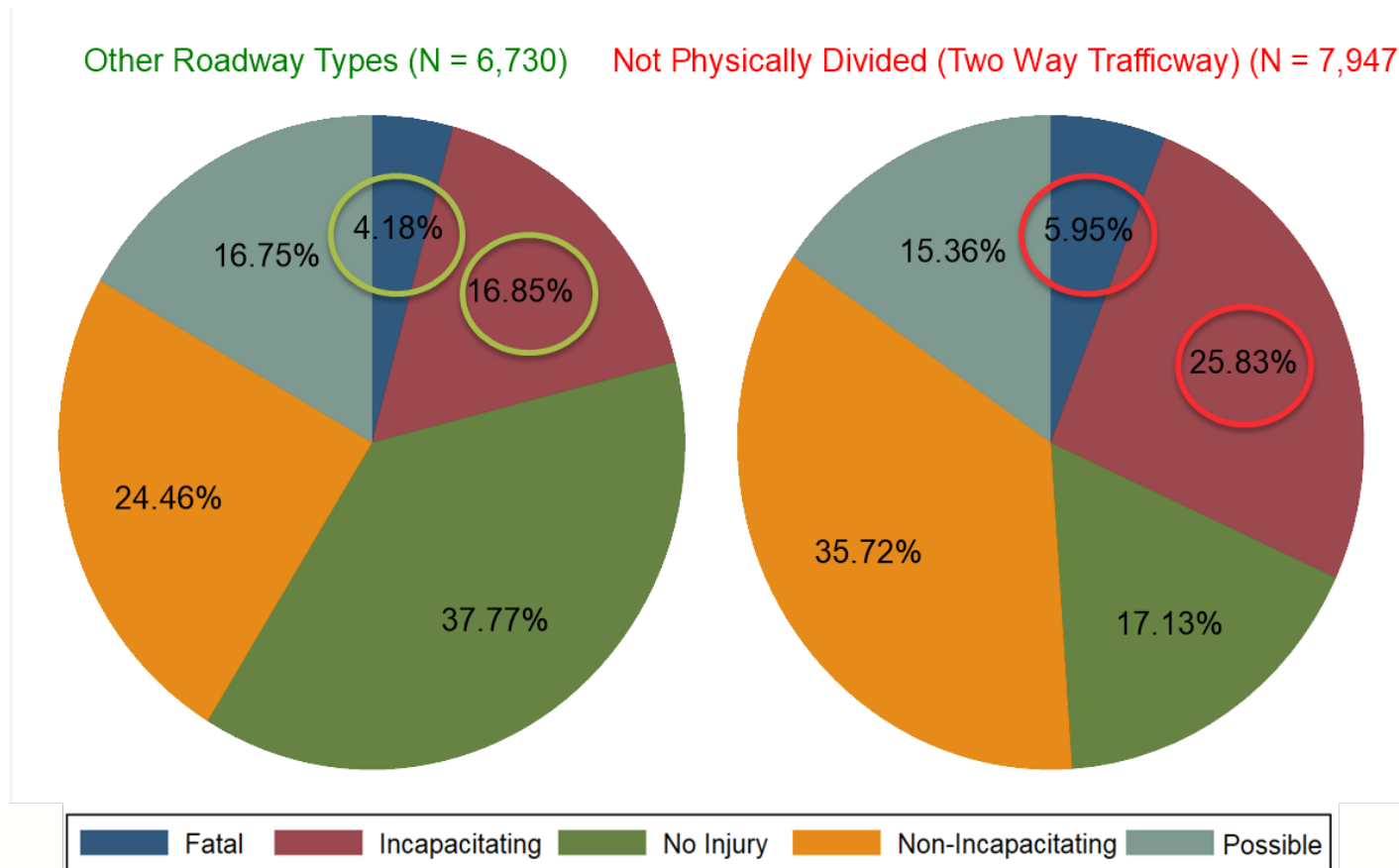
Rider Injury and Impairment (2016-2020)

- Rider injury severity would be increased by alcohol or drug impairment.



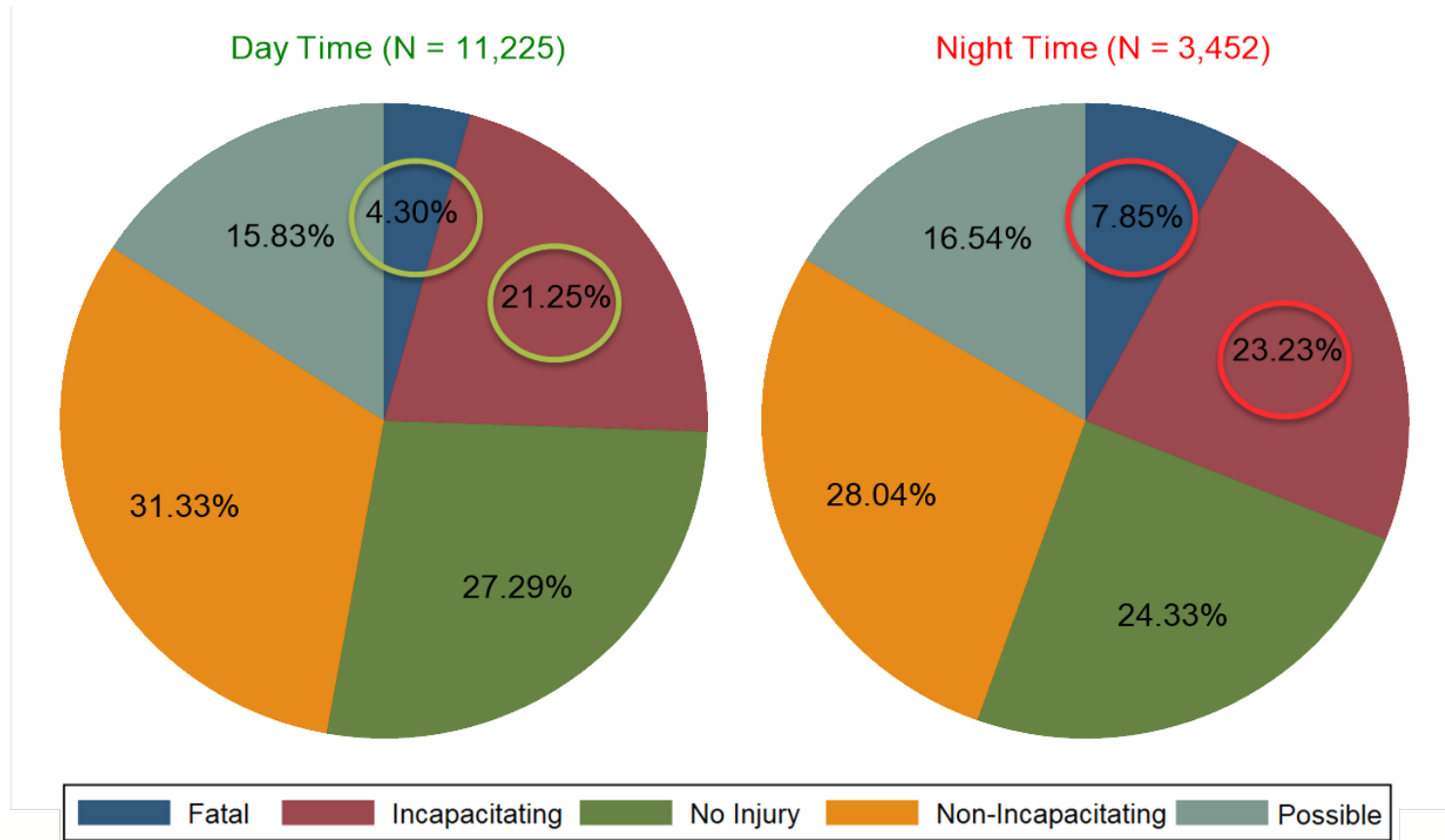
Rider Injury and Roadway Configuration (2016-2020)

- Riders are more likely to be seriously injured on physically undivided roadways.



Rider Injury and Light Condition (2016-2020)

- Riders are more likely to seriously injured during night-time



Motorcycle Safety Practices across the United States

Review Outline

Goals

- Find impactful examples of motorcycle safety practices in other locations
- Identify gaps and opportunities in current practices in TN
- Support expeditious and timely translation of research into practice

Methodology

- Web search of State Highway Safety Offices
- Supplementary search with standard keywords: Motorcycle Safety Plan & Motorcycle Safety Outreach



Alabama Department of Economic and Community Affairs



Kentucky Office of Highway Safety



Alaska Highway Safety Office



Louisiana Highway Safety Commission



Arizona Governor's Office of Highway Safety



Maine Bureau of Highway Safety



Arkansas Highway Safety Office



Maryland Highway Safety Office

Figure Source: <https://www.ghsa.org/about/shsos>

Key Takeaways

Current Practices in Tennessee

- Motorcycle Rider Education Program (MREP)
- Tennessee Motorcycle Operator Manual
- Helpful tips for motorists and motorcyclists via the website of Tennessee Highway Safety Office (THSO)
- Target enforcement mini grant program underway

Opportunities for Tennessee

- Robust media campaigns with different messaging to target motorcyclists
- Enhanced communication with motorcyclists via online and printed materials
- An entity to make recommendations on motorcycle safety
 - E . .g., a motorcycle safety advisory group

Motorcycle Safety Practices in Tennessee

Motorcycle Rider Education Program (MREP)

- Under the Tennessee Department of Safety
- Basic Rider Course (BRC) / Basic Rider Course Two (BRC 2) / Advanced Rider Course (ARC)
- Those who complete either course get a certificate that permits knowledge tests and license skills tests requirements to be waived



Figure Source: <https://www.tn.gov/content/dam/tn/safety/documents/MotorcycleRiderEducationProgram2011.pdf>

Motorcycle Safety Practices in Tennessee

Tennessee Motorcycle Operator Manual

- Developed by the National Public Services Research Institute (NPSRI), National Highway Traffic Safety Administration (NHTSA) and Motorcycle Safety Foundation (MSF)
- Chapters on preparing to ride with equipment, safe riding tips, being in shape to ride, and license requirements.

Helpful Tips from Tennessee Highway Safety Office (THSO)

HELPFUL TIPS FOR MOTORISTS

- Check your mirrors and blind spots before switching lanes. Motorcycles are smaller than most vehicles, they can be difficult to see.
- The size of a motorcycle can cause other drivers to misjudge the speed and distance away of a motorcycle.
- Always signal your intentions before changing lanes or merging with traffic. This allows motorcyclists to anticipate your movement and find a safe lane position.
- Allow a motorcyclist a full lane width. Share the road, but not the lane. A motorcyclist needs room to maneuver safely.
- Allow ample follow distance - three or four seconds - when following a motorcycle. This provides the motorcycle rider more time to maneuver or stop in an emergency.

HELPFUL TIPS FOR RIDERS

- Wear a DOT-compliant helmet and use reflective tape and gear to be more visible.
- Never ride while impaired or distracted. NHTSA-funded research has shown that motorists are distracted more than 50 percent of the time.
- Always ride with a current motorcycle license.

Source: <https://tntrafficsafety.org/motorcycles>

Opportunity: (1) Media Campaigns

1. Emotion-based Advertisements

- Colorado, Illinois, Iowa, Michigan, Missouri, Rhode Island and Utah
- To make a strong impression so that motorcyclists become more aware of safe riding
- *“There’s No Excuse to Not Wear a Helmet.”* in **Colorado**

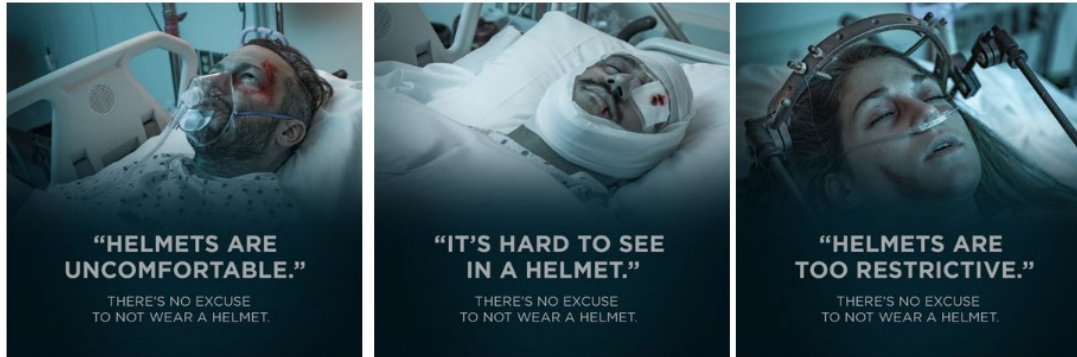


Figure Source: <https://www.codot.gov/safety/motorcycle>

- *“Don’t Ride Impaired.”* in **Missouri**



Figure Source: <https://www.youtube.com/watch?v=1T201MyUcDA>

Opportunity: (1) Media Campaigns

2. Instructional or Safety Tips Focused Advertisements

- Kansas, Maryland, Missouri, New York and Virginia
- To encourage motorists and motorcyclists to behave in a safe manner on the road
- “*Look. React. Stay in control.*” in **Kansas**



Figure Source: <https://www.ktsro.org/motorcycle-safety>

- “*Watch for Motorcycles.*” in **New York**



Figure Source: <https://www.youtube.com/watch?v=7G8tWq7nvVQ>

Opportunity: (1) Media Campaigns

3. Informative Statistics-Oriented Advertisements

- Oklahoma, South Carolina and Washington
- A highly persuasive way of inducing motorcyclists to take actions to protect themselves
- *The “Motorcycle Statistics in 2016” in Washington*

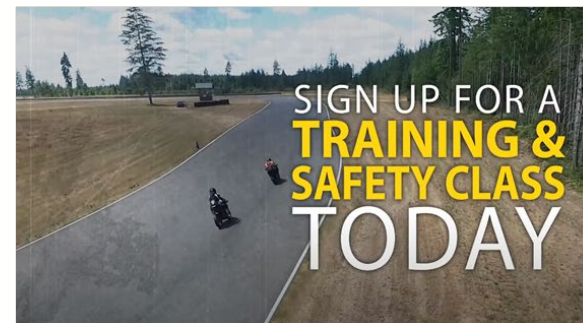
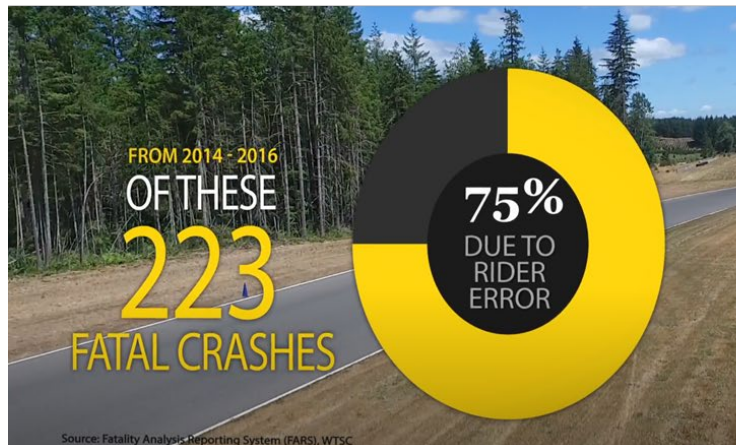


Figure Source: <https://www.youtube.com/watch?v=bSFcFaYdQyI>

Opportunity: (2) Communication with Motorcyclists

1. Communication via online materials

- Facebook pages (Montana, Pennsylvania and Wyoming)



Source: <https://www.facebook.com/MontanaMotorcycleRiderSafety>

- Motorcycle Safety Video Project (Pennsylvania)

[DMV > Driver Services > Motorcyclists > Pennsylvania Motorcycle Safety Program >](#)

Motorcycle Safety Video Project

Riding a motorcycle is a challenging sport which requires balance, patience and split-second decision making. It is a perishable skill that riders constantly practice to hone valuable skills through experiences on the road. Unfortunately, every year, we lose more brothers, sisters, friends and loved ones to avoidable crashes. We are asking for your help to try to change that.

Help Us Help Your Fellow Riders Stay Safe!

Source: <https://www.dmv.pa.gov/Driver-Services/Motorcyclists/PAMSP/Pages/Motorcycle-Safety-Video-Project.aspx>

Opportunity: (2) Communication with Motorcyclists

1. Communication via online materials

- “Online survey of motorcyclists (South Dakota)



TELL US HOW YOU RIDE.

Our goal? Keeping more riders safe. Your role? Tell us information on how you ride, and we'll use that data to shape future campaigns and education programs for riders.

Take a short motorcycle safety survey below to get started.

START SURVEY

Source: <https://southdakotarides.com/motorcycle-safety/safety-survey/>

Opportunity: (2) Communication with Motorcyclists

2. Communication via printed materials

- Rider Responsibility Postcards (Massachusetts)



7 RULES TO KEEP YOU ON YOUR BIKE - AND OFF THE PAVEMENT.

FOLLOW THE LAW
Speeding kills, especially on a motorcycle.

KNOW YOUR LIMITS
Don't let anyone pressure you to ride faster than your level of ability – or the speed limit.

SEE AND BE SEEN
Position yourself so that traffic can see you – and you can see them.

HAVE A PLAN
Adopt a riding strategy like SEE (Search, Evaluate, and Execute). It can save your life.

RIDE SOBER
Don't use alcohol, drugs, or certain medications when you ride. And stay off your motorcycle when you are not mentally or emotionally composed.

PUT ON THE RIGHT GEAR
On a motorcycle, protective gear is a must. Wear a DOT helmet (by law), full fingered gloves, jacket, denim pants, and over the ankle footwear.

GET TRAINED
The Massachusetts Rider Education Program (MREP) offers courses for riders at all levels.

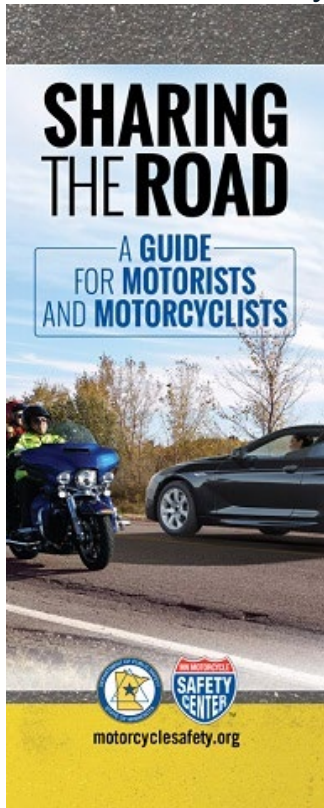
Find an MREP training course in your area at mass.gov/ridesafe

Figure Source: <https://www.mass.gov/doc/eopssmassdot-motorcycle-rider-responsibility-postcard/download>

Opportunity: (2) Communication with Motorcyclists

2. Communication via printed materials

- Brochures for safety awareness (Minnesota and Missouri)



In Missouri, motorcycle riders are required to wear approved helmets at all times.

| Year | Compliant Helmets | Non-Compliant Helmets | Total Riders |
|-----------|-------------------|-----------------------|--------------|
| 2014 | 18 | 186 | 204 |
| 2012-2014 | 20 | 48 | 268 |

Helmets
reduce the chance of fatal injury by 37%
and reduce the risk of sustaining a head injury by 69%
for motorcycle riders.

The single most important safety device a motorcyclist can have is a helmet. Chapter 302 of the Missouri Revised Statutes requires every motorcycle driver and passenger to wear approved protective headgear at all times while riding a motorcycle. In a crash without one, you are five times more likely to suffer a serious head injury than a helmeted rider.

When selecting a helmet, look for one with the Department of Transportation (DOT), American National Standards Institute (ANSI), or Snell Memorial Foundation certification and the date of manufacture.

A good helmet makes riding a motorcycle more fun. It cuts down on wind noise roaring by your ears, windblast on your face and eyes, and deflects bugs and other objects that fly through the air. It even contributes to comfort from changing weather conditions and reduces rider fatigue.

Missouri Department of Transportation
P.O. Box 270
Jefferson City, MO 65102
573-751-4161
800-800-BELT
www.saveMOLives.com
www.modot.org

This brochure paid for with federal highway safety funding by the Missouri Department of Transportation.

Professional training can keep you safely on the road enjoying your motorcycle for years to come.

Whether you're a new rider or someone with years of experience, it's important to receive proper training before riding a motorcycle. Research has shown that more than 90 percent of all riders involved in crashes were either self-taught or taught by friends.

Riding Skills
Regardless of your age, motorcycle safety courses are an excellent way to learn basic and advanced vehicle control and crash-avoidance skills. The Missouri Motorcycle Safety Program (MMSP) offers Motorcycle RiderCourses® for both beginners and experts. To locate an approved course near you, contact the MMSP at (800) 801-3588, or visit its web site at www.mmsp.org.

Earning Your License
In Missouri, motorcyclists must complete and pass a written test and a riding test before obtaining a Class M license or M endorsement. (In most cases, you can avoid the riding test by passing a Motorcycle RiderCourse® from the MMSP.) All licensing issues are handled by the Missouri Department of Revenue. For licensing information, visit www.dor.mo.gov.

Motorcycle Safety
Being Seen & Staying Safe on Motorcycles

ARRIVE ALIVE

Figure Source (Left):

<https://www.four51.com/UI/Custom.aspx?p=catalog&catid=88W5btUMqaTleerNFHYTPgZFI4Gs3Nb1OG-p50PRpZH-pMfst1T6y0-sQ-e-e&catinteropID=A54ED484-A2D9-43D6-AD94-C24C6B3F14E0&CEI=1ece366f-0f36-4d42-9115-cd84ce9d2d53>

Figure Source (Right): <https://www.modot.org/sites/default/files/documents/motorcycle%20brochure2.pdf>

Opportunity: (3) Motorcycle Safety Advisory Group

- **13 states** were found to have a motorcycle safety advisory group to make recommendations on motorcycle safety for state government:
Arizona, Colorado, Delaware, Florida, Idaho, Minnesota, Montana, New Mexico, Oklahoma, Oregon, Texas, Washington, Wisconsin.

Motorcycle Safety Advisory Council (MoSAC) in Wisconsin (Example)

Motorcycle Safety Advisory Council (MoSAC)

Safety Program

Gear and equipment

How to operate

Risks and traps

Scooter/Moped

Mission

The Wisconsin Motorcycle Safety Advisory Council (MoSAC) advises the secretary of the Wisconsin Department of Transportation on motorcycle safety issues. MoSAC also promotes the safest possible riding environment by sharing best practices and leading the nation in motorcycle safety innovation.

Vision

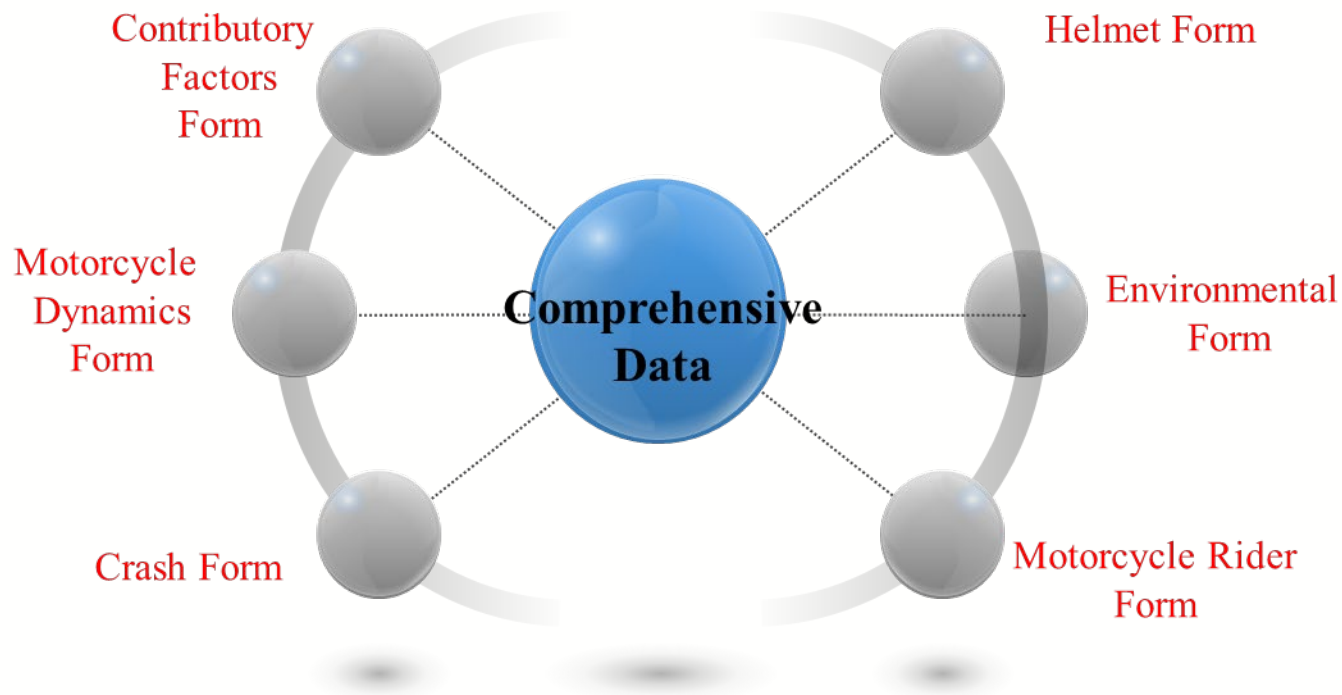
- Zero motorcycle fatalities in Wisconsin
- Zero single or multivehicle motorcycle crashes
- Zero unlicensed motorcycle riders
- Zero untrained motorcycle riders
- Zero impaired motorcycle riders
- Zero motorists not sharing the road with motorcycles
- Zero unfunded motorcycle safety programs
- Zero riders not knowing the benefits of proper and conspicuous riding gear

Source: <https://wisconsindot.gov/Pages/dmv/motorcycles/mc-safety/mosac.aspx>

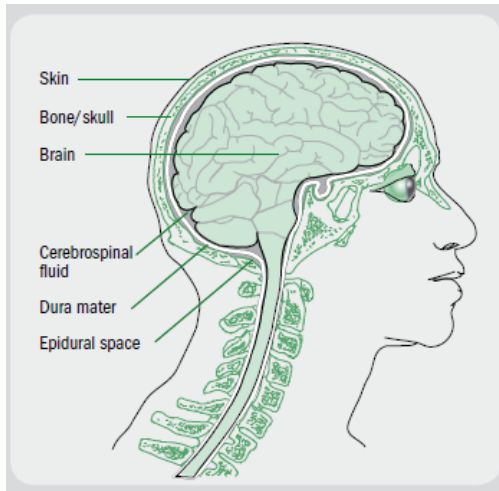
Relevant Findings from Motorcycle Crash Causation Study (MCCS) Data

Motorcycle Crash Causation Study (MCCS) Data

- MCCS was conducted in Orange County (California), which include 315 crashes & 702 controls.
 - Police Crash reports
 - Data from medical records (injury data for different body parts) – AIS scale
 - Rider interviews (controls)
 - Detailed information about helmet use and types, rider clothing, conspicuity, shoes



Mechanism of Head Injuries: Helmet Use & Color



Helmet color (light vs. dark)

Possible pathway: Helmet color associates with injury outcomes through its mediating effect on rider conspicuity

Implementable Findings to Reduce Injury Crashes

- Risk of motorcycle injury crash can be reduced by:



Encouraging “proper” helmet use

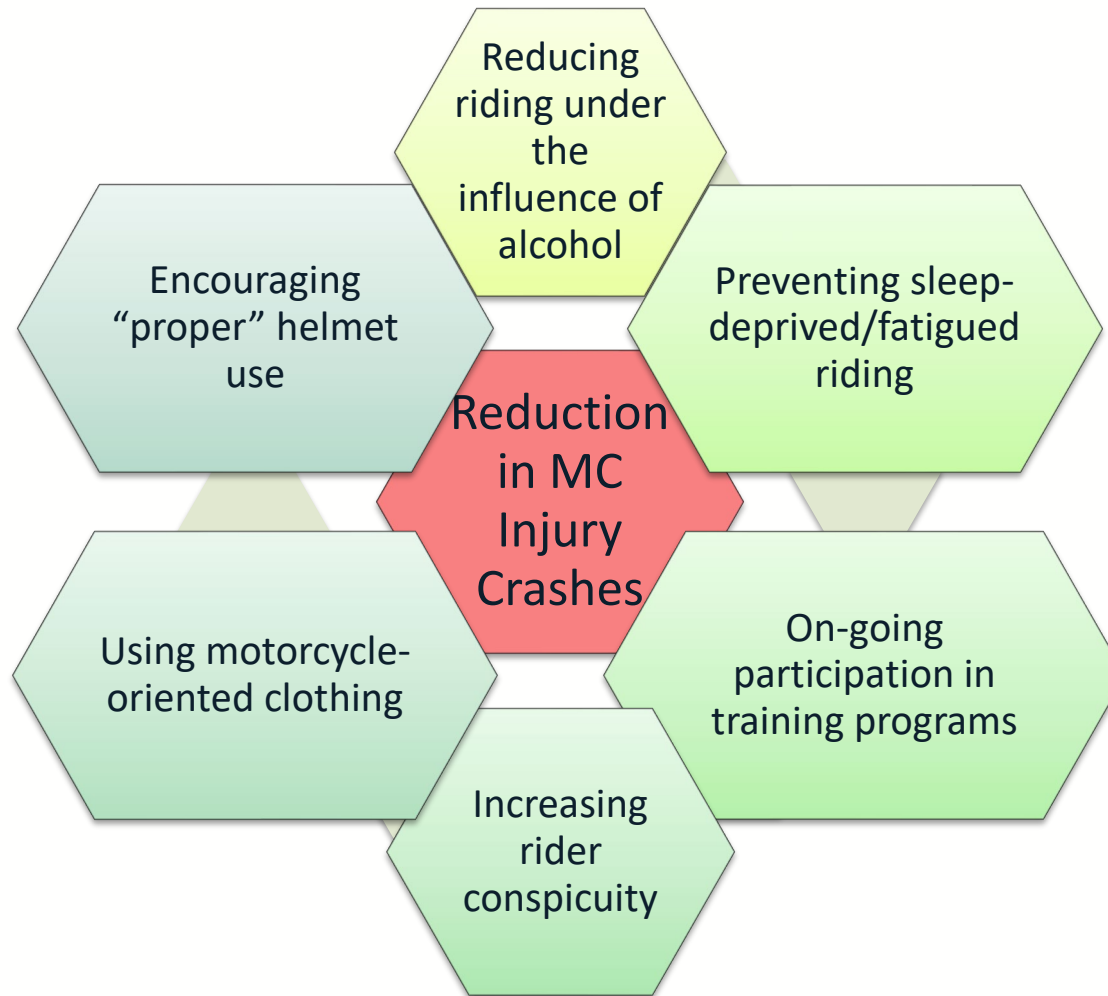


Increasing rider conspicuity

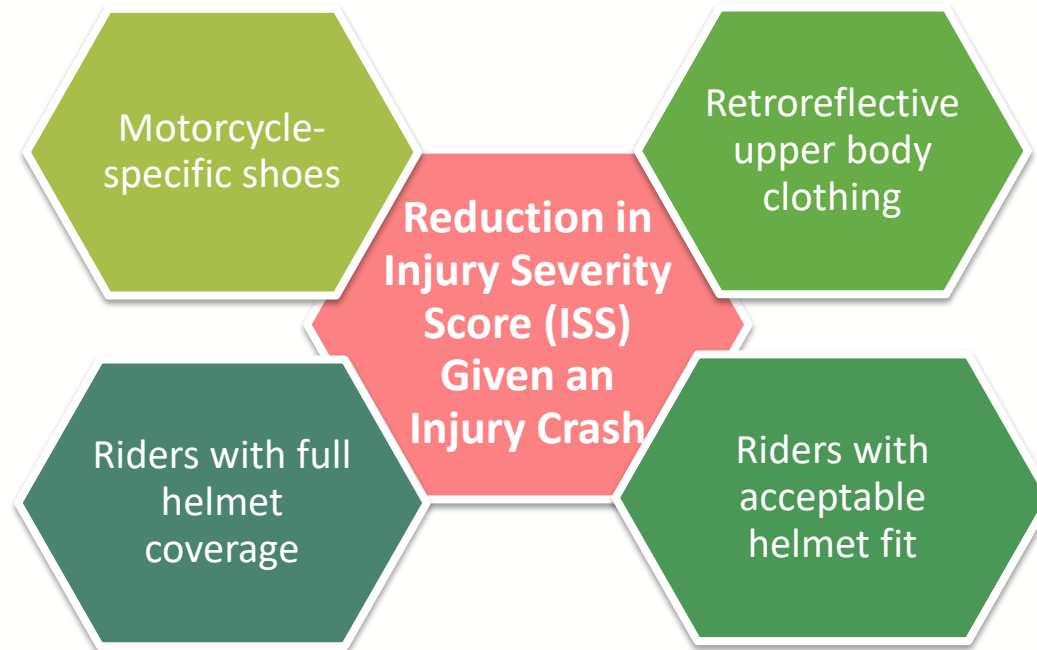


Using motorcycle-oriented clothing

Implementable Findings to Reduce Injury Crashes



Implementable Findings to Reduce Injury Severity



Conclusions and Recommendations

Tennessee Motorcycle Crash Data analysis implies...

- More efforts in outreach and education encouraging motorcyclists to properly wear a **DOT compliant helmet**
- Targeted outreach and enforcement efforts regarding the importance of **being clean/sober** when riding would likely be impactful
- Providing warning messages and signage on **undivided roadways** would be helpful
- Investing in **lighting infrastructure** should be considered for locations where motorcycle crashes frequently occur at night
- Developing a **Motorcycle Safety Clearinghouse**, which could result in an improved technology transfer and two-way information sharing between researchers and practitioners

Conclusions and Recommendations

Safety practices in other states imply...

Tennessee has an opportunity to:

- Develop more robust **media campaigns** with different messaging to target motorcyclists
- Enhance **communication with motorcyclists** via online and printed materials
- Re-establish the motorcycle safety coalition and create a motorcycle safety advisory group

Conclusions and Recommendations

MCCS Data implies...

- Injury crashes could be reduced by
 - Proper helmet use
 - Increasing rider conspicuity and
 - Using motorcycle-oriented clothing
- Rider injury severity could be reduced by
 - Retroreflective upper body clothing
 - Motorcycle-specific shoes
 - Acceptable helmet fit and full helmet coverage