Impact of Trauma Center Designation in Pediatric Renal Trauma: National Trauma Data Bank Analysis
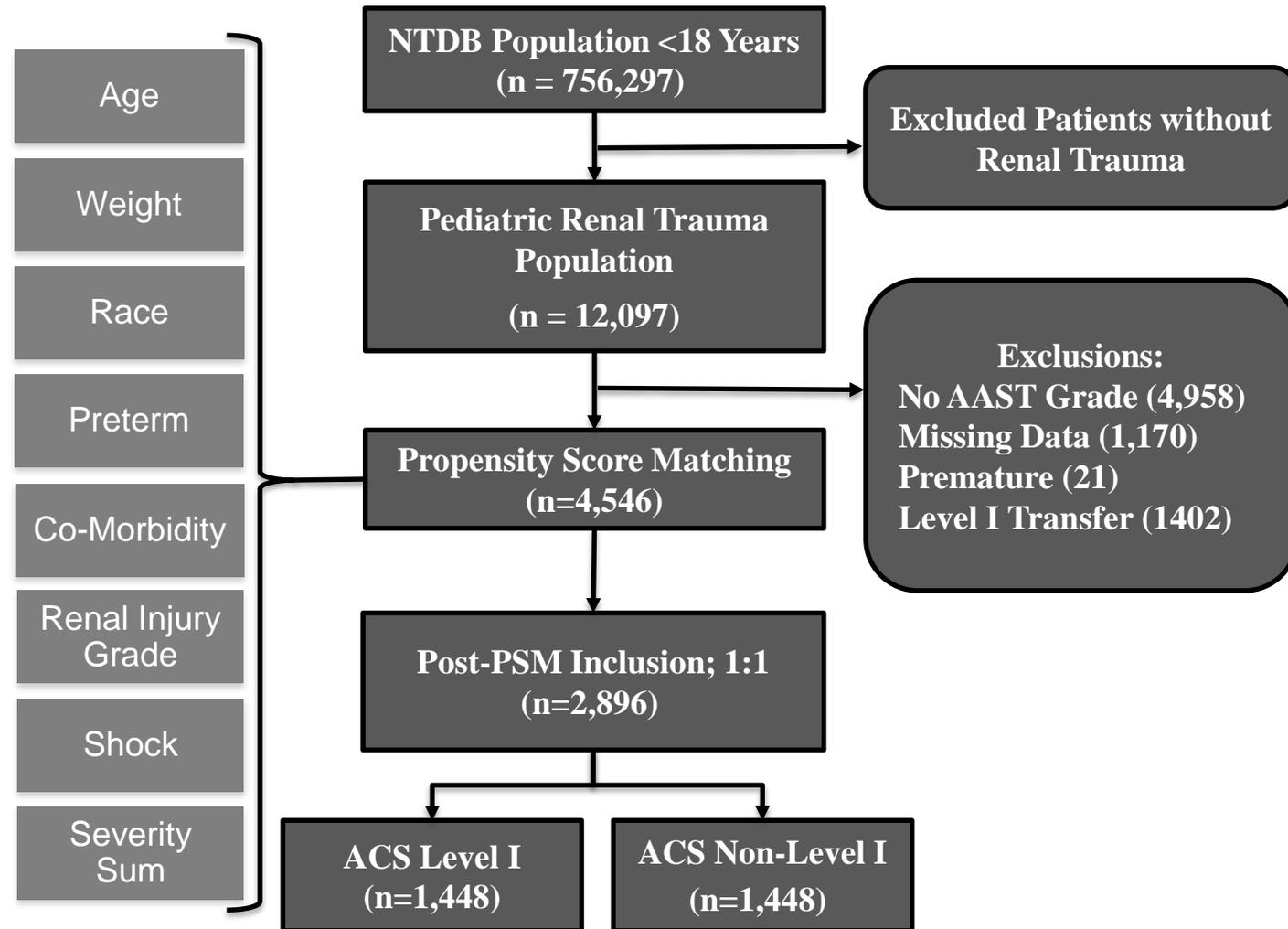
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Objective

- Kidneys are a common organ of injury after abdominal trauma occurring in up to 10% of events

- The overall incidence of Pediatric Renal Trauma is over 125,000 Cases / Year

- Trauma Centers in the US are based on a hierarchical system (Level I-V)

- **Primary Aim**: Compare Operative and Conservative Management approaches for Pediatric Renal Trauma among Level I Trauma Designated Hospitals Vs Non-Level I Designation

- **Secondary Aim**: Compare Complications from Renal Trauma across Trauma Level Designations

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Study Design

- ACS National Trauma Data Bank 2011-2016

- All Patients <18 Years with Renal Injury

- Propensity Score Matching

- Subjects categorized by:
  - AAST Renal Injury Grade
  - Management Strategy
  - Trauma Level Designation

Age

Weight

Race

Preterm

Co-Morbidity

Renal Injury Grade

Shock

Severity Sum

NTDB Population <18 Years (n = 756,297)

Excluded Patients without Renal Trauma

Pediatric Renal Trauma Population (n = 12,097)

Exclusions:
No AAST Grade (4,958)
Missing Data (1,170)
Premature (21)
Level I Transfer (1402)

Propensity Score Matching (n=4,546)

Post-PSM Inclusion; 1:1 (n=2,896)

ACS Level I (n=1,448)

ACS Non-Level I (n=1,448)

Demographics

- Differences in cohorts prior to Propensity Score Matching:
  - Gender
  - Race
  - Psychiatric Disease
  - Drug Abuse
  - Presenting Vital Signs
  - Injury Severity Sum
  - Mechanism
  - Injury Intent

Prior to PSM

	Level I	Non-Level I	p
n	1454	3554	
Age (in years): mean (SD)	13.92 (4.38)	13.84 (4.11)	0.572
Gender: Male (%)	961 (66.1)	2473 (69.6)	0.017
Race (%)			<0.001
White	820 (56.4)	2340 (65.8)	
African American	323 (22.2)	636 (17.9)	
Other/ Unknown	311 (21.4)	578 (16.3)	
Prematurity (%)	9 (0.6)	9 (0.3)	0.089
Congenital Anomalies (%)	10 (0.7)	30 (0.8)	0.697
Drug abuse (%)	34 (2.3)	31 (0.9)	<0.001
Major psychiatric illness (%)	54 (3.7)	74 (2.1)	0.001
ED SBP: mean (SD)	119.02 (24.39)	122.35 (21.77)	<0.001
ED PULSE: mean (SD)	103.45 (27.70)	99.86 (26.38)	<0.001
ED RR: mean (SD)	20.97 (7.16)	20.09 (6.68)	<0.001
V	102 (7.0)	224 (6.3)	
Severity Sum: mean (SD)	23.53 (17.80)	18.95 (15.80)	<0.001
Injury type (%)			<0.001
Blunt	1213 (83.4)	3166 (89.1)	
Other/unspecified	30 (2.1)	83 (2.3)	
Penetrating	211 (14.5)	304 (8.6)	
Injury Intent (%)			<0.001
Assault	200 (13.8)	293 (8.2)	
Self-inflicted	13 (0.9)	20 (0.6)	
Undetermined/Other	11 (0.8)	40 (1.1)	
Unintentional	1230 (84.6)	3201 (90.1)	

Demographics

- No difference between cohorts after matching

	Prior to PSM			Post-PSM		
	Level I	**Non-Level I**	**p**	**Level I**	**Non-Level I**	**p**
n	1454	3554		1448	1448	
Age (in years): mean (SD)	13.92 (4.38)	13.84 (4.11)	0.572	13.91 (4.39)	13.84 (4.27)	0.69
Gender: Male (%)	961 (66.1)	2473 (69.6)	0.017	956 (66.0)	936 (64.6)	0.458
Race (%)			<0.001			0.732
White	820 (56.4)	2340 (65.8)		818 (56.5)	838 (57.9)	
African American	323 (22.2)	636 (17.9)		321 (22.2)	315 (21.8)	
Other/ Unknown	311 (21.4)	578 (16.3)		309 (21.3)	295 (20.4)	
Prematurity (%)	9 (0.6)	9 (0.3)	0.089	9 (0.6)	8 (0.6)	1
Congenital Anomalies (%)	10 (0.7)	30 (0.8)	0.697	10 (0.7)	13 (0.9)	0.675
Drug abuse (%)	34 (2.3)	31 (0.9)	<0.001	30 (2.1)	26 (1.8)	0.686
Major psychiatric illness (%)	54 (3.7)	74 (2.1)	0.001	52 (3.6)	48 (3.3)	0.76
ED SBP: mean (SD)	119.02 (24.39)	122.35 (21.77)	<0.001	119.04 (24.42)	118.84 (24.67)	0.829
ED PULSE: mean (SD)	103.45 (27.70)	99.86 (26.38)	<0.001	103.39 (27.67)	104.30 (28.37)	0.383
ED RR: mean (SD)	20.97 (7.16)	20.09 (6.68)	<0.001	20.95 (7.14)	20.77 (7.59)	0.509
V	102 (7.0)	224 (6.3)		101 (7.0)	100 (6.9)	
Severity Sum: mean (SD)	23.53 (17.80)	18.95 (15.80)	<0.001	23.39 (17.56)	23.36 (17.78)	0.961
Injury type (%)			<0.001			0.613
Blunt	1213 (83.4)	3166 (89.1)		1209 (83.5)	1225 (84.6)	
Other/unspecified	30 (2.1)	83 (2.3)		30 (2.1)	32 (2.2)	
Penetrating	211 (14.5)	304 (8.6)		209 (14.4)	191 (13.2)	
Injury Intent (%)			<0.001			0.607
Assault	200 (13.8)	293 (8.2)		198 (13.7)	178 (12.3)	
Self-inflicted	13 (0.9)	20 (0.6)		12 (0.8)	15 (1.0)	
Undetermined/Other	11 (0.8)	40 (1.1)		11 (0.8)	14 (1.0)	
Unintentional	1230 (84.6)	3201 (90.1)		1227 (84.7)	1241 (85.7)	

Results

- Primary Outcomes between Level I and Non-Level I Trauma Designations
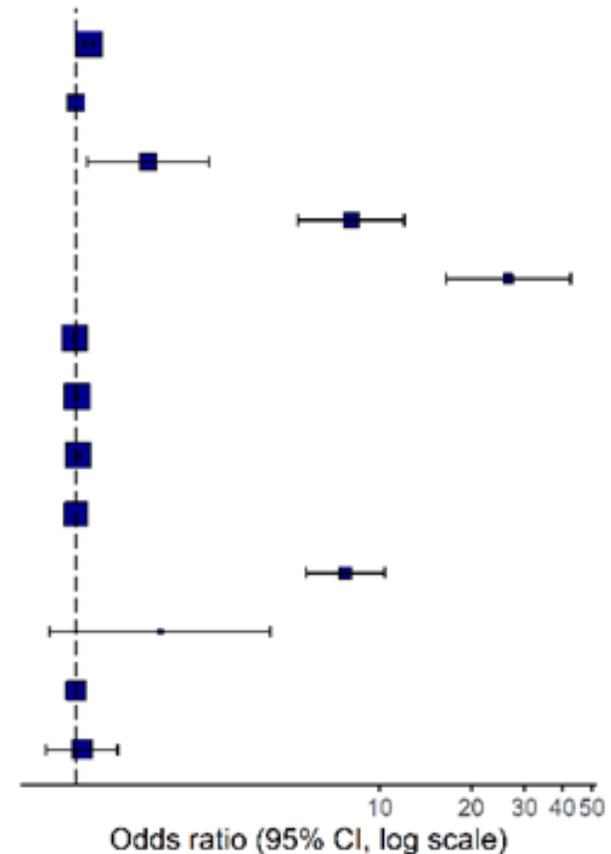 - No differences in between Cohorts

	Level I Designation	**Non-Level I Designation**	**P-Value**
Mortality (%)	67 (4.6)	64 (4.4)	0.798
Any Complication (%)	167 (11.5)	153 (10.6)	0.441
Nephrectomy (%)	73 (5.0)	72 (5.0)	1
Interventional Radiology Procedure (%)	63 (4.4)	58 (4.0)	0.71
Operative Intervention (%)	108 (7.5)	104 (7.2)	0.831
Blood Transfusion (%)	301 (20.8)	275 (19.0)	0.244

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Results

- Logistic Regression Model for: **Any Intervention**

Results

- Logistic Regression Model for: **Any Complication**

Any Complication: OR (95% CI, p-value)

		OR (95% CI, p-value)
Age (Years)	Mean (SD)	1.06 (1.02-1.10, p=0.002)
Gender	Female	-
	Male	0.77 (0.58-1.01, p=0.062)
AAST	I-II	-
	III	1.29 (0.93-1.79, p=0.128)
	IV	1.53 (1.09-2.15, p=0.014)
	V	1.66 (1.06-2.62, p=0.028)
ED SBP	Mean (SD)	0.99 (0.99-1.00, p=0.033)
ED Pulse	Mean (SD)	1.01 (1.01-1.02, p<0.001)
Prematurity	No	-
	Yes	3.31 (0.73-15.05, p=0.121)
Injury Type	Blunt	-
	Penetrating	2.72 (1.94-3.82, p<0.001)
	Other/unspecified	0.61 (0.14-2.64, p=0.509)
Severity Sum	Mean (SD)	1.05 (1.04-1.06, p<0.001)
Hospital Tier	Non-Level I	-
	Level I	1.06 (0.82-1.38, p=0.656)

Odds ratio (95% CI, log scale)

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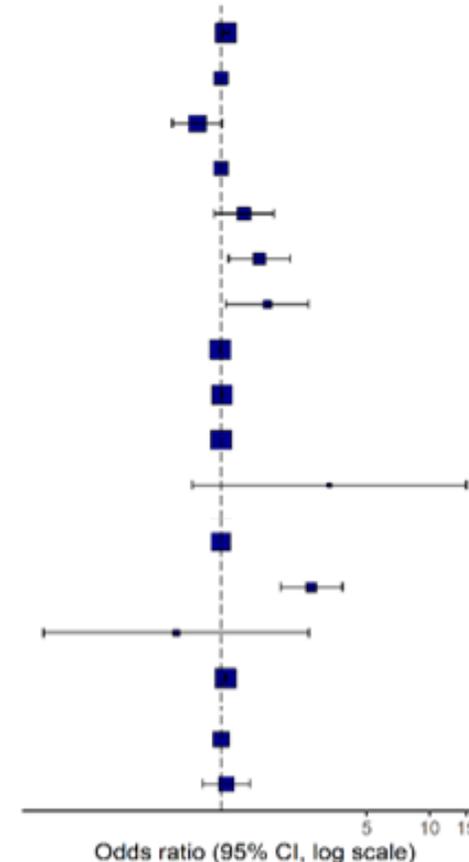
Conclusion and Limitations

- **Caveats:**
  - Retrospective Review
  - Convenience Sample; Without inclusion of all Trauma Centers

- Pediatric Renal Trauma is managed similarly across Tiered Trauma Centers
- No difference in Mortality or Complication Rate between Trauma Tiers
- Renal Injury Grade and Mechanism of Injury are important elements to predict intervention and complication rates

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