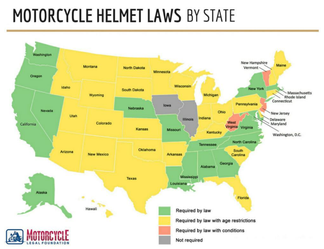
Morbidity, Mortality, and Disability After Unhelmeted Motorcycle Accidents Are Greater Than Their Helmeted Counterparts

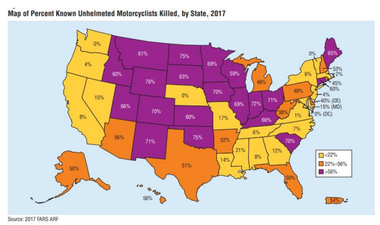
Edward Skicki DO; Madison Morgan BS; Mitch Meagher DO; Lucas Phi, DO; Loan Mai, DO

Penn Medicine Lancaster General Health
Trauma and Acute Care Surgery

BACKGROUND

- Nationwide, there is wide variation in state requirements for a motorcycle helmet[1,2]



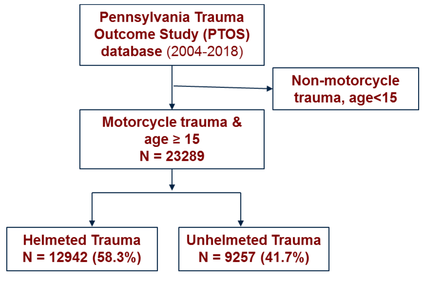


- Unhelmeted motorcyclists are more likely to die[1,2]
- In 2003, Pennsylvania repealed its universal motorcycle helmet law[3]
  - 2008 – UPitt[4], head-injury deaths from motorcycle crashes increased by 66% after law repealed helmet requirement
  - 2018 – WellSpan[5], motorcyclists killed increased 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

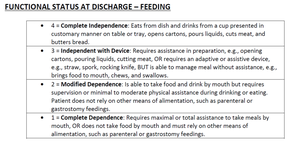
	Unhelmeted	Helmeted	p-value
Mean ISS (±SD)	16.47 (±11.45)	14.57 (±10.57)	<0.001
Mean AIS head (±SD)	2.67 (±1.35)	2.48 (±1.16)	<0.001
Mean AIS thorax (±SD)	2.72 (±1.03)	2.79 (±0.98)	<0.001
Mean AIS abdomen (±SD)	1.91 (±1.13)	2.01 (±1.19)	<0.001
Mean AIS spine (±SD)	2.24 (±0.71)	2.28 (±0.76)	0.044

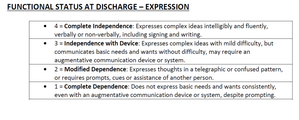
Morbidity and Mortality

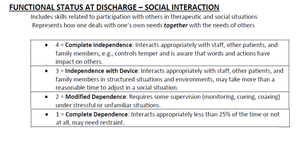
	Unhelmeted	Helmeted	p-value
Post ED destination			
ICU	3,112 (33.74%)	3,181 (24.58%)	<0.001
OR	1,665 (17.99%)	2,567 (19.84%)	
Home	12 (0.13%)	18 (0.14%)	
Mean ICU days (±SD)	2.82 (±6.79)	2.06 (±5.60)	<0.001
Mean vent days (±SD)	1.83 (±5.72)	1.23 (±4.67)	<0.001
Mean hospital days (±SD)	7.59 (±10.5)	7.00 (±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







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

1 - National Center for Statistics and Analysis. (2019, August). Motorcycles: 2017 data (Updated, Traffic Safety Facts. Report No. DOT HS 812 785). Washington, DC: National Highway Traffic Safety Administration.
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.
3 - Bureau of Maintenance And Operations. (2020, July). Pennsylvania Crash Facts and Statistics. Harrisburg, PA: Pennsylvania Department of Transportation.
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.

Penn Medicine
Lancaster General Health