

# Morbidity, Mortality, and Disability After Unhelmeted Motorcycle Accidents Are Greater Than Their Helmeted Counterparts

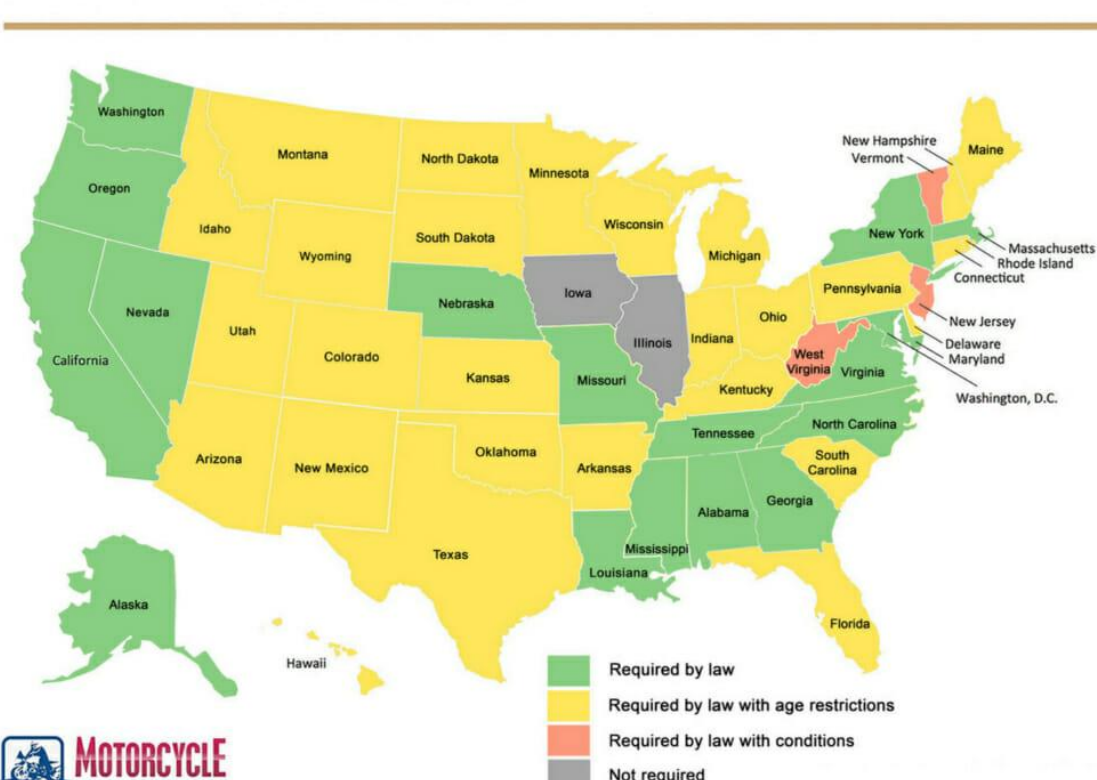
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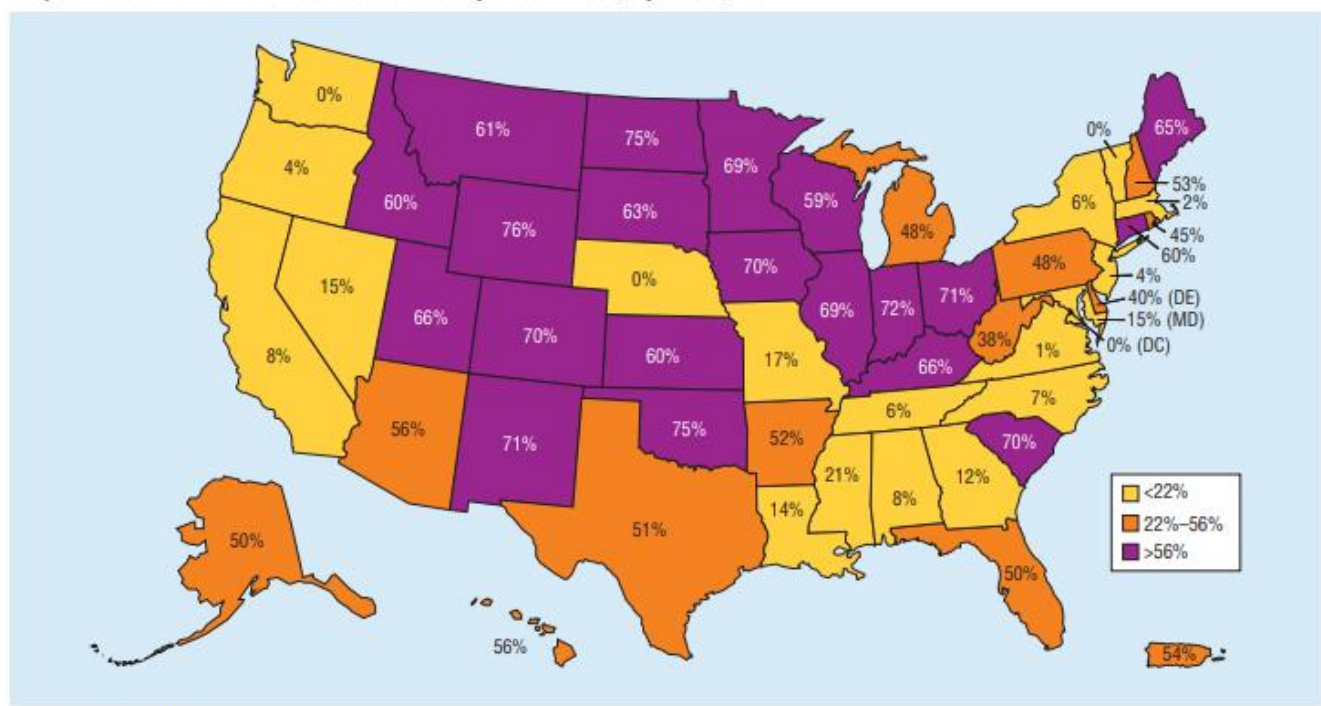
## BACKGROUND

- Nationwide, there is wide variation in state requirements for a motorcycle helmet<sup>1,2</sup>

MOTORCYCLE HELMET LAWS BY STATE



Map of Percent Known Unhelmeted Motorcyclists Killed, by State, 2017

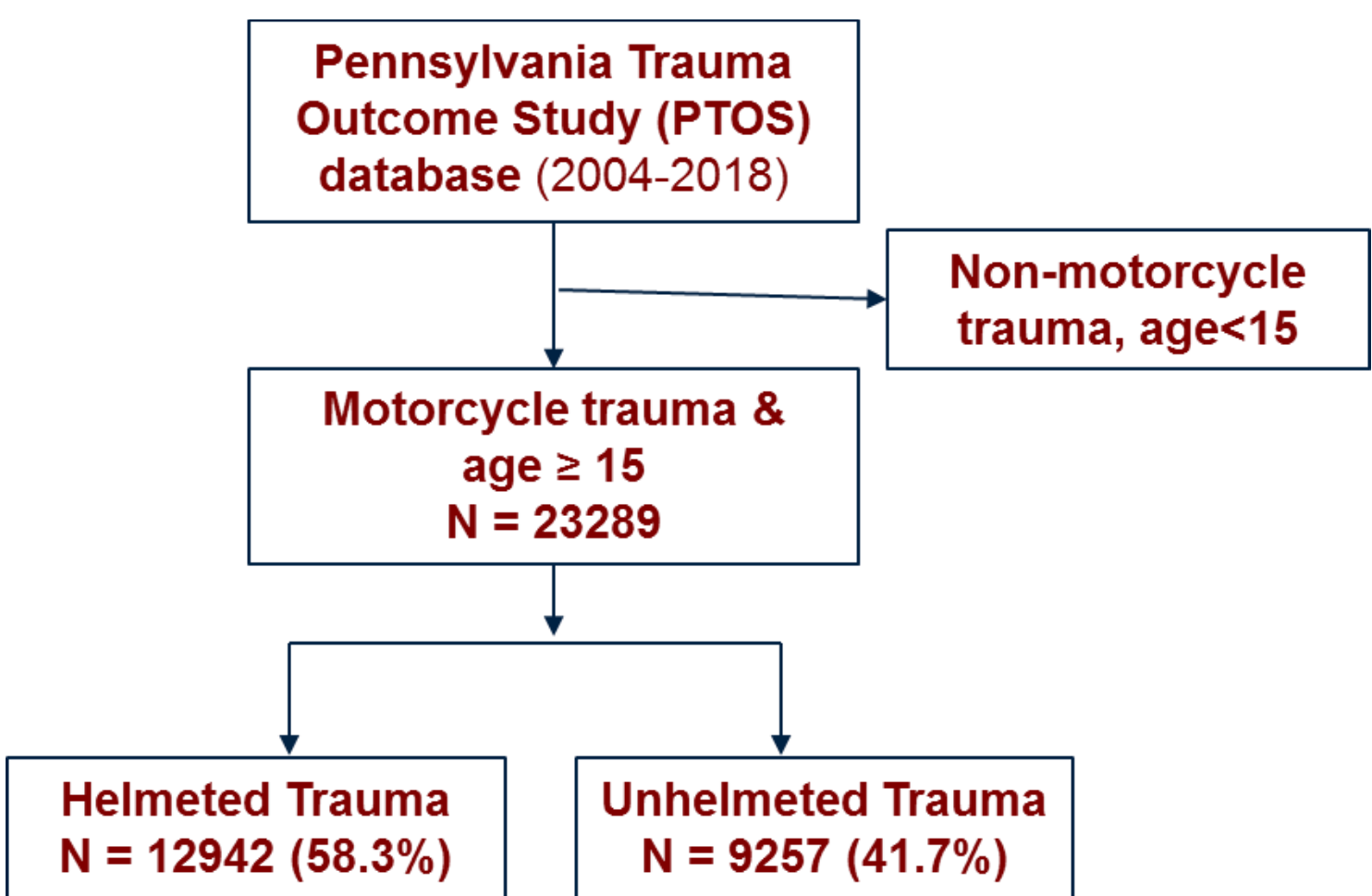


- Unhelmeted motorcyclists are more likely to die<sup>1,2</sup>
- In 2003, Pennsylvania repealed its universal motorcycle helmet law<sup>3</sup>
  - 2008 – UPitt<sup>4</sup>, head-injury deaths from motorcycle crashes increased by 66% after law repealed helmet requirement
  - 2018 – WellSpan<sup>5</sup>, motorcyclists killed increased by 60% since repeal, about half of fatalities not wearing a helmet
- No existing data on morbidities and post-injury disability comparing helmeted and unhelmeted motorcyclists

## METHODS

- Data collected:
  - Demographics
  - Initial Vital Signs
  - ISS and AIS
  - Post-ER destination
  - Morbidities
  - Mortality
  - Discharge Destination
  - Discharge Disabilities
- Univariate analysis

### Exclusion Criteria



## RESULTS

### Demographics

	Unhelmeted	Helmeted	p-value
Race			
White	7,530 (85.77%)	11,311 (90.44%)	<0.001
Black	975 (11.11%)	921 (7.36%)	
Hispanic ethnicity	367 (5.60%)	239 (2.68%)	<0.001
Male sex	8,165 (88.20%)	11,280 (87.17%)	0.021
Mean age (±SD)	40.30 (±15.71)	41.52 (±13.87)	<0.001
Mean alcohol screen (±SD)	0.57 (±1.68)	0.34 (±1.34)	<0.001
Drug screen			
Cocaine	354 (3.82%)	195 (1.51%)	<0.001
PCP	37 (0.40%)	7 (0.05%)	<0.001
Benzodiazepines	951 (10.27%)	873 (6.75%)	<0.001
THC	881 (9.52%)	769 (5.94%)	<0.001

### Initial Vitals

	Unhelmeted	Helmeted	p-value
Mean GCS	12.75 (±3.97)	13.84 (±2.92)	<0.001
% intubated	140 (1.98%)	76 (0.80%)	<0.001
Mean temperature, F (±SD)	97.84 (±1.40)	97.96 (±1.20)	<0.001

### Injury Severity Scale and Adjusted Injury Severity

	Unhelmeted	Helmeted	p-value
Mean ISS (±SD)	16.47 (±11.45)	14.57 (±10.57)	<0.001
Mean AIS head (±SD)	2.67 (±1.35)	2.48 (±1.16)	<0.001
Mean AIS thorax (±SD)	2.72 (±1.03)	2.79 (±0.98)	<0.001
Mean AIS abdomen (±SD)	1.91 (±1.13)	2.01 (±1.19)	<0.001
Mean AIS spine (±SD)	2.24 (±0.71)	2.28 (±0.76)	0.044

### Morbidity and Mortality

	Unhelmeted	Helmeted	p-value
Post ED destination			
ICU	3,112 (33.74%)	3,181 (24.58%)	<0.001
OR	1,665 (17.99%)	2,567 (19.84%)	
Home	12 (0.13%)	18 (0.14%)	
Mean ICU days (±SD)	2.82 (±6.79)	2.06 (±5.60)	<0.001
Mean vent days (±SD)	1.83 (±5.72)	1.23 (±4.67)	<0.001
Mean hospital days (±SD)	7.59 (±10.5)	7.00 (±8.62)	<0.001
Discharge destination			
home	5,925 (68.59%)	8,925 (71.73%)	<0.001
rehab	1,629 (18.86%)	2,029 (16.31%)	
SNF	440 (5.09%)	676 (5.43%)	
Mortality	627 (6.77%)	510 (3.94%)	<0.001

### Functional Status at Discharge (FSD, Disability)

	Unhelmeted	Helmeted	p-value
Mean FSD feeding (±SD)	3.71 (±0.77)	3.79 (±0.63)	<0.001
Mean FSD expression(±SD)	3.81 (±0.63)	3.89 (±0.47)	<0.001
Mean FSD social interaction(±SD)	3.81 (±0.63)	3.90 (±0.47)	<0.001
Mean FSD (±SD)	17.67 (±3.29)	17.91 (±2.73)	<0.001

#### FUNCTIONAL STATUS AT DISCHARGE – FEEDING

- 4 = **Complete Independence**: Eats from dish and drinks from a cup presented in customary manner on table or tray, opens cartons, pours liquids, cuts meat, and batters bread.
- 3 = **Independent with Device**: Requires assistance in preparation, e.g., opening cartons, pouring liquids, cutting meat, OR requires an adaptive or assistive device, e.g., straw, spoon, rocking knife, BUT is able to manage meal without assistance, e.g., brings food to mouth, chews, and swallows.
- 2 = **Modified Dependence**: Is able to take food and drink by mouth but requires supervision or minimal to moderate physical assistance during drinking or eating. Patient does not rely on other means of alimentation, such as parenteral or gastrostomy feedings.
- 1 = **Complete Dependence**: Requires maximal or total assistance to take meals by mouth, OR does not take food by mouth and must rely on other means of alimentation, such as parenteral or gastrostomy feedings.

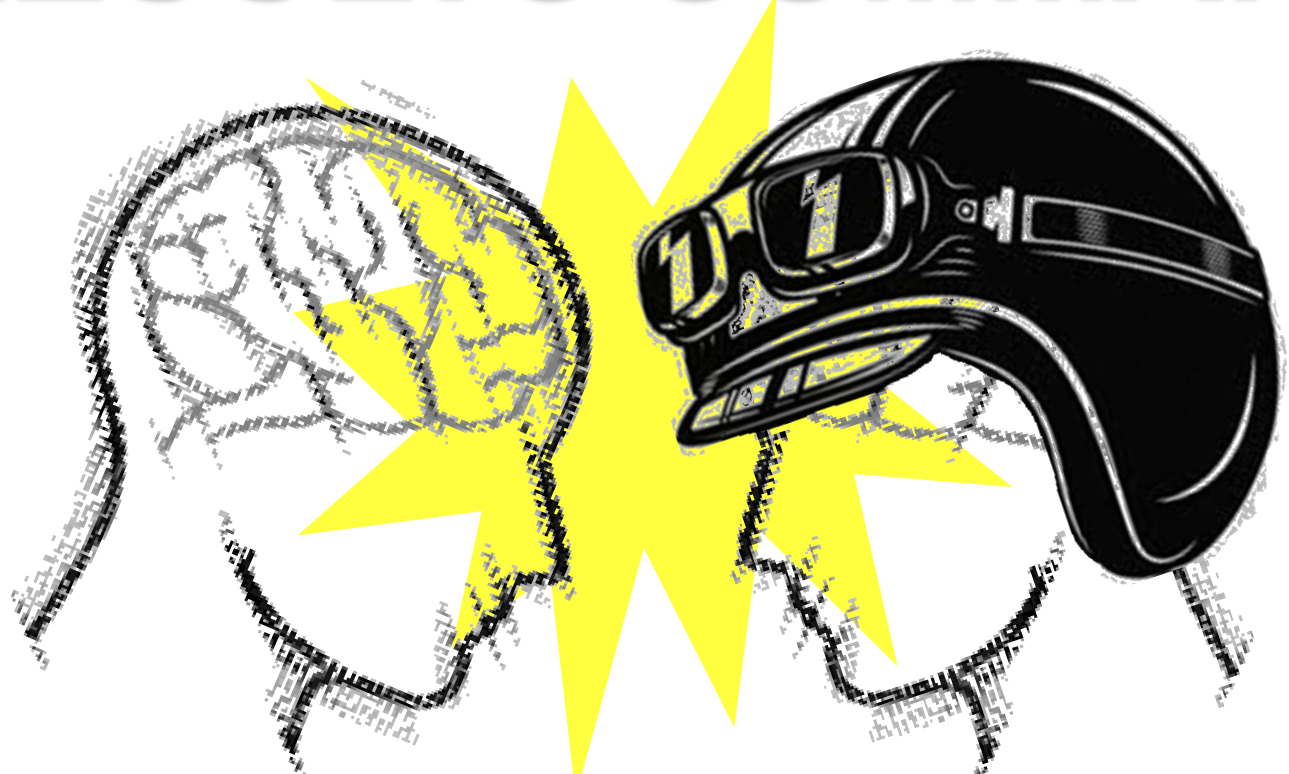
#### FUNCTIONAL STATUS AT DISCHARGE – EXPRESSION

- 4 = **Complete Independence**: Expresses complex ideas intelligently and fluently, verbally or non-verbally, including typing and writing.
- 3 = **Independence with Device**: Expresses complex ideas with mild difficulty, but communicates basic needs and wants without difficulty, may require an augmentative communication device or system.
- 2 = **Modified Dependence**: Expresses thoughts in a telegraphic or confused pattern, or requires prompts, cues or assistance of another person.
- 1 = **Complete Dependence**: Does not express basic needs and wants consistently, even with an augmentative communication device or system, despite prompting.

#### FUNCTIONAL STATUS AT DISCHARGE – SOCIAL INTERACTION

- 4 = **Complete Independence**: Interacts appropriately with staff, other patients, and family members, e.g., controls temper and is aware that words and actions have impact on others.
- 3 = **Independence with Device**: Interacts appropriately with staff, other patients, and family members in structured situations and environments, may take more than a reasonable time to adjust to a social situation.
- 2 = **Modified Dependence**: Requires some supervision (monitoring, cueing, coaxing) under stressful or unfamiliar situations.
- 1 = **Complete Dependence**: Interacts appropriately less than 25% of the time or not at all, may need restraint.

## RESULTS SUMMARY



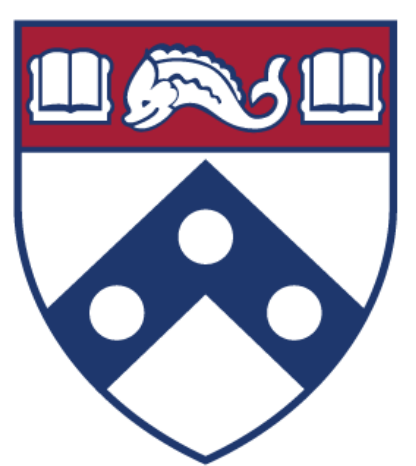
- Unhelmeted motorcycle traumas are more likely:
  - To be non-white, Hispanic, male and younger
  - To have lower GCS and be hypothermic on arrival
  - To be intubated in the trauma bay
  - To be intoxicated, more injured (especially head)
  - To need admission, longer hospital, ICU, and ventilator days
  - To die (overall mortality)
  - To have impairments at discharge in feeding, expression and social interaction

## CONCLUSIONS

- Unhelmeted motorcycle trauma has a higher morbidity, mortality, and post-injury disability
- Limitations**: retrospective multiyear database study, inherent bias/limitations of sampling methods (trauma centers, reporting in rural hospitals, incomplete data)
- Next study will expand to National Trauma Database to clarify if universal state laws lead to better outcomes/less severe injuries/disability

## REFERENCES

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- 2 - National Center for Statistics and Analysis. (2019, December). Lives and costs saved by motorcycle helmets, 2017 (Traffic Safety Facts Crash•Stats Report No. DOT HS 812 867). Washington, DC: National Highway Traffic Safety Administration.
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- 4 - Mertz KJ, Weiss HB. Changes in motorcycle-related head injury deaths, hospitalizations, and hospital charges following repeal of Pennsylvania's mandatory motorcycle helmet law. Am J Public Health. 2008 Aug;98(8):1464-7.
- 5 - Ashie A, Wilhelm A, Carney D, DiPasquale T, Bush C. Comparing fracture patterns of younger versus older riders involved in nonfatal motorcycle accidents. Traffic Inj Prev. 2018;19(7):761-765.



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