

Incidence of Combat Sport-Related Mild Traumatic Brain Injuries Presenting to the Emergency Department from 2012-2016

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AGENDA:

1. Introduction
2. Aims/Hypothesis
3. Methods
4. Results
5. Discussion/Conclusion



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Introduction: What are Mild Traumatic Brain Injuries AKA Concussions?

[Neurosurgery](#). 2018 Feb 1;82(2):232-236. doi: 10.1093/neuros/nyx344.

The Berlin International Consensus Meeting on Concussion in Sport.

[Davis GA](#)^{1,2}, [Ellenbogen RG](#)³, [Bailes J](#)⁴, [Cantu RC](#)⁵, [Johnston KM](#)⁶, [Manley GT](#)⁷, [Nagahiro S](#)⁸, [Sills A](#)⁹, [Tator CH](#)¹⁰, [McCrory P](#)¹.

[+ Author information](#)

A subset of mild traumatic brain injury induced by biomechanical forces that display several common features that can be utilized when defining a concussive injury including:

1. Caused either by a direct blow to the head, face, neck or elsewhere on the body with an **impulsive forces transmitted to the head.**
2. **Rapid onset of short lived impairment of neurological function that resolves spontaneously.**
However, in some cases, symptoms and signs may evolve over a number of minutes to hours
3. May result in neuropathological changes, but the acute clinical symptoms largely reflect a **functional disturbance** rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.
4. A **range of clinical signs** and symptoms that **may or may not involve loss of consciousness.**
Resolution of the clinical and cognitive symptoms typically follows a sequential course.
However, in some cases symptoms may be prolonged



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Introduction: An increased awareness and interest on sport-related concussion

51.50 - NYDailyNews.com SPORTS FINAL Party cloudy, 37/24, Saturday, January 30, 2016

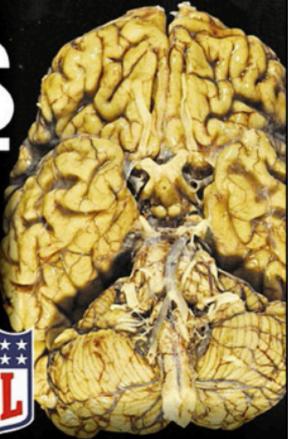
DAILY NEWS

NEW YORK'S HOMETOWN NEWSPAPER

This is your brain on football

Despite immense pressure from the medical community and attempts to lower concussion rates, the NFL reported a whopping increase in head injuries for 2015.

SEE SPORTS



NFL

- **NFL concussions up a stunning 58%**
- **Frightening figures just 'tip of iceberg'**

WHITE HOUSE: HIL HAD TOP-SECRET EMAILS PAGES 6-7





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Introduction: How do combat sports stack up to their mainstream counterparts?



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Introduction: How do combat sports stack up to their main stream counterparts?

1. Paucity of literature regarding the epidemiology, risk factors and prevention of MTBI in combat sport-related MTBI



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Introduction: How do combat sports stack up to their main stream counterparts?

2. Lack of understanding on the signs and symptoms among participants and trainers
 - Lack of formal concussion education requirements among athletes
 - Lack of formal concussion education requirements among trainers/gym owners



**CONCUSSION SAFETY
PROTOCOL CHECKLIST**



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Introduction: How do combat sports stack up to their main stream counterparts?

3. Lack of explicit and available injury tracking datasets by the organizations which govern combat sports



High School RIO™

High School Sports-Related Injury Surveillance Study
presented by the Center for Injury Research & Policy



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Introduction: How do combat sports stack up to their main stream counterparts?

- 4. Lack of uniform return to play (RTP) guidelines or the requirement for medical clearance prior to RTP

RETURN-TO-PARTICIPATION PROTOCOL



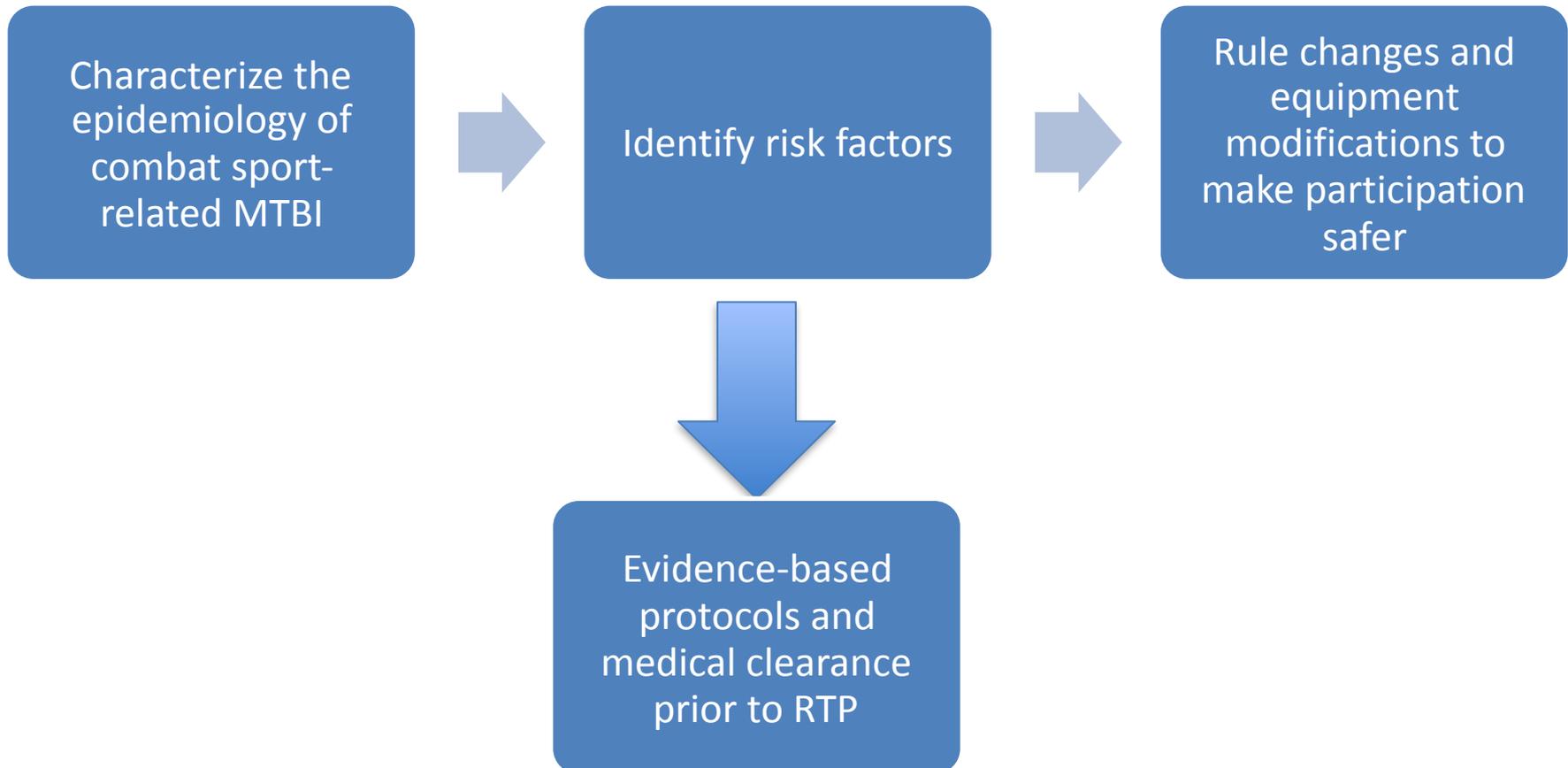
CONCUSSION SAFETY PROTOCOL CHECKLIST





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How can combat sports do better?





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Aims/Hypothesis

- We sought to determine the incidence of combat sport-related MTBI presenting to ED's in United States over a 5 year study period.
- The incidence of MTBI due to each combat sport was analyzed separately to allow for a better understanding regarding the:
 - The differences between various combat sports
 - How the organizational structure of the sport may affect an athlete's use of the health care system.



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Methods

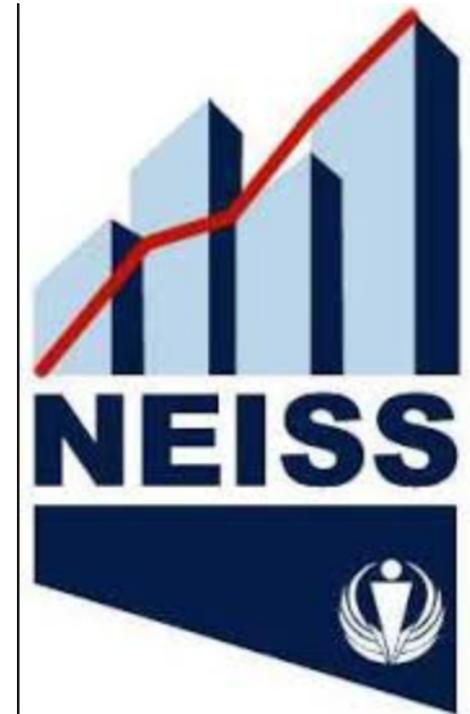
- Retrospective epidemiological cross-sectional study of MTBI in combat sport athletes evaluated in United States emergency departments.



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Methods

- NEISS- Operated by the U.S. Consumer Product Safety Commission (CPSC)
 - All injury-related visits to the emergency departments within 100 hospitals that are a stratified sample of emergency departments in the US and its territories.
 - NEISS sample weights allow for the estimation of the total number of emergency department visits that occur nationally during a specific year.





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Methods

- All head injuries from 2012-2016, diagnosed as a concussion (code 52) or internal head injury (code 62) that occurred during boxing (code 1207), martial arts (code 3257) or wrestling (code 1270) were selected.
- In order to target MTBIs that occurred during organized sports participation, using the locale assigned to each case, we excluded any case that did not occur at school or a place of recreation.
- Furthermore, we reviewed all the narratives provided for each case. All cases in which the narrative described situations other than organized competitive sports participation at the time of injury were excluded
- Of the 1375 cases originally extracted, 1310 (95%) cases met inclusion criteria.





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Methods

$$\text{Annual Incidence of MTBI} = \frac{\text{Sum of estimated case weights for the respective year}}{\text{Total participants for respective sport per 100K person – years}}$$

$$\text{Incidence of MTBI} = \frac{\text{Sum of estimated case weights from 2012 – 2016}}{\text{Total participants from 2012 – 2016 for respective sport per 100K per.}}$$

- Participation Data: 2017 Sports, Fitness, and Leisure Activities Topline Participation Report





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Results

- 2012-2016 → 41,920 ED visits for combat sport-related MTBI
- 2012-2016 Overall Incidences: All Combat Sports → 125.1 per 100k person-years

Incidence of Combat Sport-Related Traumatic Brain Injuries Presenting to the Emergency Departments in the United States From 2012 to 2016

Sport	Boxing	Martial Arts	Wrestling
Incidence per 100K person-years (n)			
2012	80.8 (775.9)	71.1 (2340.1)	304.9 (6068.0)
2013	119.5 (1589.3)	65.0 (2098.4)	310.0 (5673.1)
2014	58.5 (748.6)	58.6 (2163.0)	316.3 (5977.4)
2015	65.8 (894.6)	51.7 (2016.2)	238.3 (4717.7)
2016	103.3 (1250.0)	58.8 (2105.2)	176.9 (3503.3)
Overall incidence (95% CI)	85.6 (83.3-88.0)	60.6 (59.5-61.8)	268.0 (264.7-271.2)*

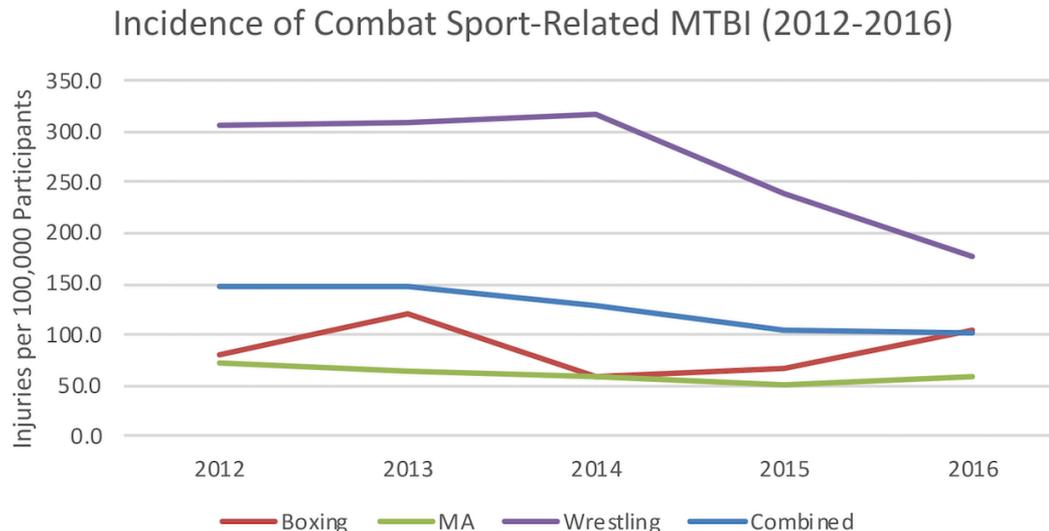
* Denotes statistical significance $P < 0.01$.

CI, confidence interval; N, number of cases (weighted).



Results

- The combined overall incidence declined from 147.2 per 100,000 person-years in 2012 to 101.2 per 100,000 person-years in 2016 ($p < 0.01$).
- Wrestling exhibited the largest decrease in incidence over the study period, decreasing by **42%** while boxing increased by **28%**





Results

- 92.2% Males; 7.8% Females
- The large majority of patients were Caucasian (54.6%)
 - Boxing had the largest proportion of African Americans (17.1%; $p < 0.01$),
 - MA had the largest proportion of Asians (3.6%; $p < 0.01$).
 - Wrestling had largest proportion of Caucasians ($p < 0.01$)

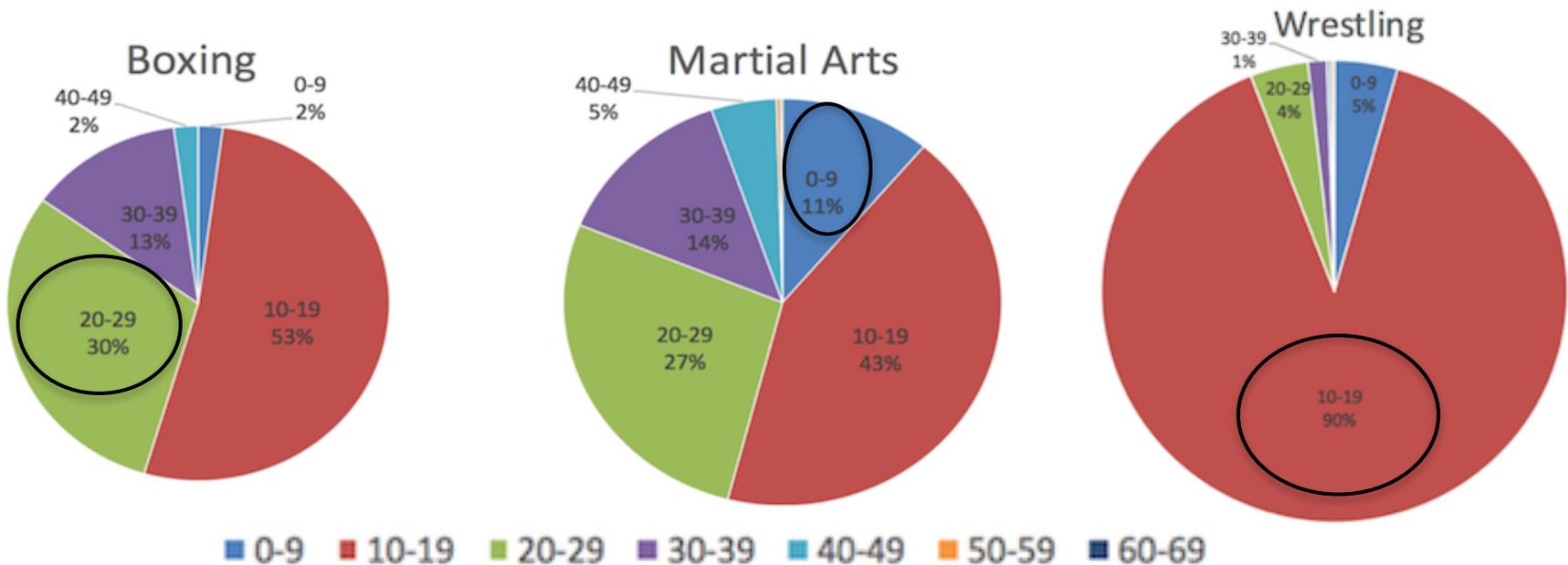
Total Cases (Weighted) of Combat Sport-Related MTBI by Age, Race, and Sex by Sport			
Sport	Boxing	Martial Arts	Wrestling
Age (range [95% CI])	21 (5-49 [20-22])	20 (4-62 [19-21])	15 (6-53 [15-16])*
Race (% of total):			
Not specified	112 (26.2)	120 (39.3)*	336 (25.0)
White	199 (46.5)	135 (44.3)	800 (59.4)*
Black	73 (17.1)*	14 (4.6)	84 (6.2)
Hispanic	38 (8.8)	21 (6.9)	111 (8.2)
Asian	0 (0)	11 (3.6)*	11 (0.8)
American Indian	6 (1.4)	4 (1.3)	0 (0)
Hawaiian/Pacific Islander	0 (0)	0 (0)	4 (0.4)
Total estimated cases by sex (%)	Male: 4693 (89.3)* Female: 565 (10.7)	Male: 8098 (75.6)* Female: 2610 (24.4)	Male: 25 095 (96.7)* Female: 845 (3.3)

* Denotes statistical significance $P < 0.01$.
CI = confidence interval.



Results

- The average age for those injured in boxing, MA, and wrestling was 21.7, 19.9 and 15.0 years old, respectively. The average age was significantly younger for wrestling, compared to boxing and MA ($p < 0.01$)





Results

- No significant differences in regards to patient disposition were seen between combat sports
- Most patients with combat sport-related MTBI were treated and released (96.3%), with only 1.7% of patients being admitted and 0.6% of patients being held for observation.
- Although not significantly different, patients presenting to the ED with MTBI due to boxing were twice as likely to leave without being seen as martial artists (1.6% vs 0.8%) and three times more likely than wrestlers (0.5%).

TABLE 4. Patient Disposition After Combat Sport-Related MTBI From 2012 to 2016

Disposition*	Boxing	Martial Arts	Wrestling
Treated/released	97.5% (417)	95.1% (290)	96.3% (1297)
Transferred	0% (0)	2.3% (7)	0.4% (12)
Admitted	0.9% (11)	1.6% (4)	2.0% (27)
Held for observation	0% (0)	0.2% (1)	0.8% (11)
Left w/o being seen	1.6% (7)	0.8% (2)	0.5% (7)

* Number of cases (weighted).



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Conclusions

- This is the first study to compare the incidence and characteristics of combat sport- related MTBI ED presentations in the United States.
- Wrestling has the largest incidence of combat sport- related MTBI that presented to the ED, followed by boxing and MA.
- Furthermore, the majority of the patients presenting to the ED for combat sport-related MTBI were males less than 20 years old.



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Study Limitations

- NEISS database does not account for the patients that received care outside of emergency departments, including outpatient clinics, urgent care centers, and high school/collegiate athletic training rooms.
- Injury narratives included in the NEISS database are sometimes inconsistent and did not provide uniform information on injury data (mechanism of injury, body site, presence/absence of protective gear, competition vs. practice, etc).
- Participation data



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Discussion

- We must consider injuries that did not present to the ED!
- Is the incidence of MTBIs in wrestling truly larger than boxing and MA, or is this a reflection of participants usage of the healthcare system and/or the social contexts of wrestling compared to other combat sports?
- Boxing VS Wrestling
 - Boxing - “the poor mans sport”
 - Wrestling- a scholastic sport, primarily in the school setting where licensed athletic trainers are more readily available



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Future Directions

- A greater emphasis on required concussion education for both fighters and trainers
- In order to better characterize and understand the incidence of MTBI's in boxing, we propose that sanctioning organizations such as USA Boxing begin to track and maintain databases available for research purposes on injuries during sanctioned competitions, similar to what is done in professional and scholastic sports.
- Enforce policies that require medical clearance by a head injury specialist before returning to competition, to prevent second impact syndrome prior to full recovery.



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Full Text Article



[Clin J Sport Med.](#) 2018 Aug 13. doi: 10.1097/JSM.0000000000000633. [Epub ahead of print]

Incidence of Combat Sport-Related Mild Traumatic Brain Injuries Presenting to the Emergency Department From 2012 to 2016.

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[Phys Sportsmed.](#) 2018 Sep 8:1-6. doi: 10.1080/00913847.2018.1516478. [Epub ahead of print]

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[Lemme NJ](#)¹, [Ready L](#)¹, [Faria M](#)², [DeFroda SF](#)¹, [Gil JA](#)¹, [Owens BD](#)¹.



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Questions?

