Cutting Edge HSR Techniques

A View of Expertise from the Trauma Community

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Objectives

1. Brief overview of **selected HSR methods** of increasing **importance in the trauma literature**
2. Showcase **how you might use these techniques**
3. Highlight **expertise in the trauma research community**

The Power of Hierarchical Data

Clusters, Caterpillars, and So Much More

Why Hierarchical Modelling?

Assumptions of Most Regression Models:

1. Model fits data
2. Model is not over-specified
3. No influential observations
4. Observations are *independent*

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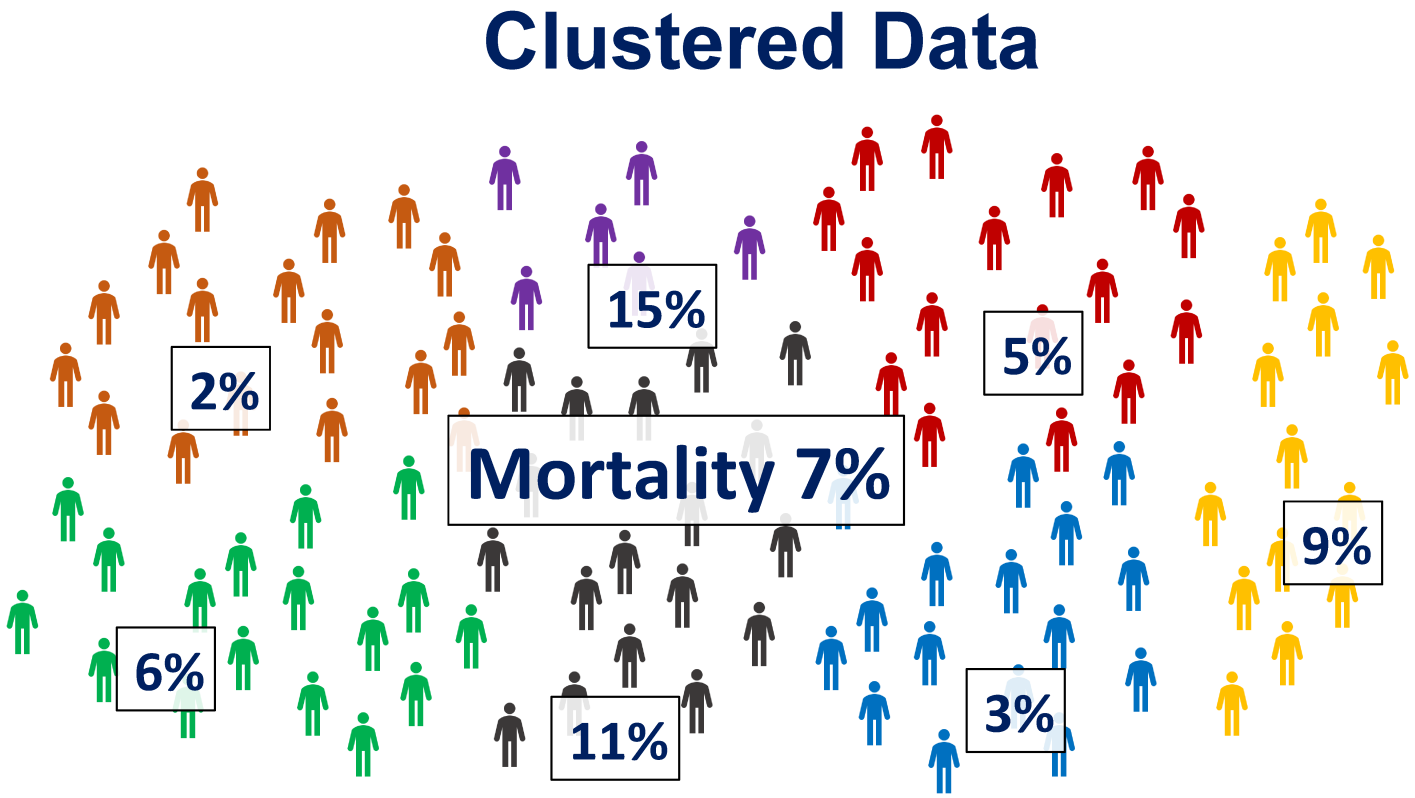
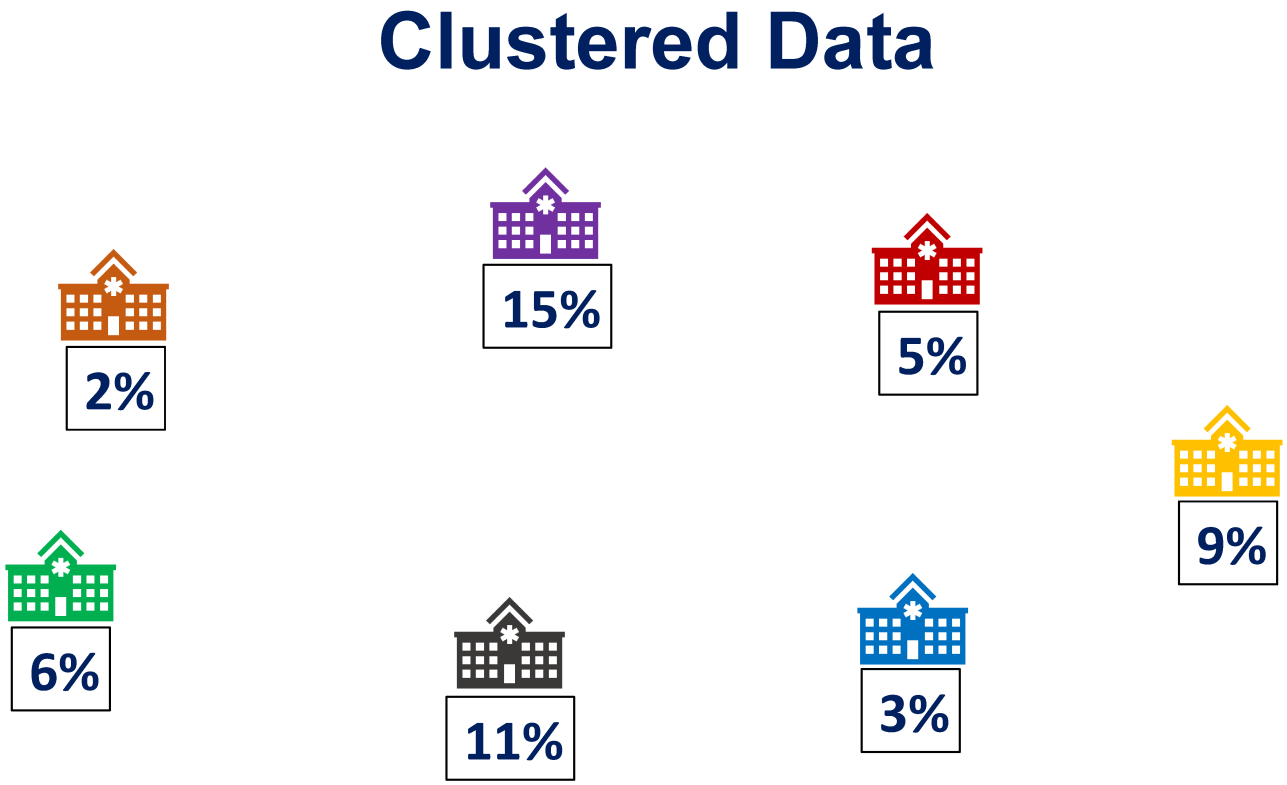
Clustered Data
Mortality 7%


Clustered Data
2%
15%
5%
Mortality 7%
9%
6%
11%
3%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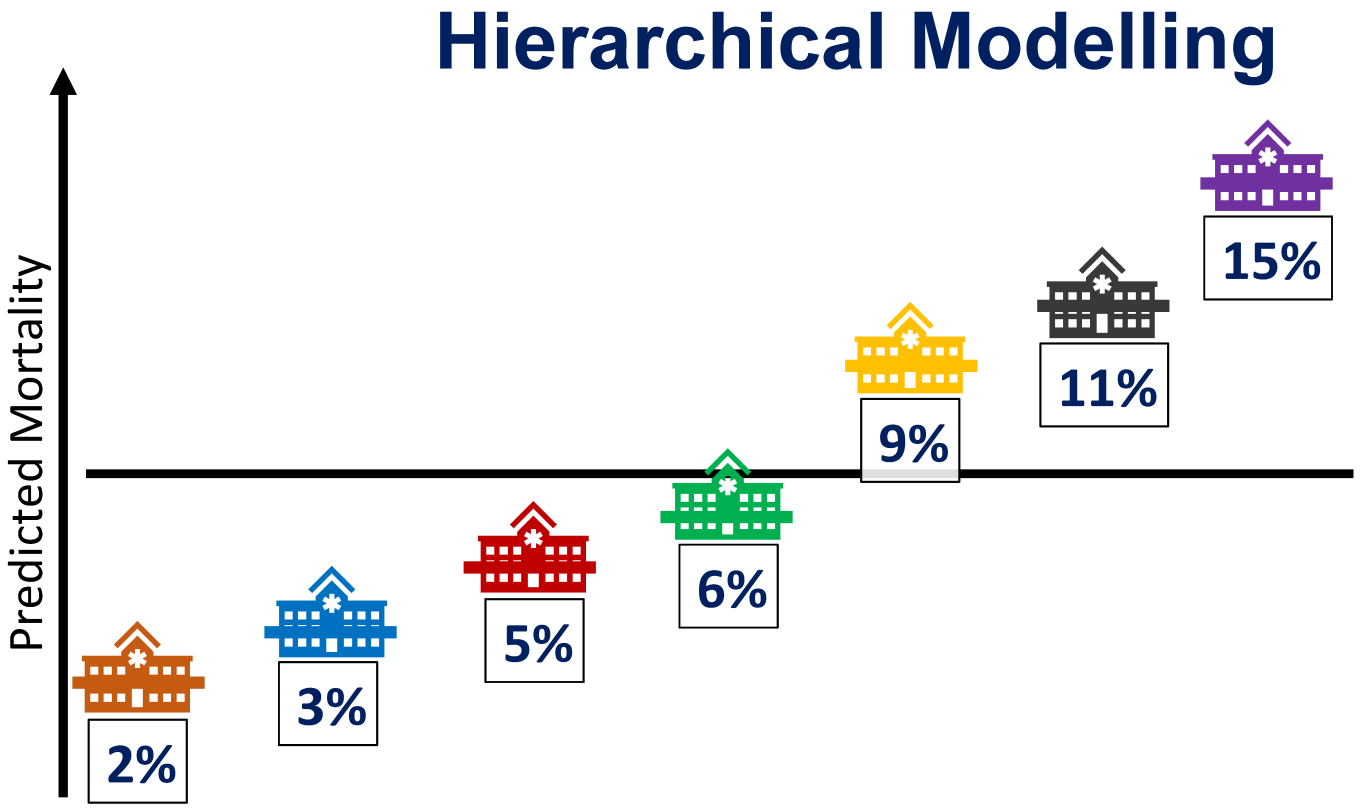
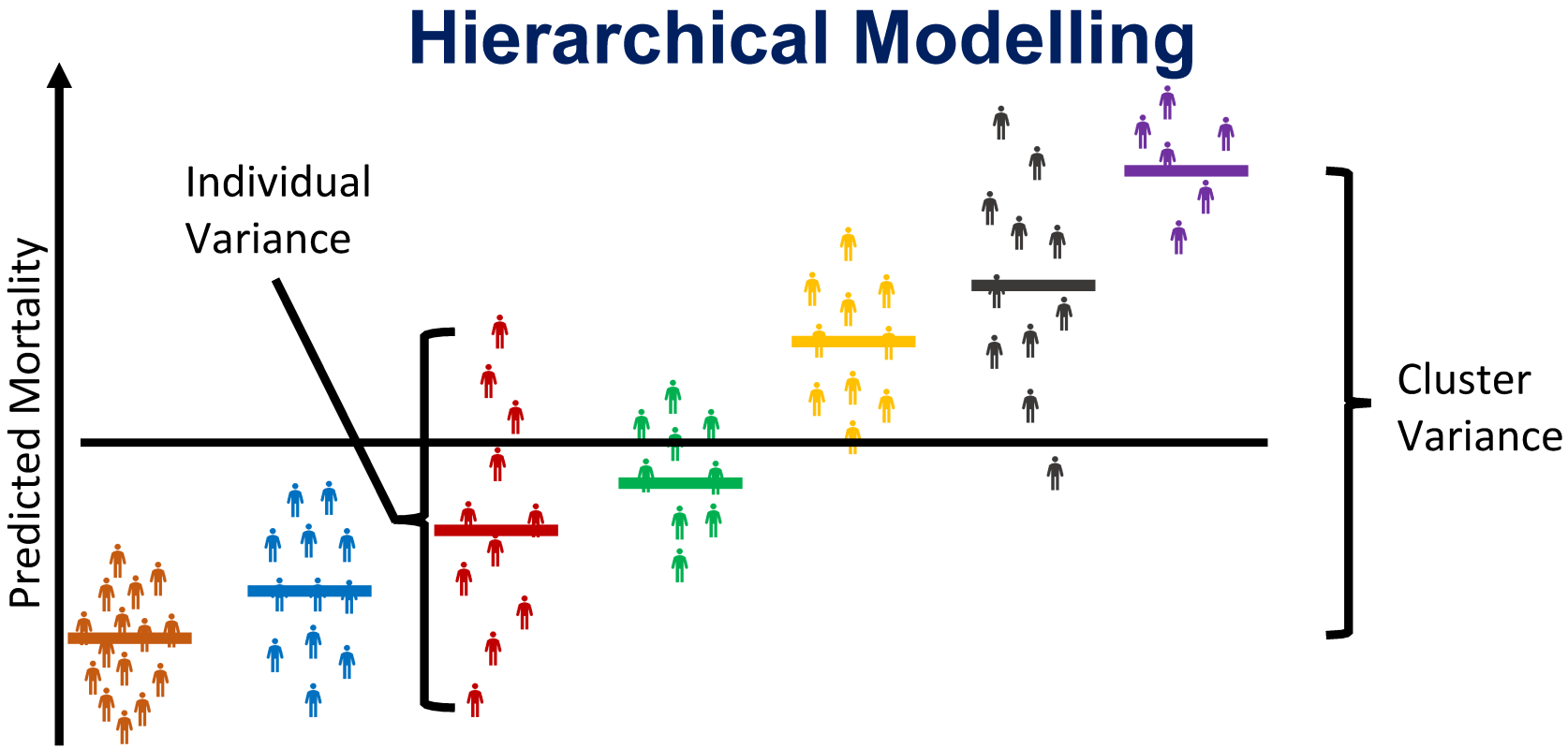

Hierarchical Modelling
Predicted Mortality
2%
3%
5%
6%
9%
11%
15%


Hierarchical Modelling
Predicted Mortality
Individual Variance
Cluster Variance

Now the Standard

Practical Guide to Comparative Effectiveness Research Using Observational Data

Ryan P. Merkow, MD, MS; Todd A. Schwartz, DrPH; Avery B. Nathens, MD, MPH, PhD

"A common approach is risk adjustment using regression models to control for known factors when estimating the association of the exposure or variables of interest with the outcome. An important component to risk adjustment is that variation is often hierarchical. Patients are nested within hospitals, which are nested within regions and states. Accounting for this nested nature in multilevel models should be used when possible. Regression techniques controlling for known

Practical Guide to Surgical Data Sets: National Trauma Data Bank (NTDB)

Zain G. Hashmi, MBBS; Amy H. Kaji, MD, PhD; Avery B. Nathens, MD, MPH, PhD

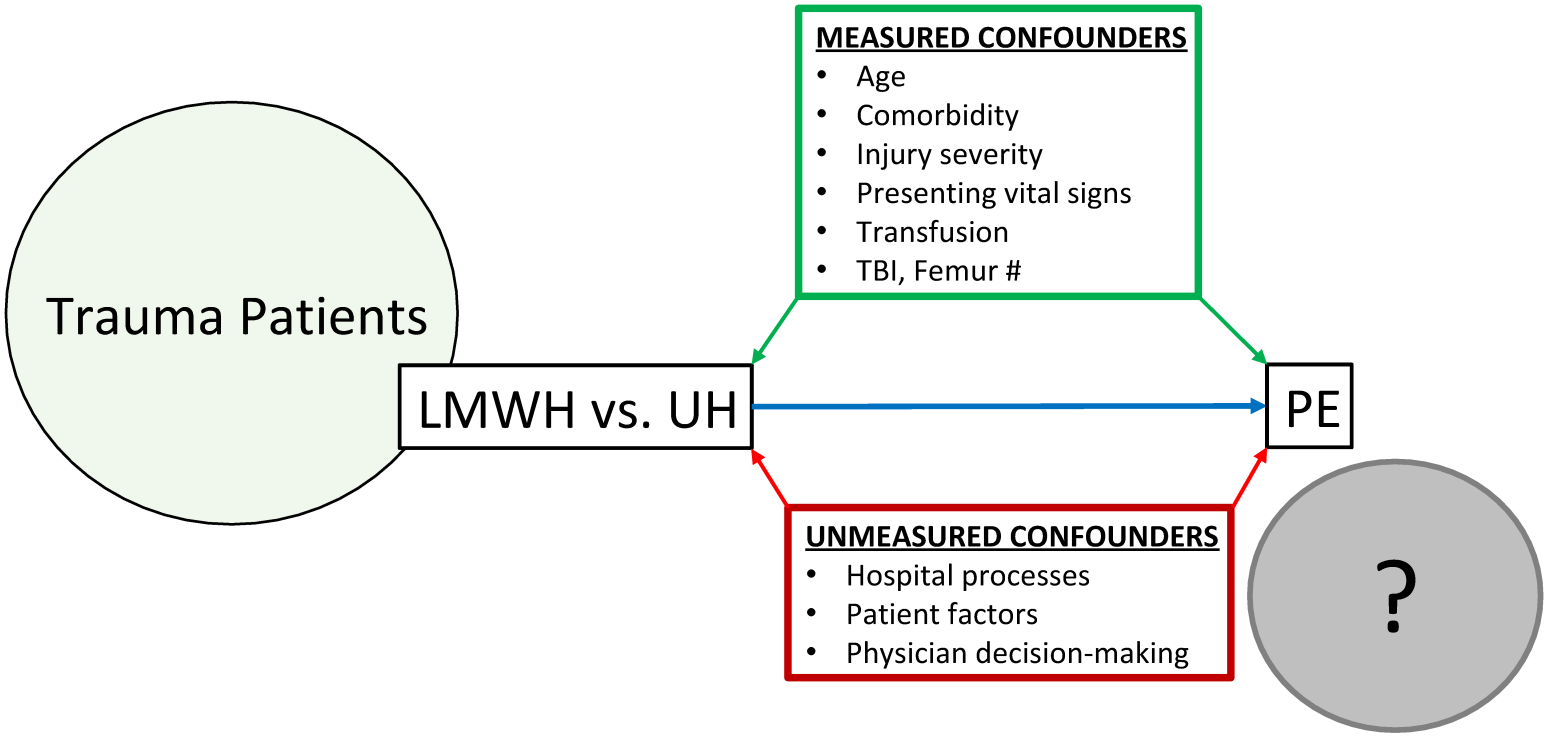
"Additionally, model performance statistics and whether multicollinearity and effect modification were assessed should be specified. If data include a facility identifier, hierarchical analyses should be used to account for correlated patients outcomes, as patients are nested within facilities."

JAMA Surgery: Guide to Statistics ar

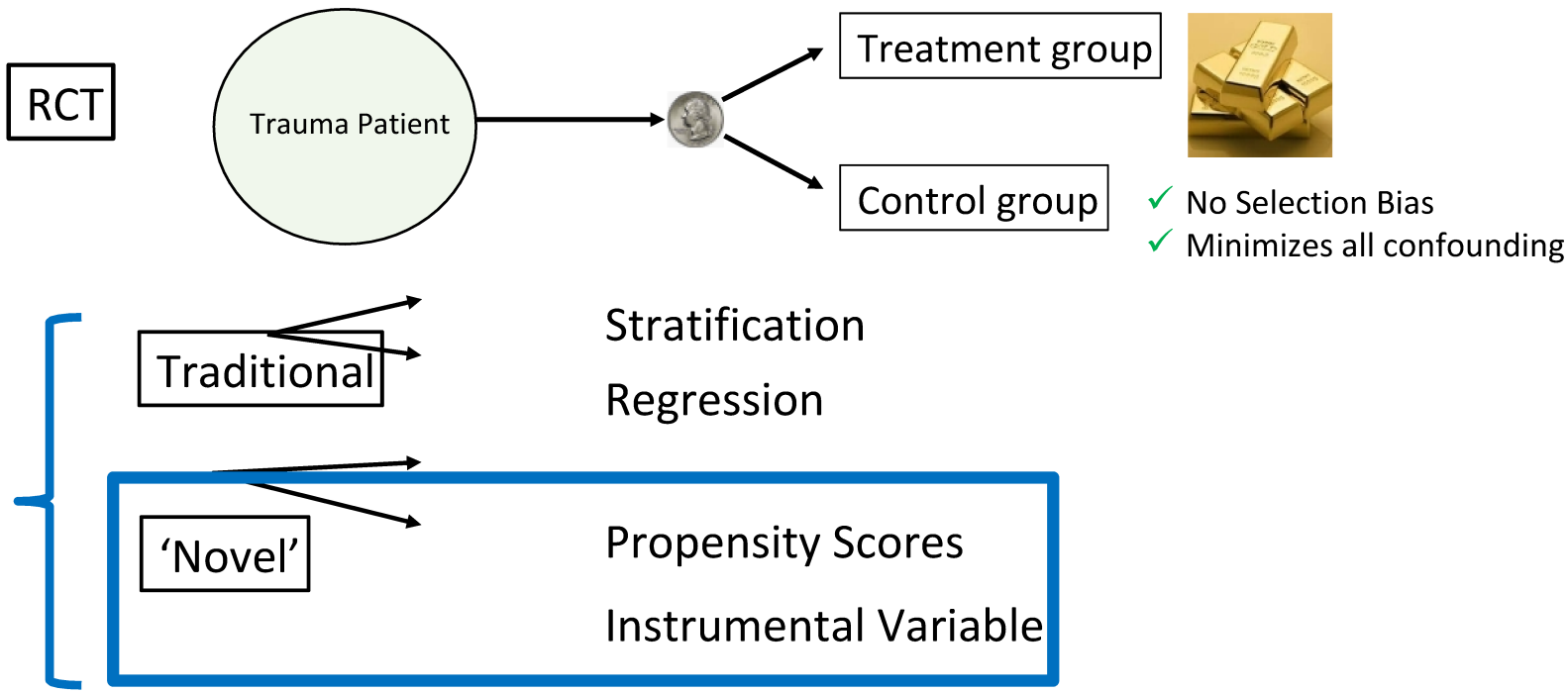
Advanced Confounder Control

Propensity Scores and Instrumental Variable

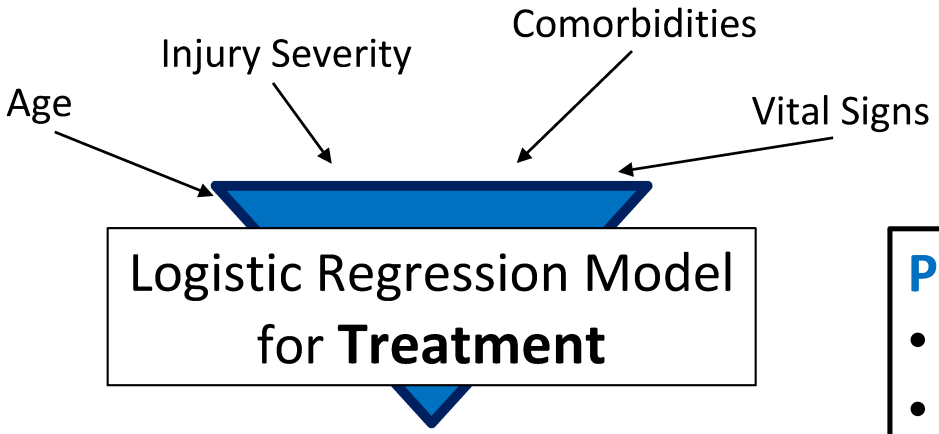
Definition of Confounder



Study Design Options



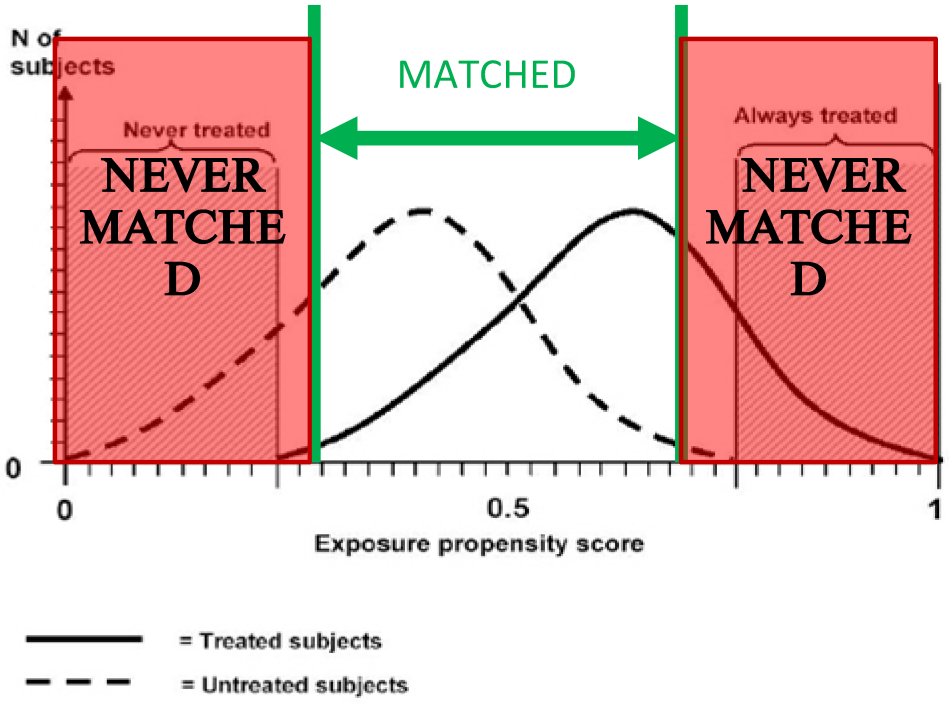
Propensity Scores



PS = Probability of Treatment

- Accounts for selection bias
- "Balancing Score"

Propensity Scores



PS Best Practices

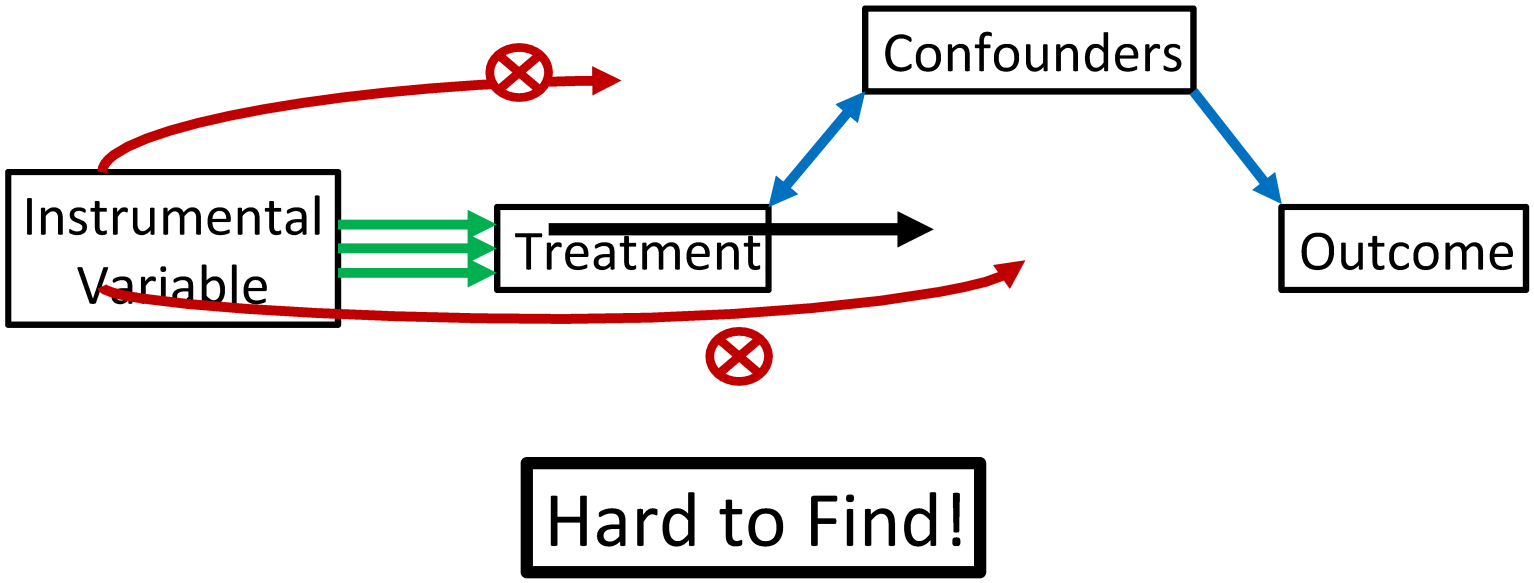
A systematic review of propensity score methods in the acute care surgery literature: avoiding the pitfalls and proposing a set of reporting guidelines

T.L. Zakrison, P.C. Austin, V.A. McCredie

Eur J Trauma Emerg Surg (2018); 44: 385-395.

PS Matching Studies - Overall Poorly Reported

Instrumental Variable Analysis



Geospatial Analysis

A Picture = 1000 Words

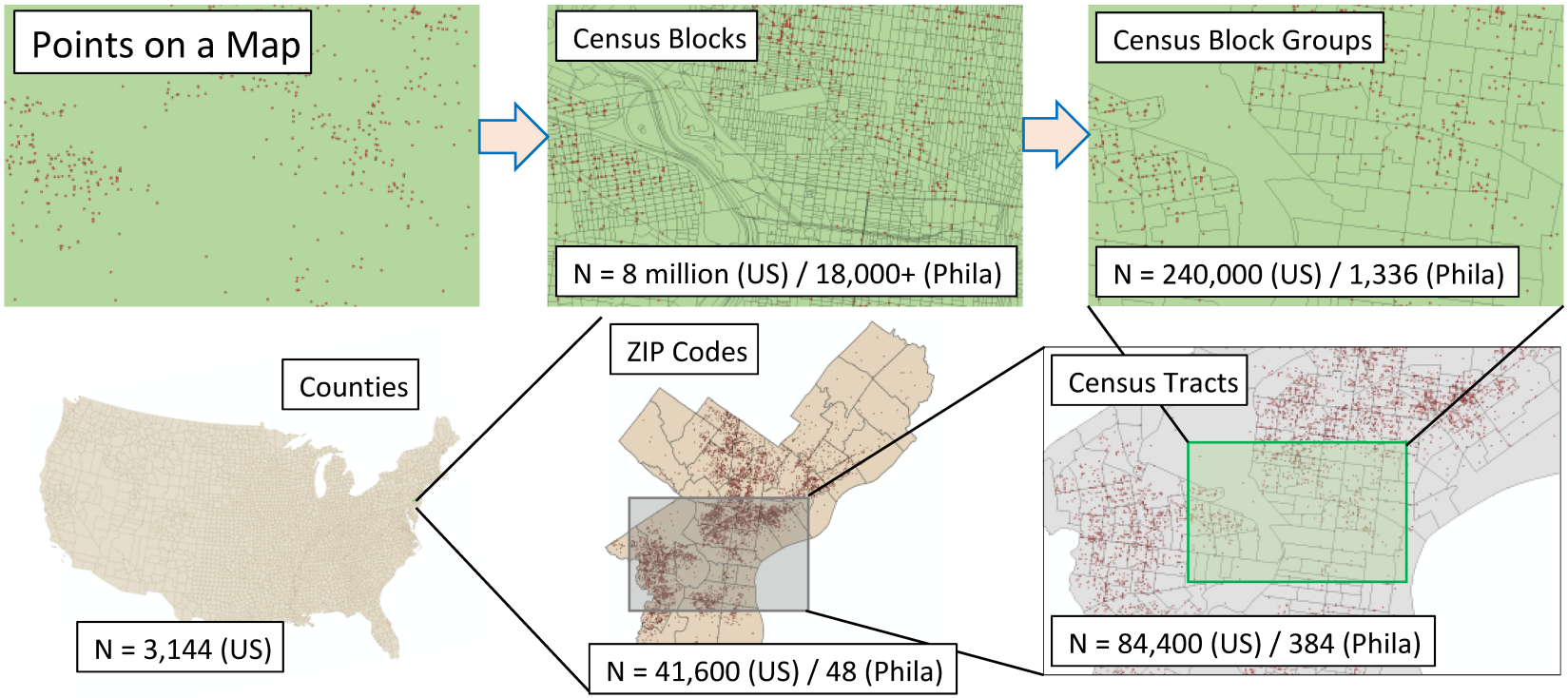
When to Use Geospatial Analysis

1. Have data with **location information** (coordinates, address, zip code, county)

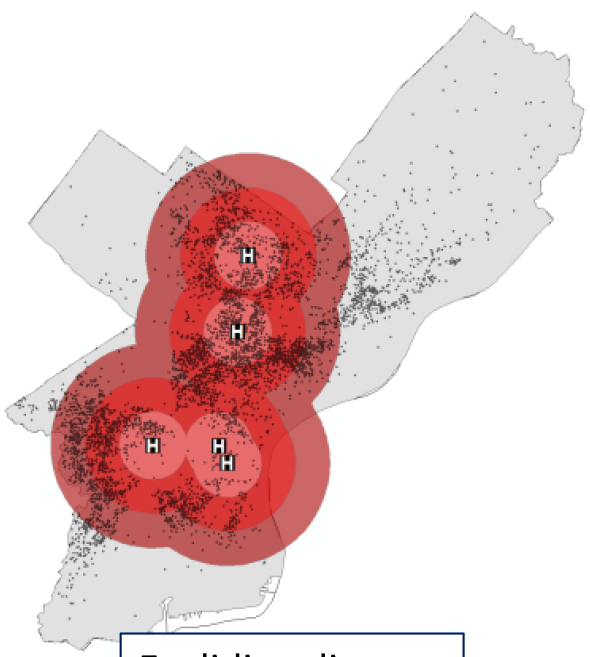
2. Want to **visually represent geographic data**

3. Measure **relationship between two points** on a map

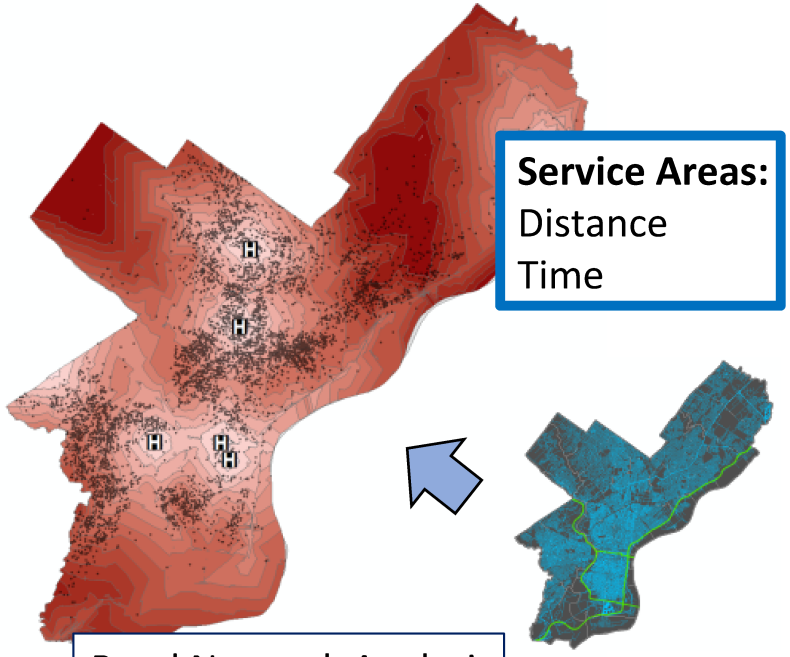
Geographic Units of Measurement



Access to Care



Euclidian distance



Road Network Analysis