

A National Review of Inpatient Admissions for Pediatric Concussion

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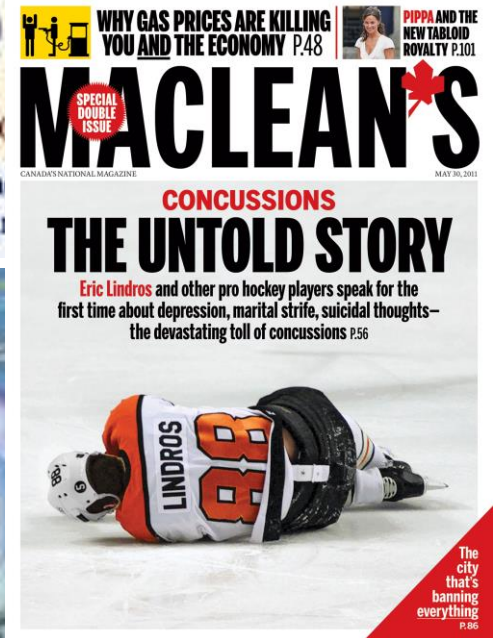
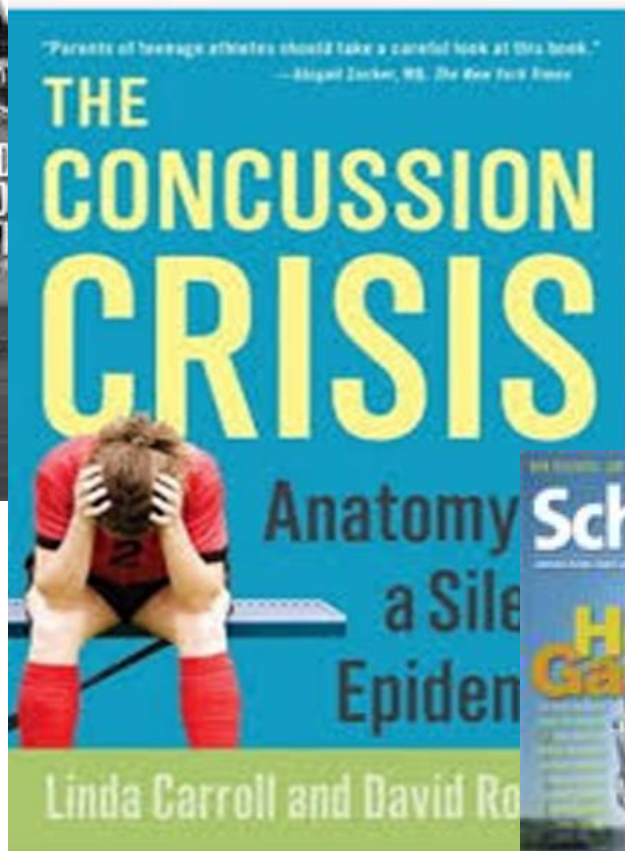
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Disclosures

- The authors have no relevant financial relationships with the manufacturer(s) of any commercial product(s) and/or provider(s) of commercial services discussed in this CME activity.
- I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation.

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- Indications for admission and goals of inpatient care for pediatric concussion are unclear
- Significant inter-hospital variability in the admission rates for pediatric concussion (5-72%) (*Bourgeois 2014*)

**Evaluate national trends of pediatric
hospitalizations for concussion
from 2007-2013**

Design: Retrospective cohort

Source: Pediatric Health Information System
(PHIS) Database – 42 hospitals

Study Period: 2007 - 2013

Participants: Children hospitalized with
traumatic brain injury (TBI)

Inclusion Criteria

- **Ages 0-18 years**
- **Inpatient or observational unit charges**
- **International Classification of Diseases, Clinical Modification, Ninth revision (ICD9-CM)**
TBI-related codes
 - “Concussion” patients
 - Subset of ICD9-CM diagnosis codes: 850.0–850.9
 - Head Abbreviated Injury Score* 1-2
 - Total Injury Severity Score* of ≤ 6
- *Calculated using ICDMAP-90 software (Tri-Analytics, Inc.)*

Outcome

- Proportion of all TBI admissions for concussion

Analyses

- Trend analysis over time using the Cochran-Armitage Trend Test

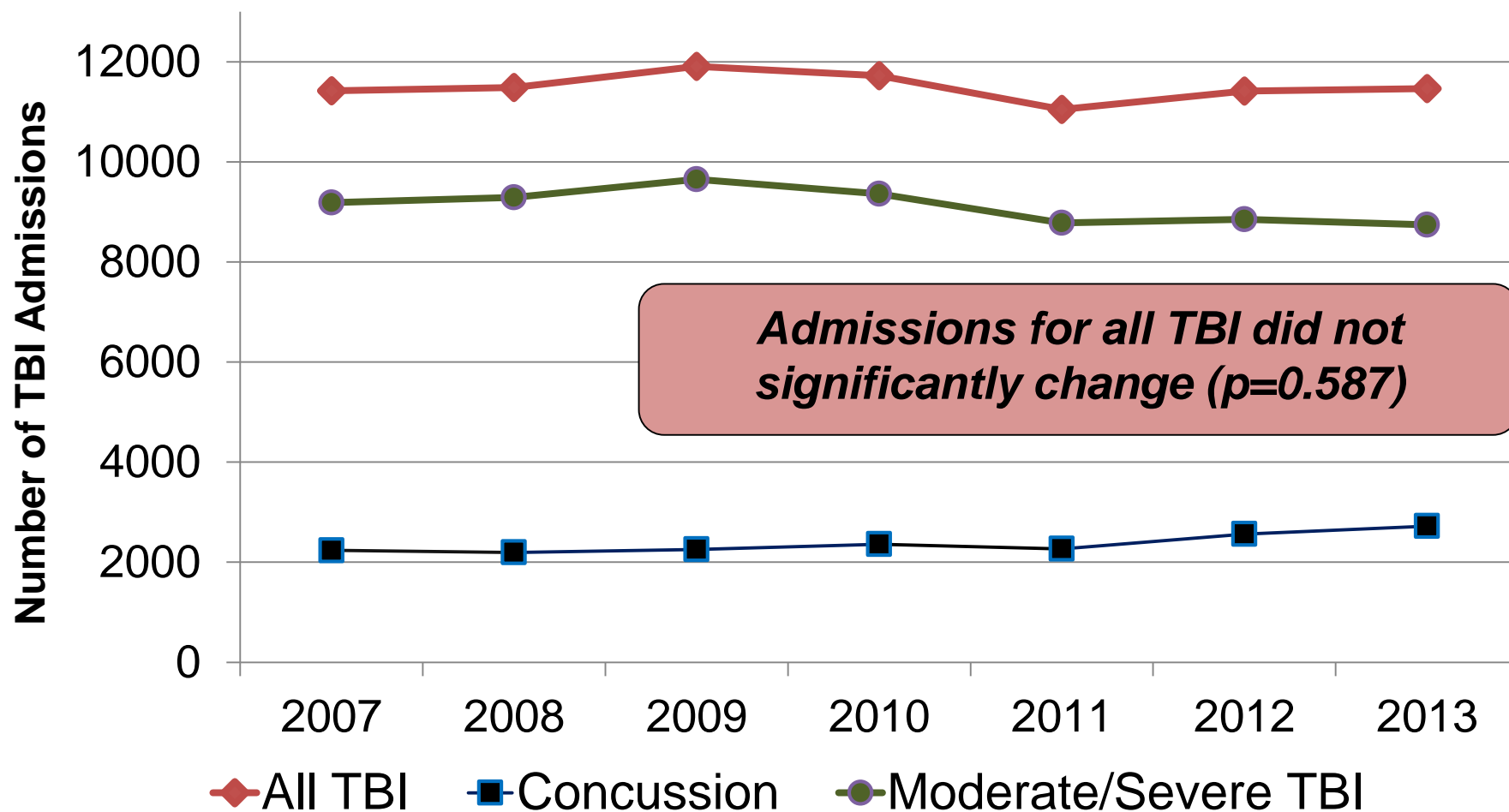
Data Elements

- | | |
|---|--|
| <ul style="list-style-type: none">• Age• Race• Gender | <ul style="list-style-type: none">• Payer type• Mechanism of injury• Hospital size |
|---|--|

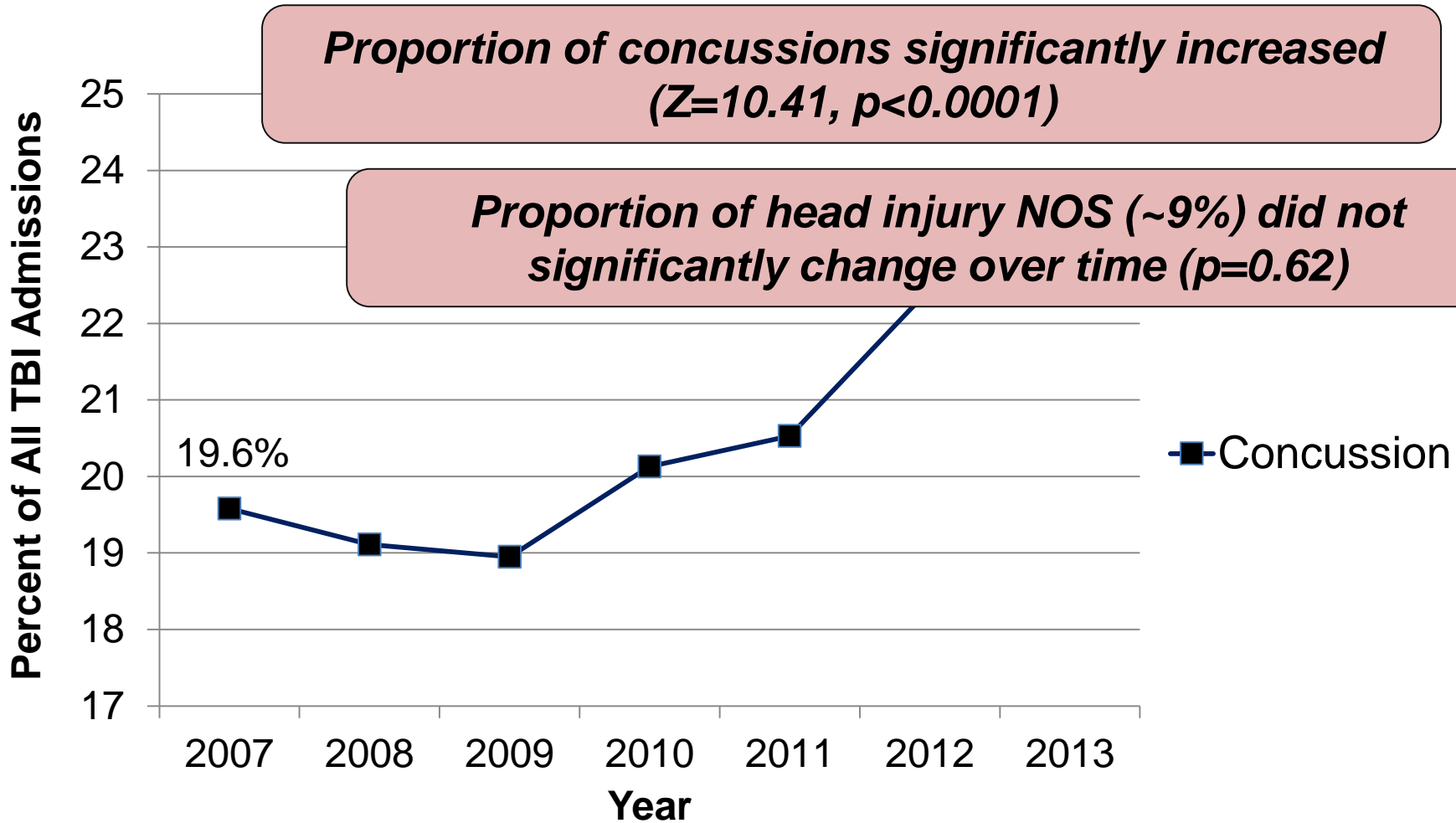
Analyses

- Descriptive analysis of data elements
- Trend analysis over time using the Cochran-Armitage Trend Test

Proportion of Concussion Admissions versus Overall TBI Admissions

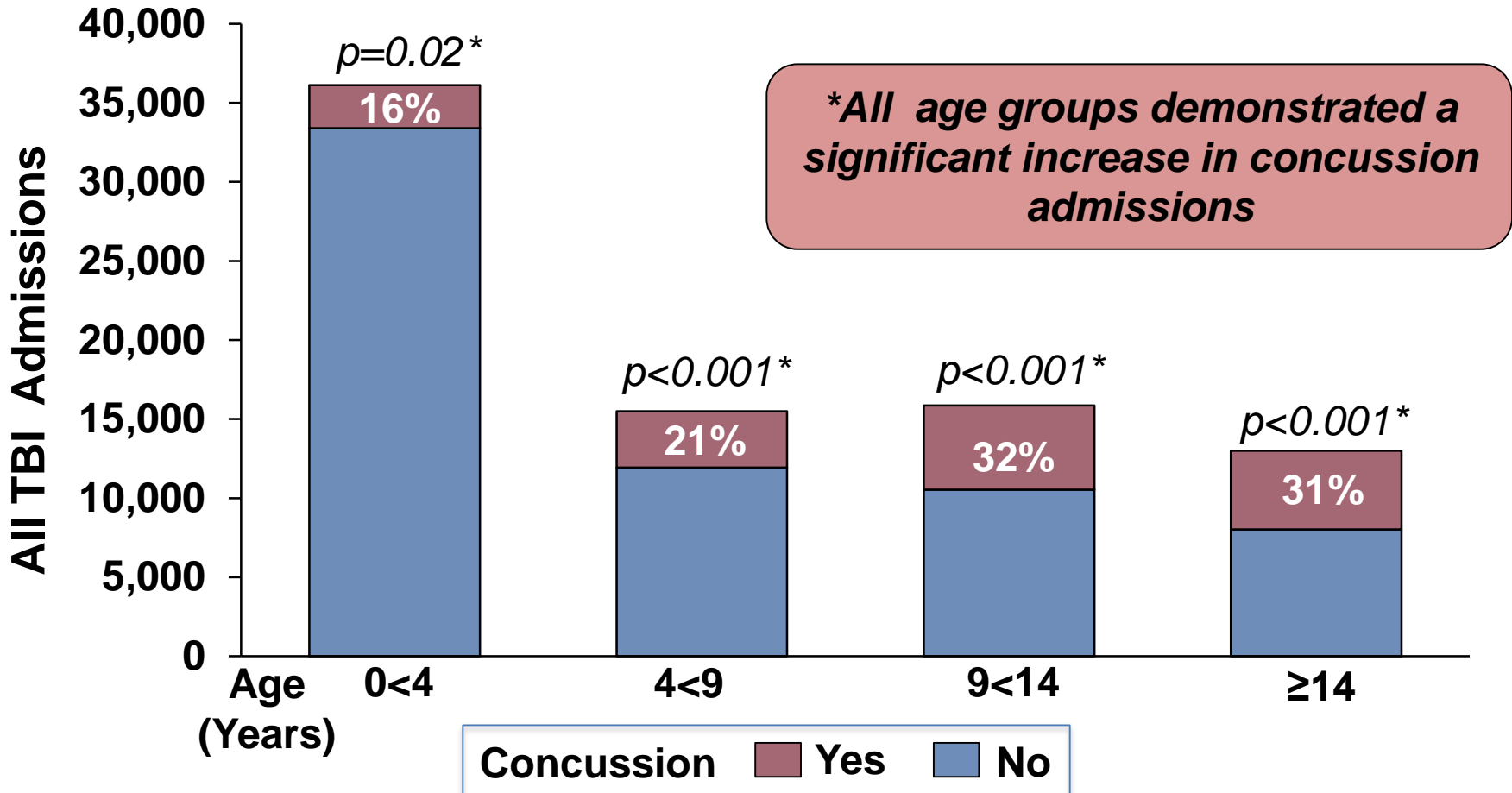


Proportion of TBI Admissions that were Concussions from 2007-2013





Age of Children Admitted with Concussion from 2007-2013 (N= 16,599)

	Median (IQR)	Mean (\pm SD)
Years	11 (6-14)	9.8 (5)




Characteristics of Children Admitted with Concussion from 2007-2013 and Changes Over Time (N= 16,599)







Data Element	% of Cohort	Change over Time p-value*
Race (N=16578)		
Black	22%	<0.001 
White	63%	0.05
Other	15%	<0.0001 
Gender (N=16557)		
Male	67%	0.28

*Based on Cochran-Armitage Trend Test

Denoted significant p-values <0.05

Increasing 

Decreasing 

Data Element	% of Cohort	Change over Time p-value*
Payer Type (N=16,599)		
Government	42%	<0.0001 
Non-Government	41%	0.43
Self Pay	14%	<0.0001 
Mechanism (14,431)		
Fall	32%	<0.0001 
Motor Vehicle Collision	25%	<0.0001 
Transport	7%	0.34
Struck by/against	9%	0.74
Sports	13%	<0.001 
Other	12%	<0.01 

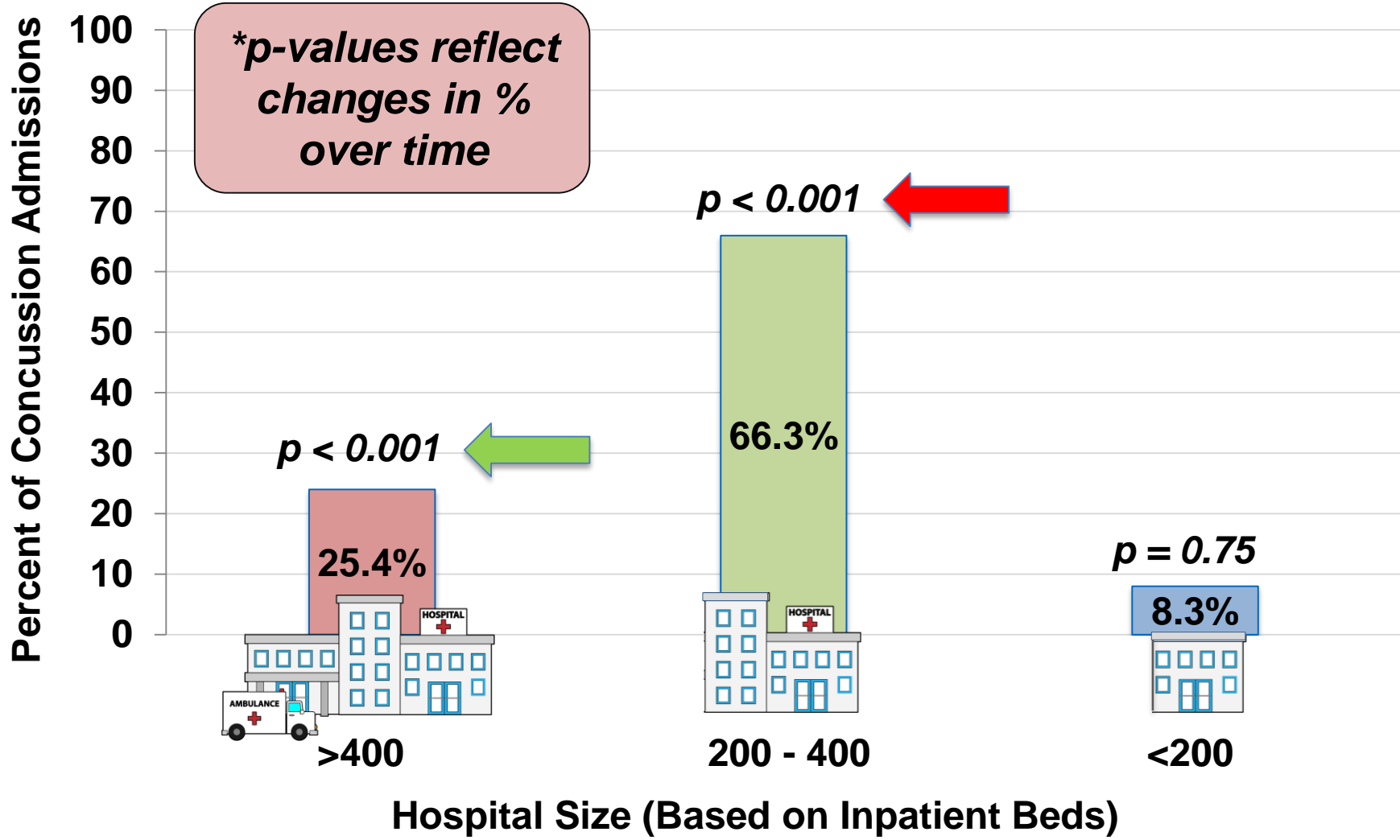
*Based on Cochran-Armitage Trend Test

Denoted significant p-values <0.05.

Increasing 

Decreasing 

Percentage of Children Admitted with Concussion Based on Hospital Size from 2007-2013 (N= 16,599)



- Despite a stable rate of admissions for pediatric TBI, the proportion of children admitted for concussion significantly increased to almost 24%
- The majority of children admitted for concussion were male (67%), white (63%), and had a median age of 11 years
- Falls and motor vehicle collisions accounted for 55% of concussion admissions
 - Sports increased from 10 to 15%

- Administrative database
- Severity of TBI determined by ICD-9 codes
- Generalizability

- Concussions account for a substantial portion of pediatric TBI admissions
- Additional work is needed detailing the interventions made during admissions
 - help understand outcomes following inpatient care
 - lead to the development of evidenced-based inpatient care guidelines

1. Faul M, Xu L, Wald MW, Coronado VG. Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations, and Deaths 2002-2006. 2010
2. Mannix R, O'Brien MJ, Meehan WP 3rd. The epidemiology of outpatient visits for minor head injury: 2005 to 2009. *Neurosurgery*. 2013 Jul;73(1):129-34; discussion 134.
3. Schneier AJ, Shields BJ, Hostetler SG, Xiang H, Smith GA. Incidence of pediatric traumatic brain injury and associated hospital resource utilization in the United States. *Pediatrics*. 2006 Aug;118(2):483-92.
4. Blinman TA, Houseknecht E, Snyder C, Wiebe DJ, Nance ML. Postconcussive symptoms in hospitalized pediatric patients after mild traumatic brain injury. *J Pediatr Surg*. 2009 Jun;44(6):1223-8.
5. Bourgeois FT, Monuteaux MC, Stack AM, Neuman MI. Variation in emergency department admission rates in US children's hospitals. *Pediatrics*. 2014 Sep;134(3):539-45.
6. Tri-Analytics, Inc. and Johns Hopkins University. ICDMAP-90 Software User's Guide. 1997

- **Thank you:**

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- Amy Liu

- Oliver Rhine

- **Questions?**

EXTRA SLIDES

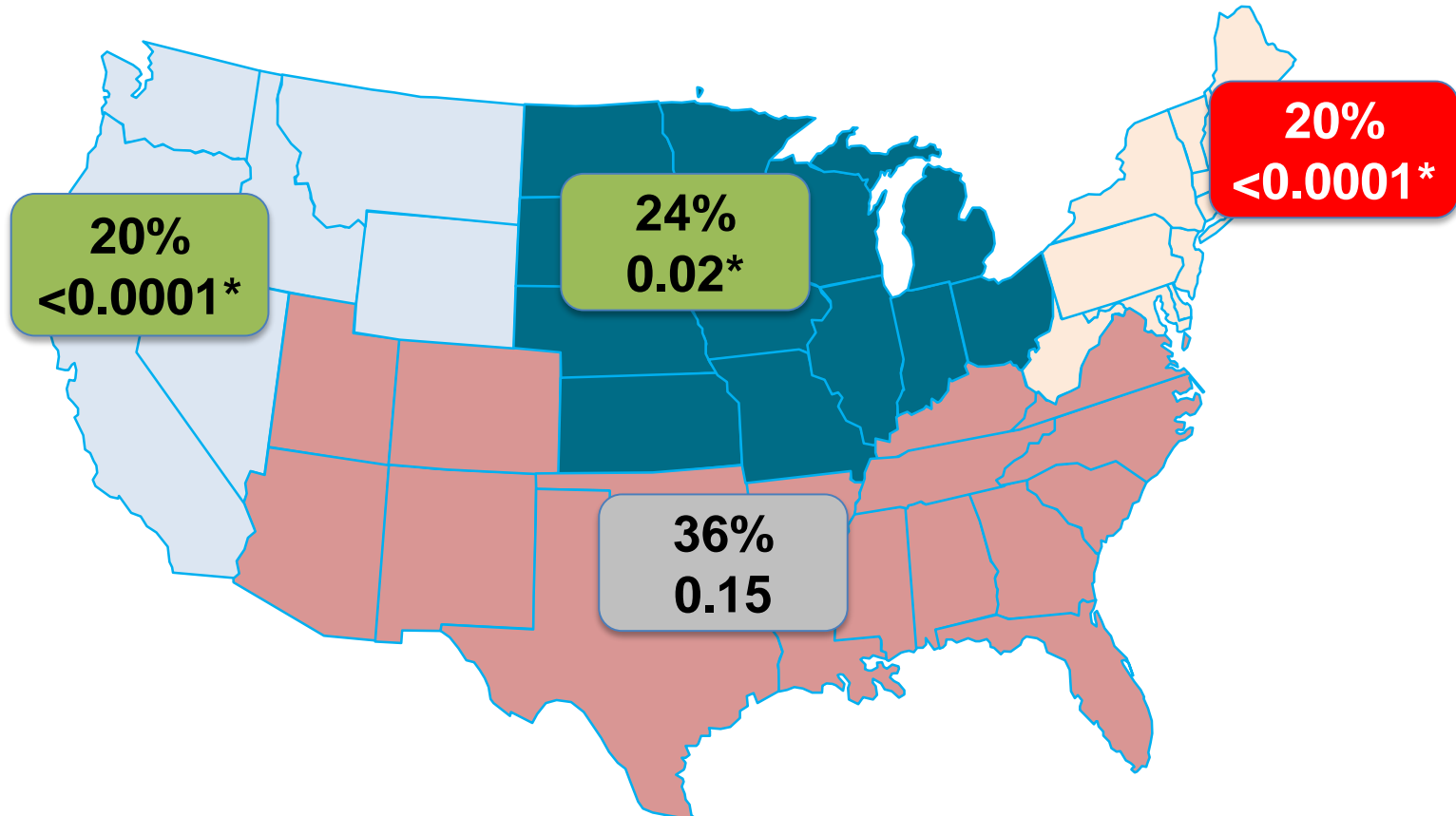
Length of Stay for Inpatient Pediatric Concussion Admission		
	Median (IQR)	Mean (\pmSD)
Length of Stay (Days)	1 (1-2)	1.8 (3.5)

Care Practices During Inpatient Pediatric Concussion Admission	
Variable	% of Cohort
Nonnarcotic pain medication	56.6%
Narcotic pain medication	30.1%
Antiemetic medication	35.3%
Maintenance IV fluids	48.1%
Head CT	72.1%

Length of Stay for Inpatient Pediatric Concussion Admission		
	Median (IQR)	Mean (\pmSD)
Length of Stay (Days)	1 (1-2)	1.8 (3.5)

Predictors of Length of Stay for Inpatient Pediatric Concussion Admission (0-1 vs >1 Day)	
Significant Variable	Odds Ratio (95% Confidence Interval)
Age	1.02 (1.01-1.03)
Payer Type (Govt vs Self)	1.23 (1.09-1.39)
Hospital Size (Large vs Small)	1.18 (1.01-1.38)
Region (West vs Midwest)	1.41 (1.25-1.6)
Region (West vs South)	1.16 (1.01-1.3)
Mechanism (Motor Vehicle vs Sport)	3.64 (3.17-4.18)
Mechanism (Transport vs Sport)	2.65 (2.22-3.15)

Percentage of Children Admitted with Concussion Based on Hospital Region from 2007-2013 (N= 16,599)



***Significant changes over time are denoted by box color: Green increasing % and Red decreasing %**