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Crystalloid Versus Albumin for Volume Resuscitation in Septic Shock: A Propensity-Matched Analysis

Research Associate Program in Emergency Medicine and Critical Care

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Overview

Introduction

Primary analysis

- Methods: TriNetX
- Cohort Building & Propensity Score Matching
- Data & Results

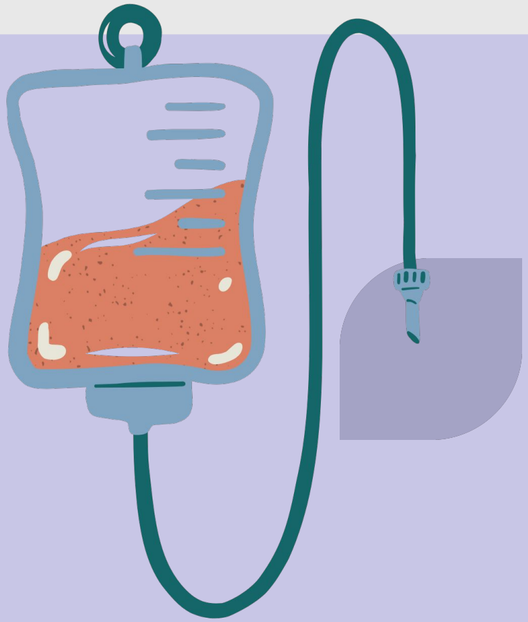
Secondary analysis

- Subgroup Analyses
- Groups and Rationale
- Data & Results

Conclusion

- Discussion
- Future Direction

Introduction



- Septic shock is a life-threatening form of sepsis characterized by severe **circulatory and metabolic dysfunction.**
- Hallmarks of sepsis include **vasodilation**, and **capillary leak,** which reduces **circulating volume** and **tissue perfusion**
- Current management emphasizes **early recognition, antibiotics, fluid resuscitation, and vasopressors, most commonly norepinephrine.**

Crystalloids:

- First-line resuscitation fluid
- Small molecules that distribute between intravascular and interstitial spaces
- Common IV fluids (Lactated Ringer's, Plasma-Lyte…)

Albumin:

- Colloid solution containing major plasma protein albumin
- Larger molecule that is more intravascularly retained than crystalloids
- Theoretically improve intravascular volume

“Does adding albumin to early resuscitation actually translate into better outcomes for patients with septic shock?”

While crystalloids remain the standard resuscitation fluid in septic shock, studies of adjunctive albumin have yielded **conflicting results.**

We hypothesized that early adjunctive albumin **does not improve 28-day outcomes** compared to crystalloids alone.

Methods

POPULATION

Adult patients (≥ 18 yrs) admitted to the hospital with septic shock requiring **norepinephrine** administration

INTERVENTION

Norepinephrine **+ albumin** within **24 hours of sepsis diagnosis**

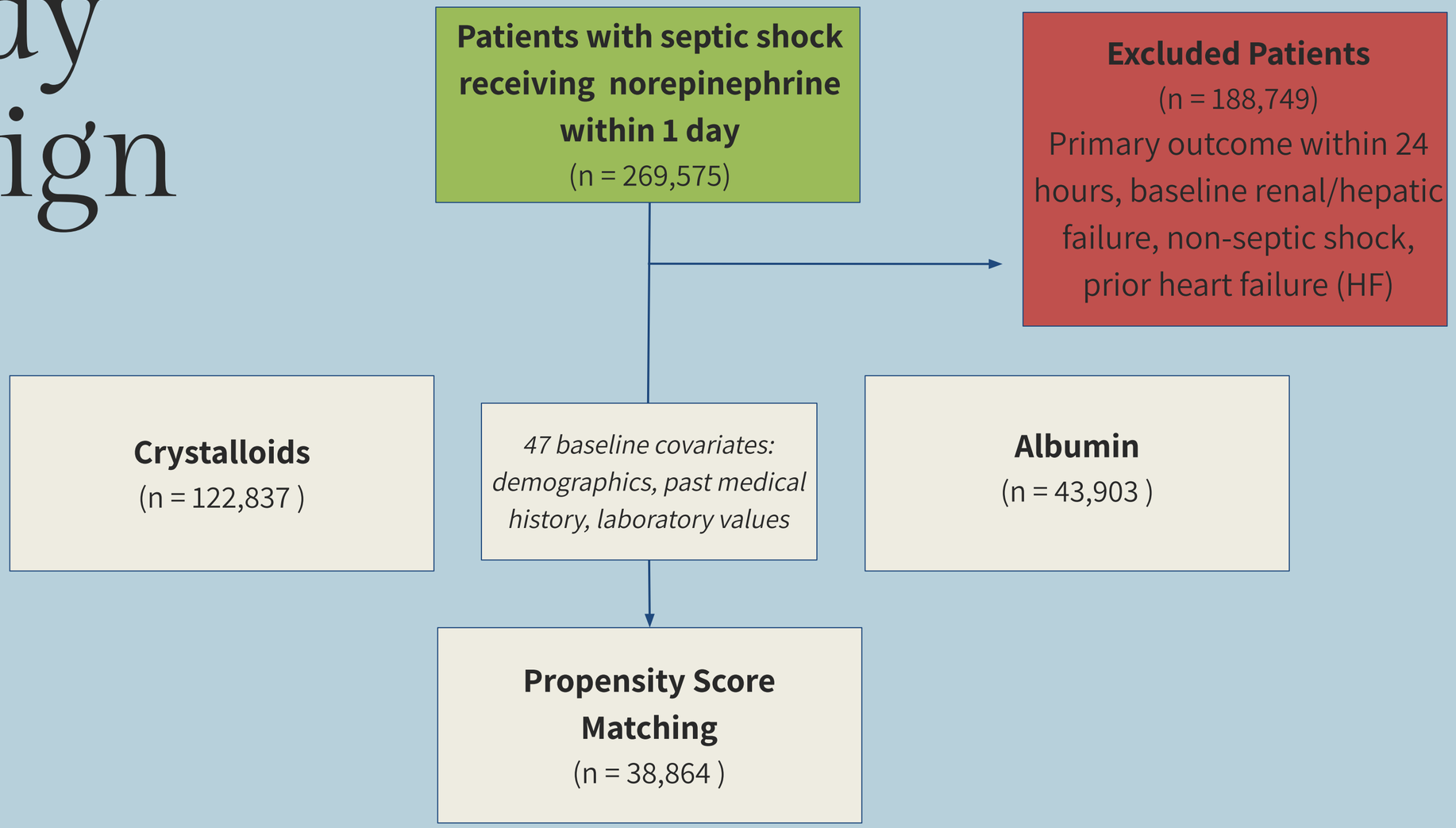
CONTROL

Norepinephrine **+ crystalloids alone.**

OUTCOMES

28 day outcomes:
Primary: Mortality
Secondary: Acute Kidney Injury (AKI) – Heart Failure – Stroke – Acute Myocardial Infarction (AMI) – Tachyarrhythmia – Mechanical Ventilation – Hemodialysis Dependence

Study Design



Results

OUTCOMES	CRYSTALLOID	ALBUMIN	*p*
28-Day Mortality	**21.7%**	**28.8%**	**<0.001**

Subgroup Analyses

Full Cohort
Septic shock patients
(Albumin vs Crystalloids)

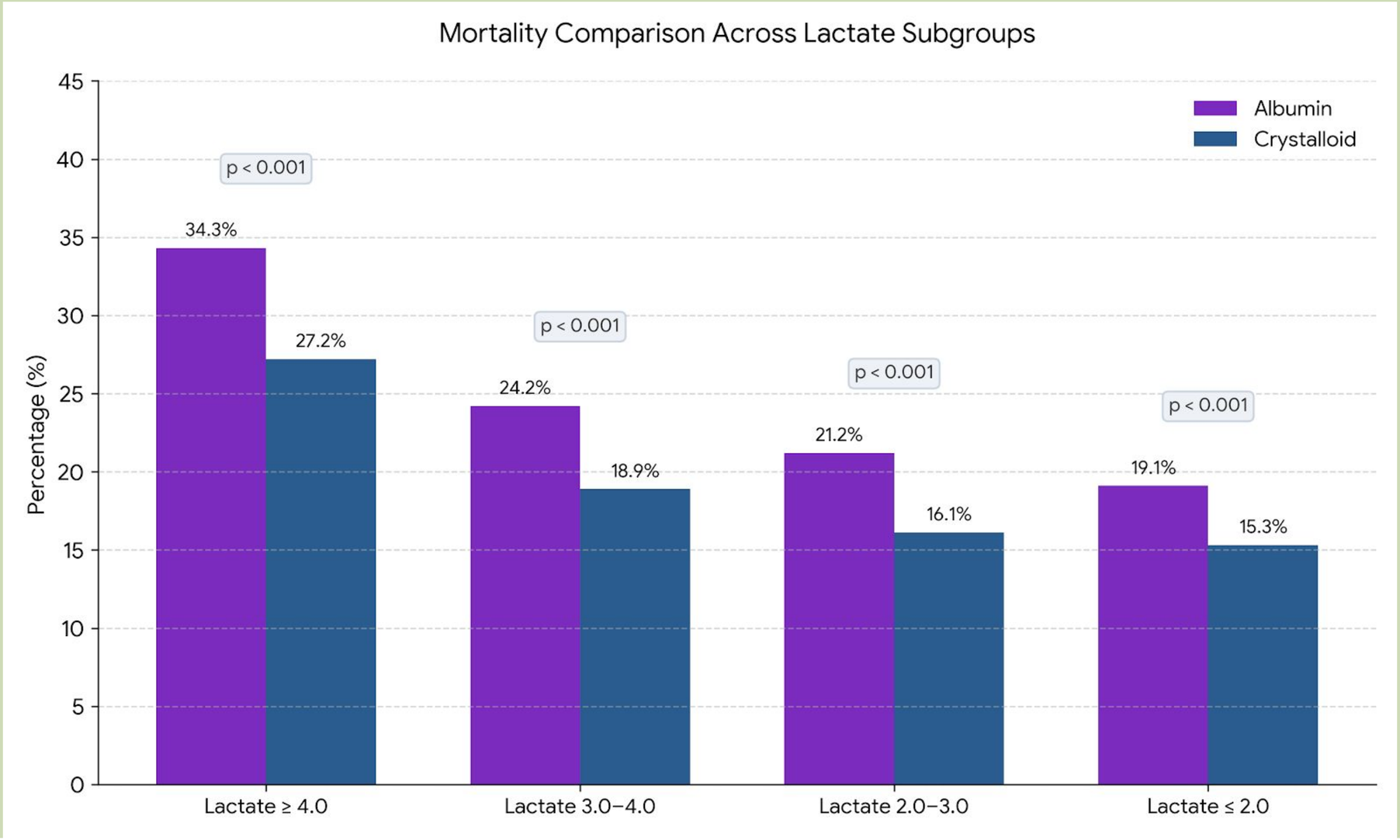
Subgroup Analyses
Assess any meaningful clinical phenotypes that may cause variation between fluid type and outcomes

Shock severity
Definition: Lactate ≤ 2.0, 2.0-3.0, 3.0-4.0, ≥4.0 mmol/L
Rationale: Tests for effect modification by shock severity

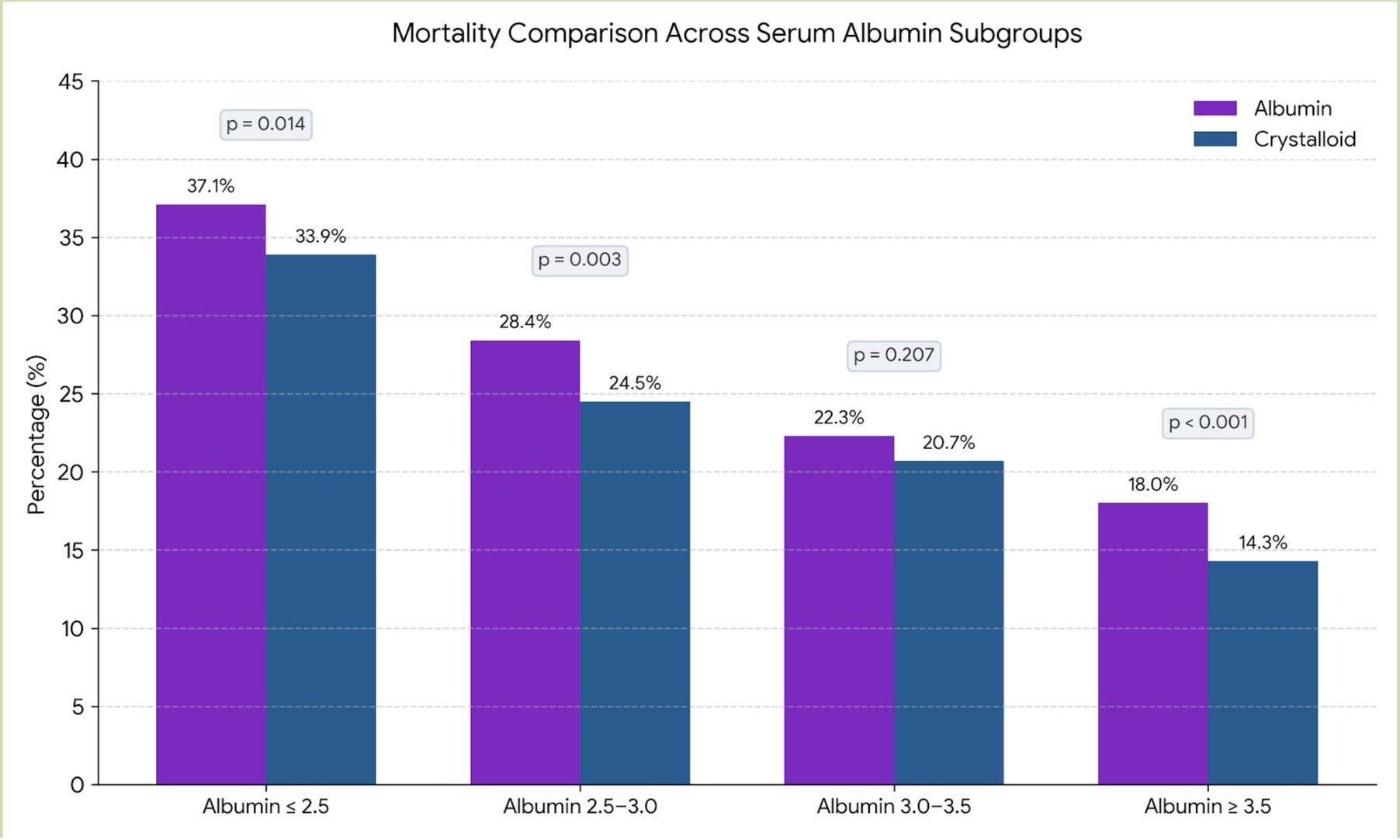
Albumin levels
Definition: Serum albumin ≤2.5, 2.5-3.0, 3.0-3.5, ≥3.5 g/dL
Rationale: Albumin may be more relevant when albumin in blood is low

Cirrhosis
Definition: History of cirrhosis
Rationale: Established clinical use of albumin

Subgroup Results - Shock severity(Baseline Lactate)



Subgroup Results - Serum Albumin



Subgroup Results - Cirrhosis

OUTCOMES	CRYSTALLOID	ALBUMIN	*p*
28-Day Mortality	**28.27%**	**46.0%**	**<0.001**
Acute Kidney Injury (AKI)	**5.0%**	**11.9%**	**<0.001**
New-Onset HF	2.1%	2.8%	0.096
Stroke	0.8%	0.8%	0.977
Acute Myocardial Infarction (AMI)	1.0%	1.5%	0.093
Tachyarrhythmia	3.6%	4.6%	0.070
Mechanical Ventilation	**6.5%**	**13.5%**	**<0.001**
Hemodialysis Dependence	**4.4%**	**11.4%**	**<0.001**

Discussion

- Despite theoretical physiological benefits of albumin fluid replacements, the outcomes indicate that **albumin performed worse** across major outcomes
- Although these associations persisted across **baseline shock and albumin profiles**, **residual confounds** may still exist
- **Future subgroup analysis**, along with **prospective randomized trials** are needed to further define the effective utilization of albumin in septic shock

Study Limitations

- Greater baseline illness severity among patients administered albumin could contribute to confounding of the observed outcome differences

- TriNetX cohort may not be representative of all septic shock patients, limiting the generalizability of the study results

- Limited granularity of TriNetX to specific day by day changes, which may alter clinical trajectory

Future Directions

- Prospective randomized trials are necessary to further determine the clinical utility of adjunctive albumin in the treatment of septic shock

- Further evaluation is necessary to determine the role of albumin in specific high risk septic shock subgroups

Conclusion

Although providing theoretical benefits, albumin does not significantly improve patient outcomes compared to crystalloids in a retrospective analysis of septic shock.

Sources

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Any Questions?