National Pediatric Readiness Assessment and Outcome Information

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National Pediatric Readiness Project

Multi-phase quality improvement initiative to ensure that ALL U.S emergency departments have the essential resources to provide effective emergency care to children.

Measurement

- Web-based assessment of ED readiness for children completed in 2013 provided baseline data for quality improvement and research projects
- > 80% Response Rate
- Main measure of readiness was the Weighted Pediatric Readiness Score (WPRS) with highest score of 100.

Important Findings Include…

- Emergency Departments with
  - High pediatric volume have higher WPRS
  - A nurse and/or physician PECC have higher WPRS
  - A pediatric facility recognition program in their state have higher WPRS
- Findings suggest that pediatric readiness can be improved through processes but we were missing information on health outcomes, including a link between pediatric readiness and mortality outcomes

Getting to Outcomes

- Need to link or associate the NPRP database with other databases
- Larger undertaking than examining the NPRP data alone
- Three studies that linked or associated other databases with the NPRP data to increase our understanding on the importance of pediatric readiness.

Getting to Outcomes

- Dr. Kristin Ray: Cross-sectional analysis of geographic access to Pediatric Readiness EDs
- Drs. Marianne Gausche-Hill and Stefanie Ames: ED Readiness and Mortality in Critically Ill Children
- Dr. N. Clay Mann: ED Readiness and hospital mortality and in-hospital complications for injured children

The Value of Pediatric Readiness for the Emergency Care of Children - Trauma

Disclosures

- None

Funding

- National Institute of Child Health and Human Development (NICHD)
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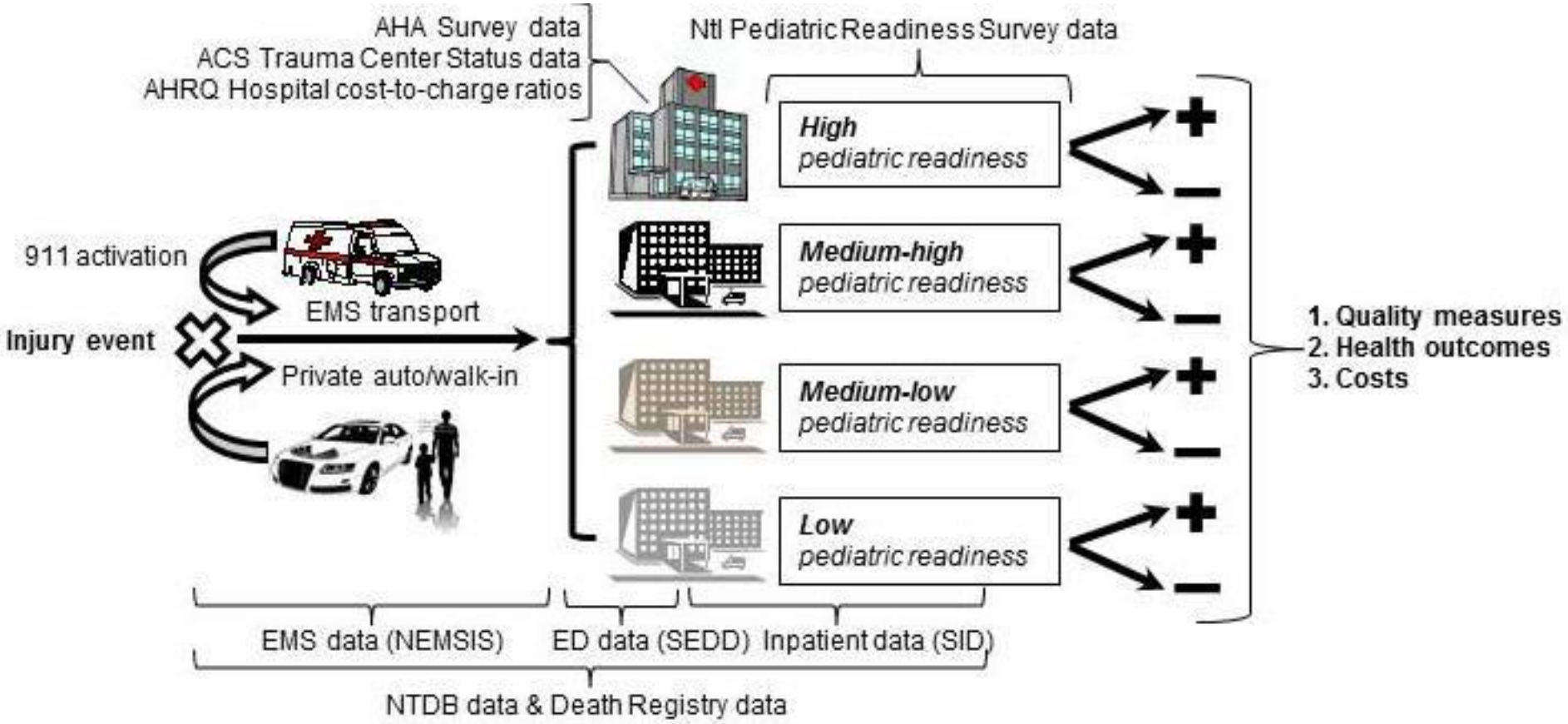
- 9/30/2017 - 6/30/2022

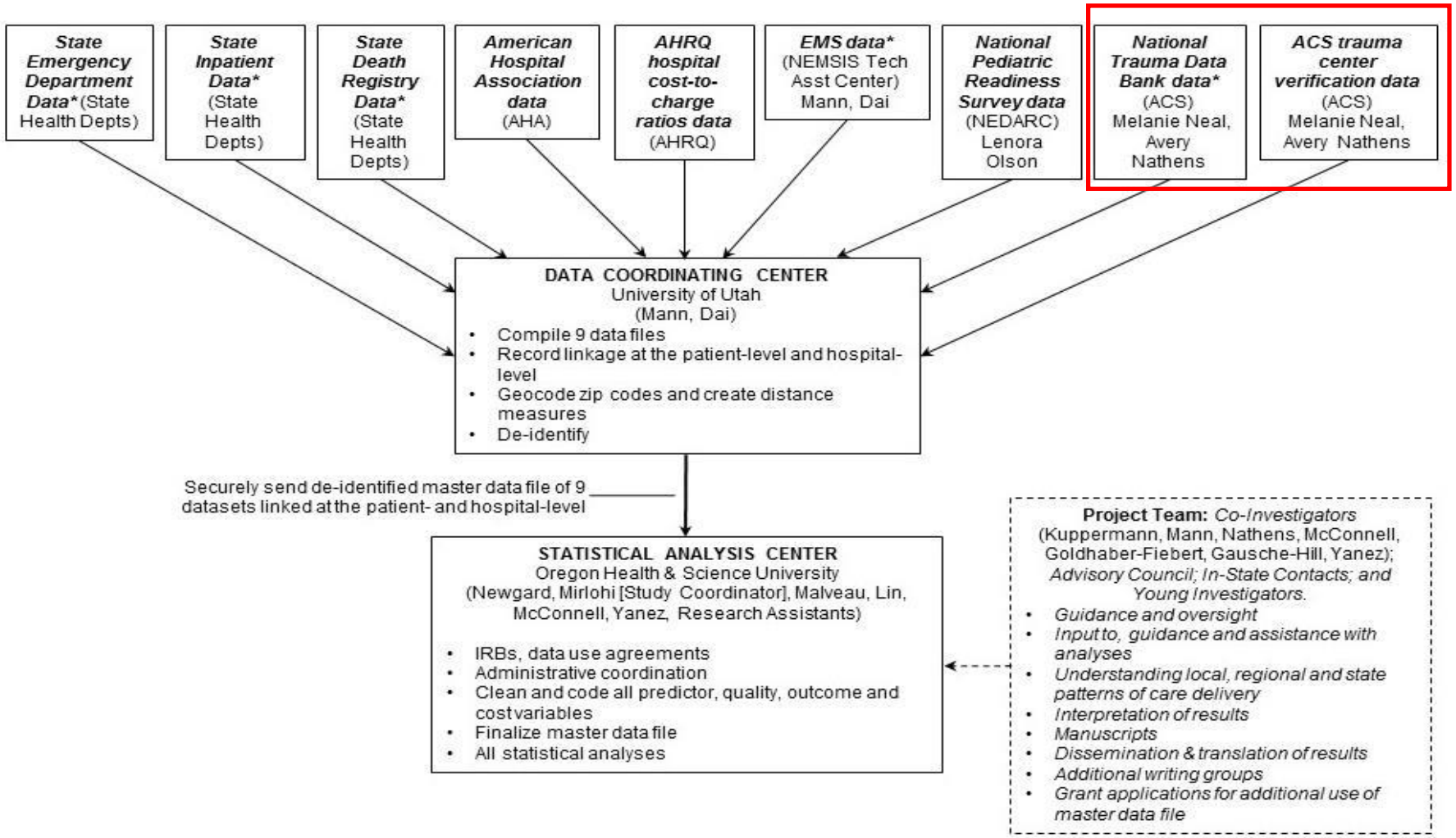
Background

- Unintentional injury is the leading cause of death and years of potential life lost in children
- Use of emergency services after injury is common
- History of National Pediatric Readiness Program
- Large variability in the readiness of EDs to care for children
- Unclear if increased readiness improves quality and health outcomes in children

Full Project - Conceptual Model



Full Project Data Flow & Coordination



*There are 5 patient-level data sets. The additional 4 datasets are at the hospital-level.

Aims - Trauma

1. Describe and quantify the trauma care of children across 44 states in the context of ED pediatric readiness using NTDB.

2. Evaluate the adjusted association between ED pediatric readiness, in-hospital mortality, and complications among injured children admitted to a hospital and included in NTDB.

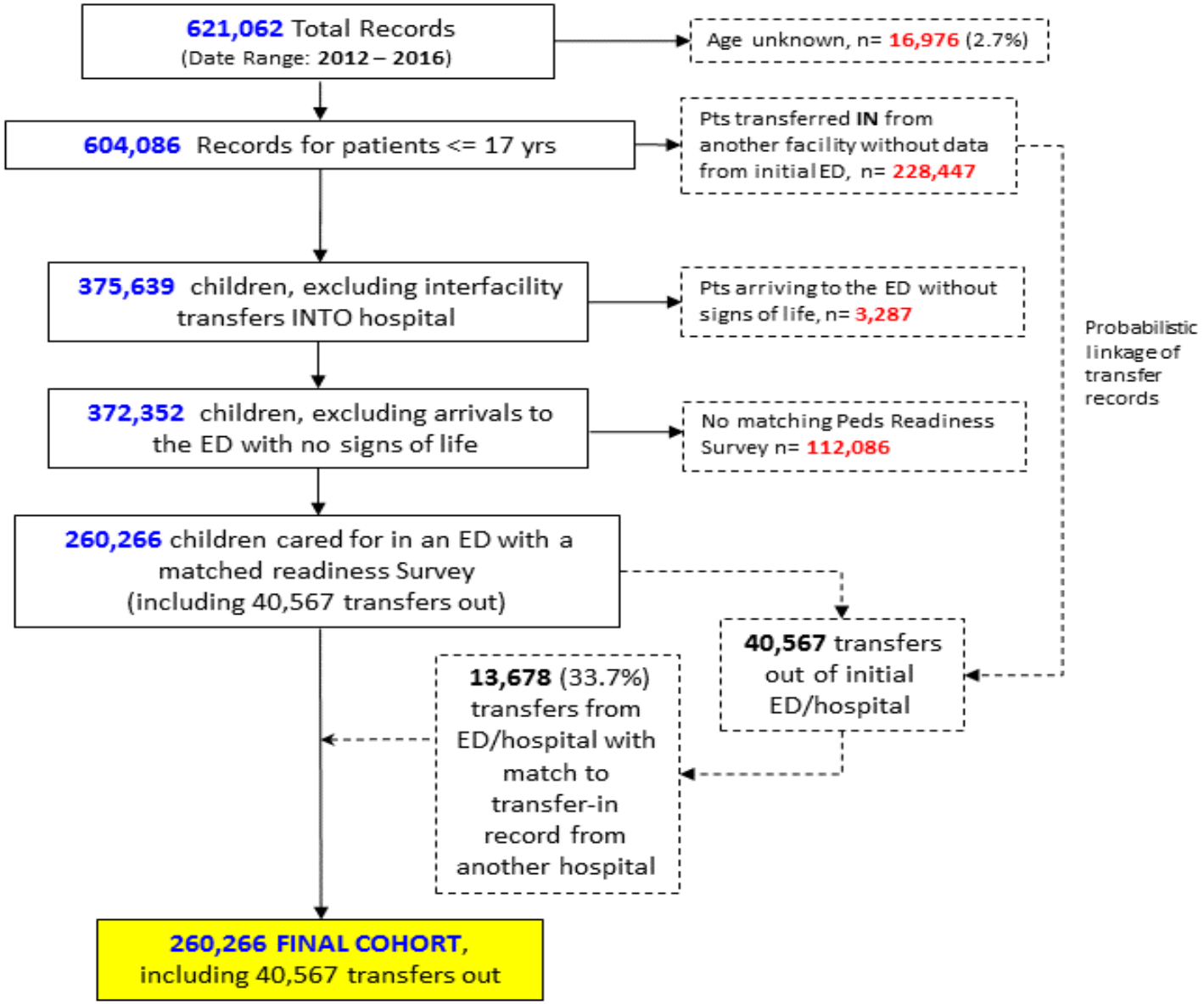
National Trauma Data Base (NTDB)

- 44 states, 1/1/2012 – 12/31/2016
- 639 hospitals (trauma centers I-V, non-trauma hospitals participating in some states)
- Children 0 – 17 years (trauma registry criteria):
  - Admitted
  - Transferred (We exclude inter-facility transfers INTO the hospital)
  - In-hospital death due to trauma
- Linkage to state death records for 10 states (in process)

Pediatric Readiness Survey

- Conducted in 58 states and Territories
- 2012-2013
- 6 domains:
  1. Policies, procedures, protocols
  2. Patient safety
  3. Equipment and supplies
  4. Quality improvement
  5. Personnel
  6. Administration and coordination
- Overall score = weighted pediatric readiness score (WPRS) from the 6 domains

Cohort creation



Variables

- Patient-level:
  - Demographics (age, sex, race)
  - Mode of arrival
  - Initial physiologic measures (GCS, SBP, respiratory rate)
  - Mechanism of injury (16 categories)
  - Comorbidities
  - Injury severity (AIS, ISS)
  - Surgical procedures on head, neck, chest, or abd-pelvis
  - Orthopedic surgery
  - Blood transfusion
  - Airway/ventilatory support
  - Critical care procedures (vasopressors, ECMO, mechanical vent)
  - Transfer status (from ED vs inpatient)
- Hospital-level:
  - ***ED pediatric readiness*** (weighted measure 0-100)
  - Trauma center level (I-V, none)
  - Pediatric status
  - Annual pediatric trauma volume

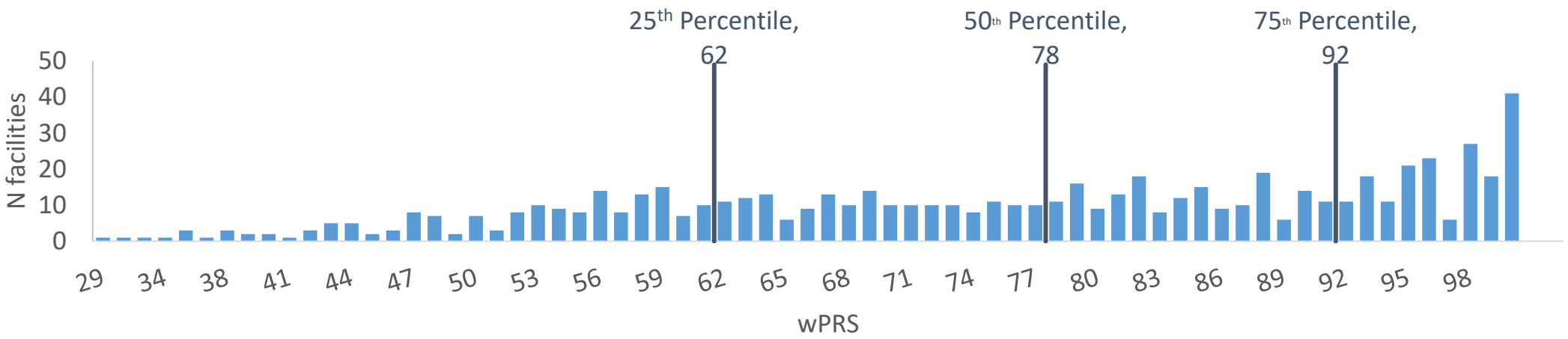
Outcomes

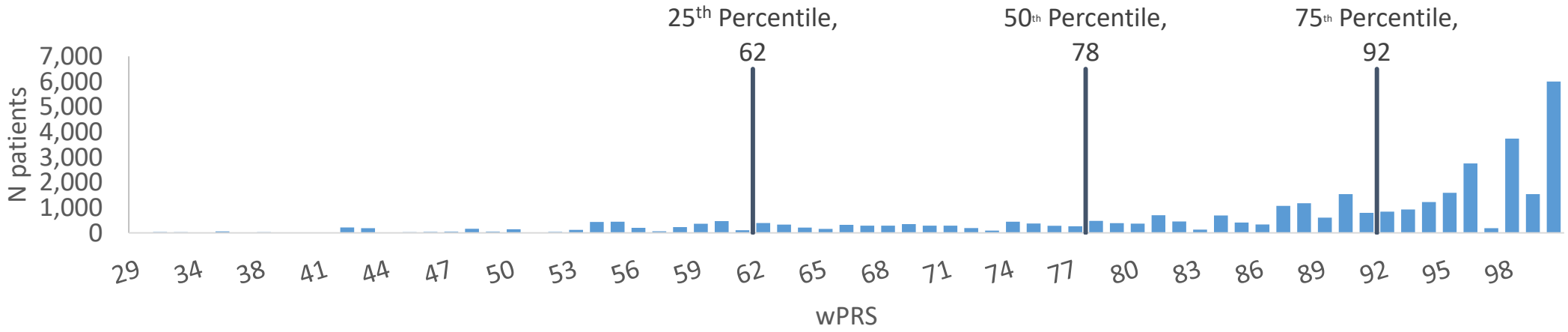
- In-hospital mortality
- Complications:
  - ARDS or acute lung injury
  - Decubitus ulcer
  - Central line associated infection
  - UTI
  - Acute kidney injury
  - Venous thrombo-embolism
  - Pneumonia
  - Osteomyelitis
  - Surgical infection
  - Sepsis
  - Unplanned admission to ICU
- Composite (death or any complication)
- 1-year mortality (in process of linkage)

Statistical Analysis

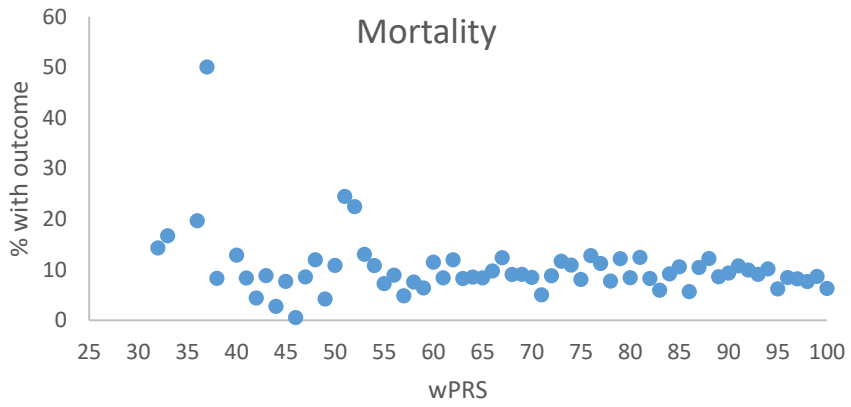
- Probabilistic linkage:
  - transfers out (ED/inpatient) matched to transfers in
  - State death registries from 10 states to generate 1-year mortality
- Multiple imputation for handling missing values
- Descriptive statistics
- **Primary analysis: ISS >= 16**
- Key subgroups: head AIS >= 3; max AIS >= 3
- Sensitivity analyses: All NTDB
- Pediatric readiness: quartiles
- Risk adjustment: mixed effects logistic regression models clustering on hospital including covariates of patient demographics, injury and clinical characteristics, and procedures.

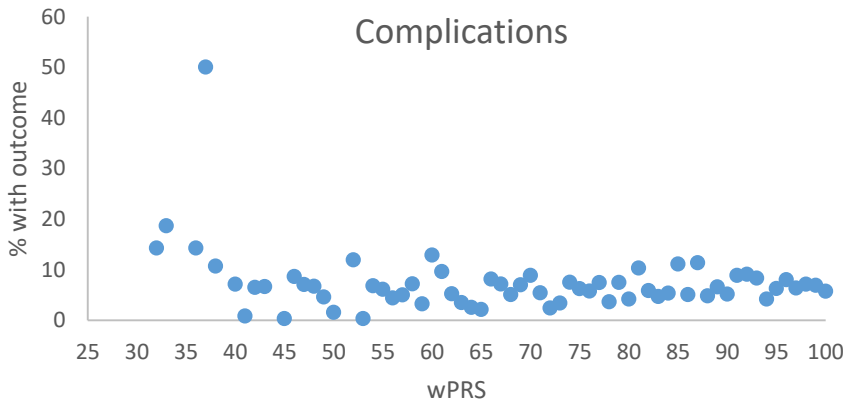
Quartiles of ED Pediatric Readiness by Hospital and Patient

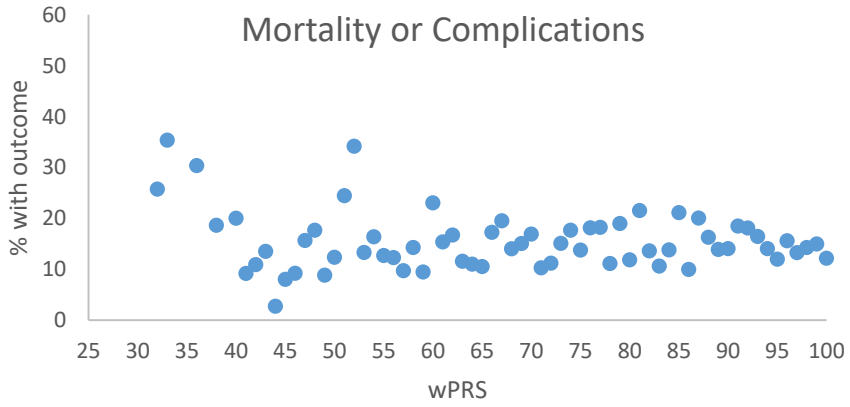




Unadjusted Rate of Outcomes by WPRS for ISS≥16





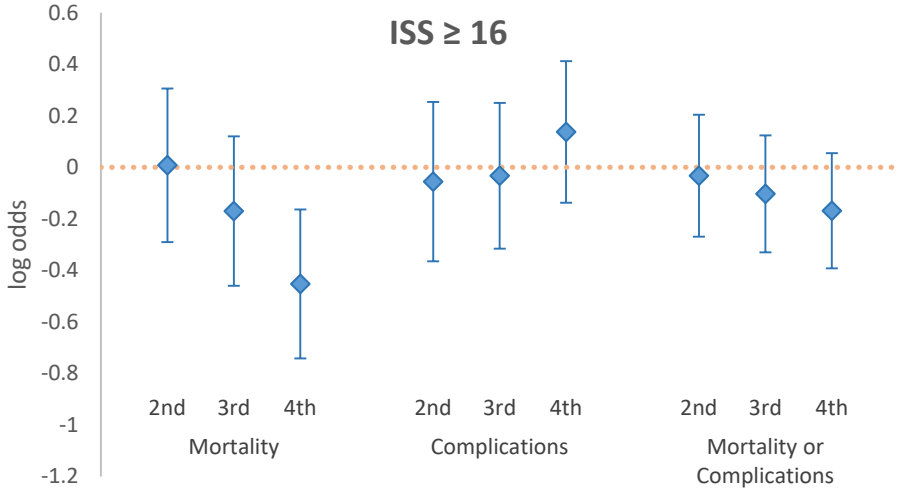


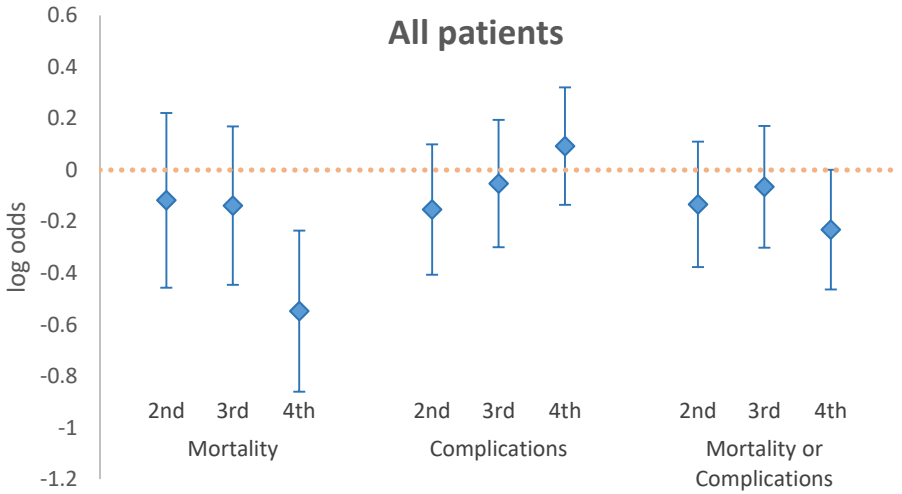
Multivariable Model Results

Adjusted odds ratios & 95% confidence intervals

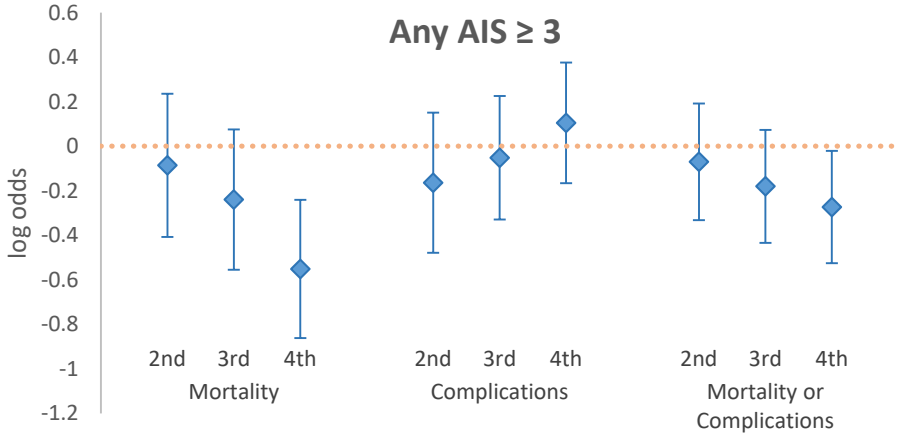
Sample	wPRS Quartile	Mortality	Complications	Mortality or Complications
ISS ≥ 16	1st Least Ready	referent	referent	referent
	2nd	1.01(0.75-1.36)	0.95(0.69-1.29)	0.97(0.76-1.23)
	3rd	0.84(0.63-1.13)	0.97(0.73-1.28)	0.90(0.72-1.13)
	4th Most Ready	***0.64(0.48-0.85)***	1.15(0.87-1.51)	0.84(0.67-1.06)
All patients	1st Least Ready	referent	referent	referent
	2nd	0.89(0.63-1.25)	0.86(0.67-1.10)	0.88(0.69-1.12)
	3rd	0.87(0.64-1.18)	0.95(0.74-1.22)	0.94(0.74-1.19)
	4th Most Ready	***0.58(0.42-0.79)***	1.10(0.87-1.38)	0.79(0.63-1.00)
Head AIS ≥ 3	1st Least Ready	referent	referent	referent
	2nd	0.92(0.67-1.27)	0.85(0.62-1.16)	0.93(0.72-1.21)
	3rd	0.79(0.57-1.08)	0.95(0.72-1.25)	0.83(0.65-1.08)
	4th Most Ready	***0.58(0.42-0.79)***	1.11(0.85-1.46)	***0.76(0.59-0.98)***
Any AIS ≥ 3	1st Least Ready	referent	referent	referent
	2nd	0.91(0.66-1.26)	0.86(0.65-1.13)	0.88(0.70-1.11)
	3rd	0.85(0.62-1.15)	0.92(0.71-1.19)	0.90(0.72-1.13)
	4th Most Ready	***0.58(0.42-0.79)***	1.06(0.83-1.36)	***0.78(0.63-0.98)***

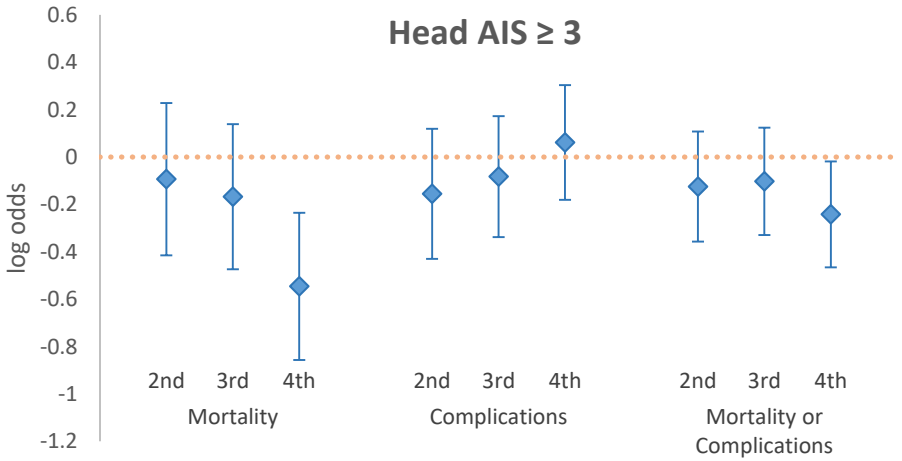
Adjusted OR and 95% CI of Outcomes, as Compared to Least Ready Quartile (reference group)



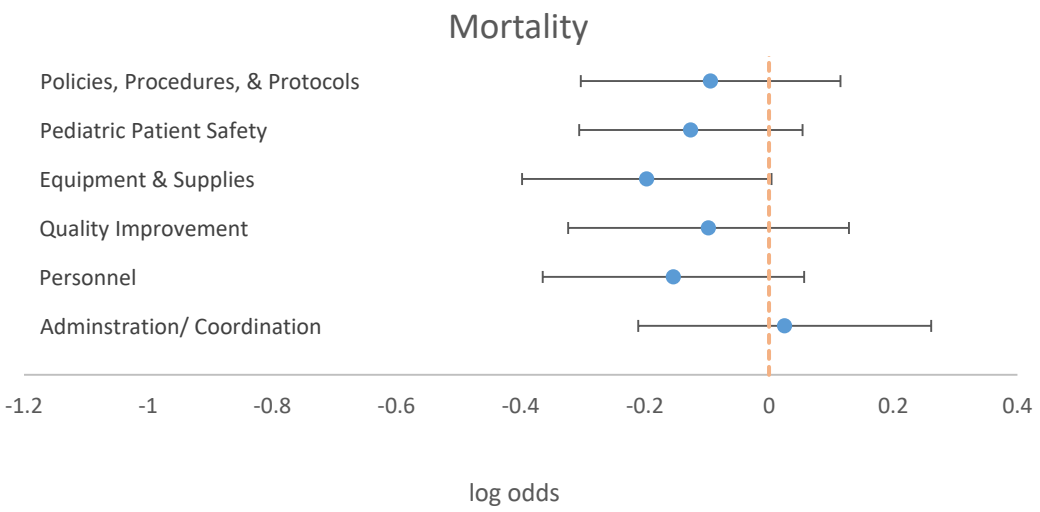


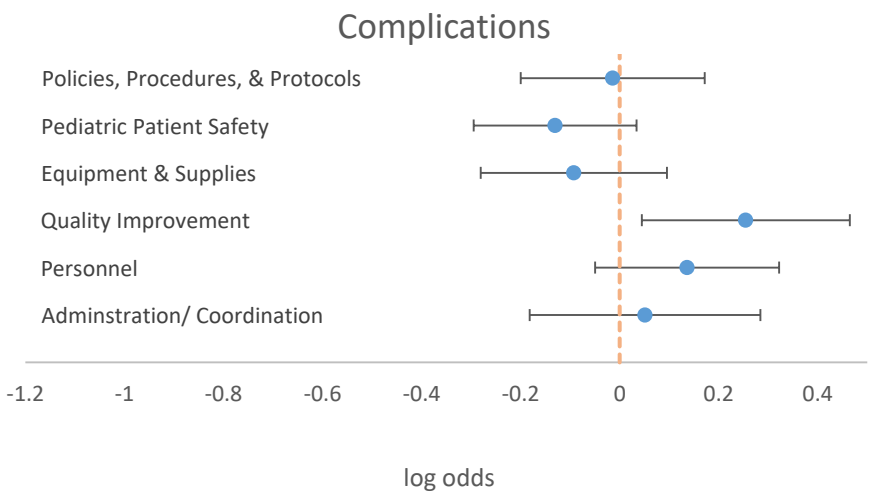
Readiness Quartiles

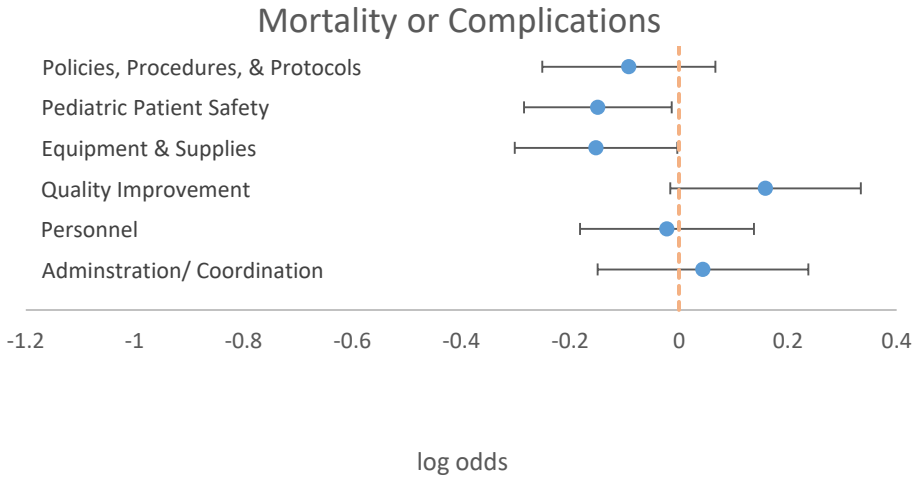




Adjusted OR and 95% CI of Outcomes by Domain (6) for ISS≥16







SENSITIVITY ANALYSES: Multivariable model for ISS≥16, adding facility-level characteristics

Sample	wPRS Quartile	Mortality	Complications	Mortality or Complications
Primary Analysis ISS ≥ 16	**1st Least Ready**	referent	referent	referent
	2nd	1.01(0.75-1.36)	0.95(0.69-1.29)	0.97(0.76-1.23)
	3rd	0.84(0.63-1.13)	0.97(0.73-1.28)	0.90(0.72-1.13)
	4th Most Ready	***0.64(0.48-0.85)***	1.15(0.87-1.51)	0.84(0.67-1.06)
Including TC Level	**1st Least Ready**	referent	referent	referent
	2nd	0.99(0.75-1.32)	0.96(0.7-1.32)	0.96(0.76-1.22)
	3rd	0.91(0.69-1.20)	0.96(0.73-1.28)	0.93(0.74-1.16)
	4th Most Ready	***0.74(0.56-0.98)***	1.12(0.84-1.48)	0.89(0.71-1.12)
Including TC Level & Peds TC Level	**1st Least Ready**	referent	referent	referent
	2nd	1.03(0.78-1.37)	0.96(0.7-1.33)	0.98(0.77-1.24)
	3rd	0.96(0.73-1.26)	0.95(0.71-1.26)	0.94(0.74-1.18)
	4th Most Ready	0.82(0.62-1.09)	1.07(0.8-1.43)	0.90(0.71-1.14)
Including TC Level, Peds TC Level & ED Peds Volume	**1st Least Ready**	referent	referent	referent
	2nd	0.98(0.73-1.32)	1.04(0.75-1.42)	0.99(0.77-1.26)
	3rd	0.88(0.65-1.20)	1.05(0.76-1.44)	0.95(0.73-1.22)
	4th Most Ready	0.75(0.55-1.03)	1.19(0.86-1.65)	0.91(0.70-1.19)

Limitations

- Obtaining and preparing divergent State datasets for probabilistic linkage is difficult and time consuming
- Limited to children included in NTDB (met trauma registry inclusion criteria)
- Primarily reflective of US trauma centers – may not represent all US EDs/hospitals
- In-hospital outcomes only (1-year mortality linkage in process)

Preliminary Conclusions

- Increasing Pediatric Readiness scores associate with an accumulating protective effect against in-hospital mortality
- In-hospital complications were not independently associated Pediatric Readiness….additional analyses are need to understand trending

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Thank You