Relative Hypoglycemia in Non-Diabetics

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MIT HST.953 — Secondary Analysis of Health Records

Glycemic Control in ICU

- Why glycemic control?
  - Deviate normal physiology and lead to ↑ mortality and morbidity when the problem becomes severe
- Optimizing target for glycemic control

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INTENSIVE INSULIN THERAPY IN CRITICALLY ILL PATIENTS

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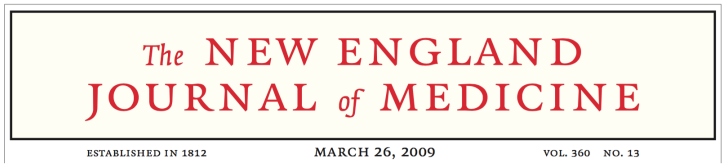

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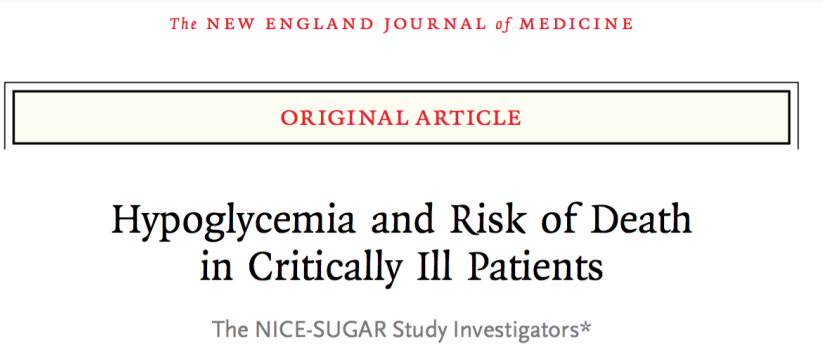
Intensive versus Conventional Glucose Control in Critically Ill Patients

The NICE-SUGAR Study Investigators*



The NEW ENGLAND JOURNAL of MEDICINE

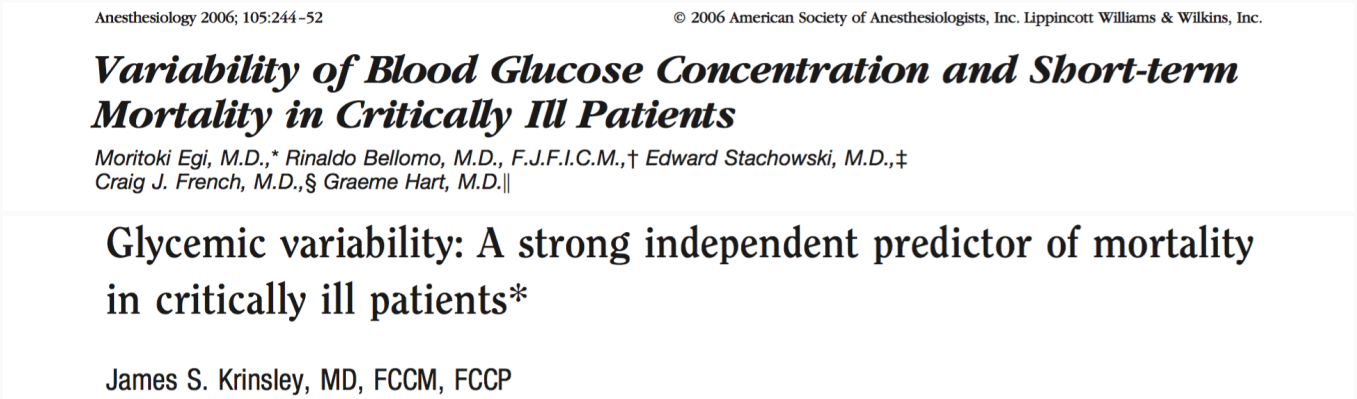
ORIGINAL ARTICLE

Hypoglycemia and Risk of Death in Critically Ill Patients

The NICE-SUGAR Study Investigators*

Current Guideline

- Guideline: 6-10 mmol/l (100-180 mg/dl) for the ICU patients
- Problem?
  - Uniform glycemic control strategy but insulin responses and body response to glucose level should be different in diabetics and non-diabetics
  - ↑ hypoglycemia or ↑ glycemic variability → mortality ↑
- Objective: Better approach to figure out the strategy for flexible glycemic control



Anesthesiology 2006; 105:244–52 © 2006 American Society of Anesthesiologists, Inc. Lippincott Williams & Wilkins, Inc.

Variability of Blood Glucose Concentration and Short-term Mortality in Critically Ill Patients

Moritoki Egi, M.D., Rinaldo Bellomo, M.D., F.J.F.I.C.M.,† Edward Stachowski, M.D.,‡ Craig J. French, M.D.,§ Graeme Hart, M.D.‖*

Glycemic variability: A strong independent predictor of mortality in critically ill patients*

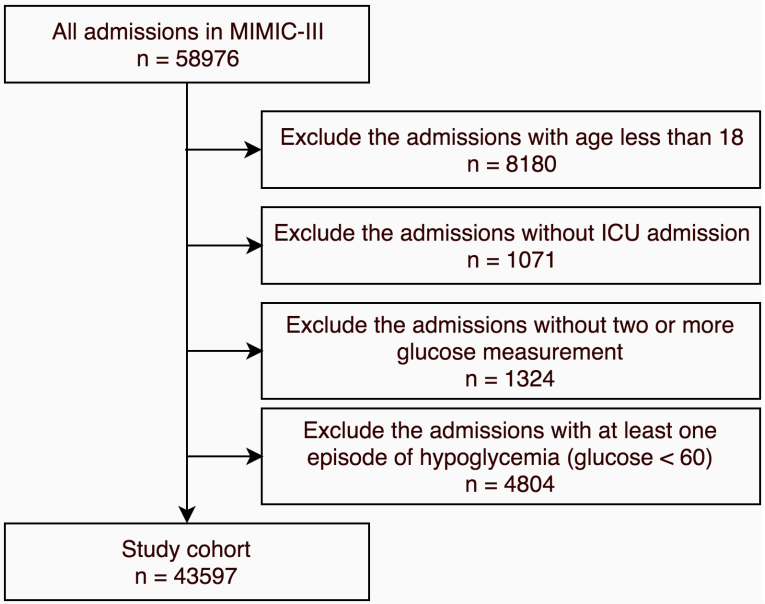
James S. Krinsley, MD, FCCM, FCCP

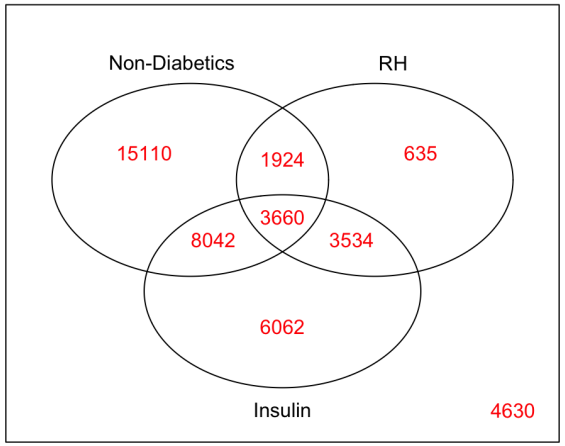
Relative Hypoglycemia

- Definition
  - Glucose level has greater variability but not dropped to the threshold of true hypoglycemia (Martensson 2016)
  - Glucose levels $\downarrow 30\%$ but ≥ 60 mg/dL, in two consecutive glucose measurements within the six-hour interval
  - Related to autonomic instability and also cause the cardiovascular impairment, and increase mortality
- Hypothesis: RH is associated with higher mortality in critically ill diabetics and non-diabetics

Study Design

- Longitudinal retrospective cohort study (43597 admissions)
- MIMIC-III, BIDMC, 2001-2012, more than 60K admissions
- ICU admission, age $\geq$ 18, no hypoglycemia (glucose $\leq$ 60)
- Exposure
  - Diabetes: ICD-9 / pre-admission HbA1c / pre-admission OHA and insulin / past medical history (diabetes)
  - RH: as defined



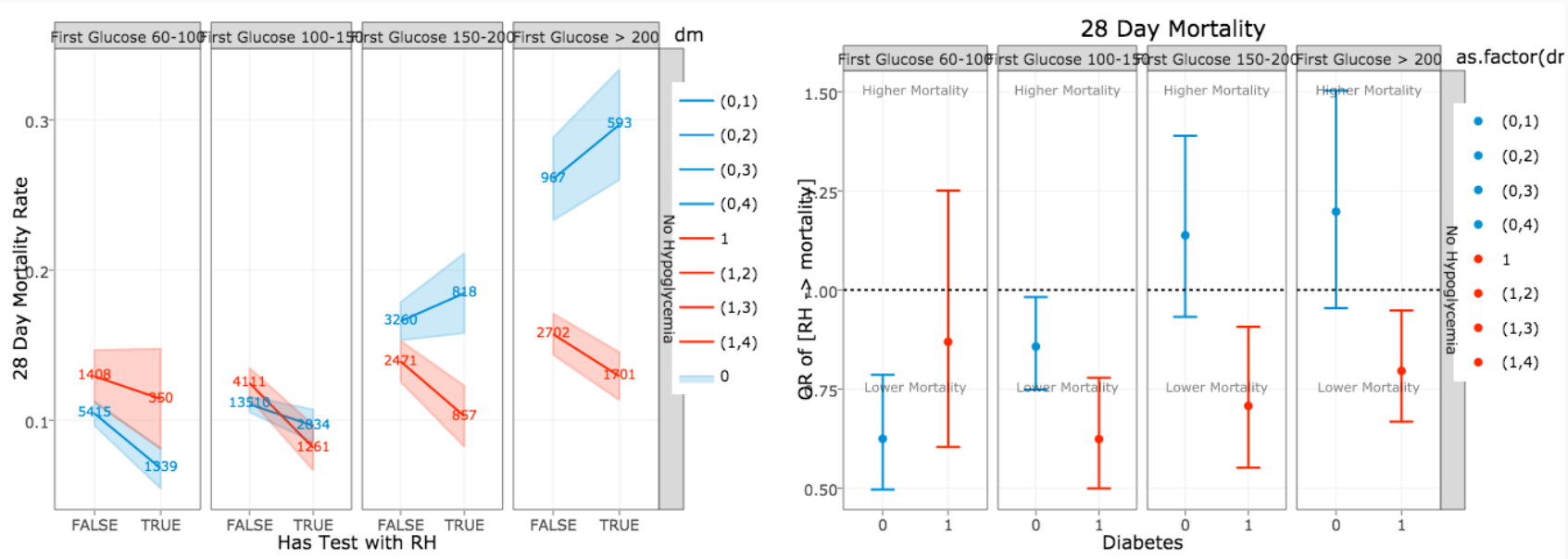


Study Design

- Primary outcome: 28-day mortality (short-term mortality)
- Covariates/Confounders
    - age, gender, Sequential Organ Failure Assessment (SOFA) score and Elixhauser comorbidity index on admission, insulin usage
- Mortality rate, odds ratio with 95% confidence interval

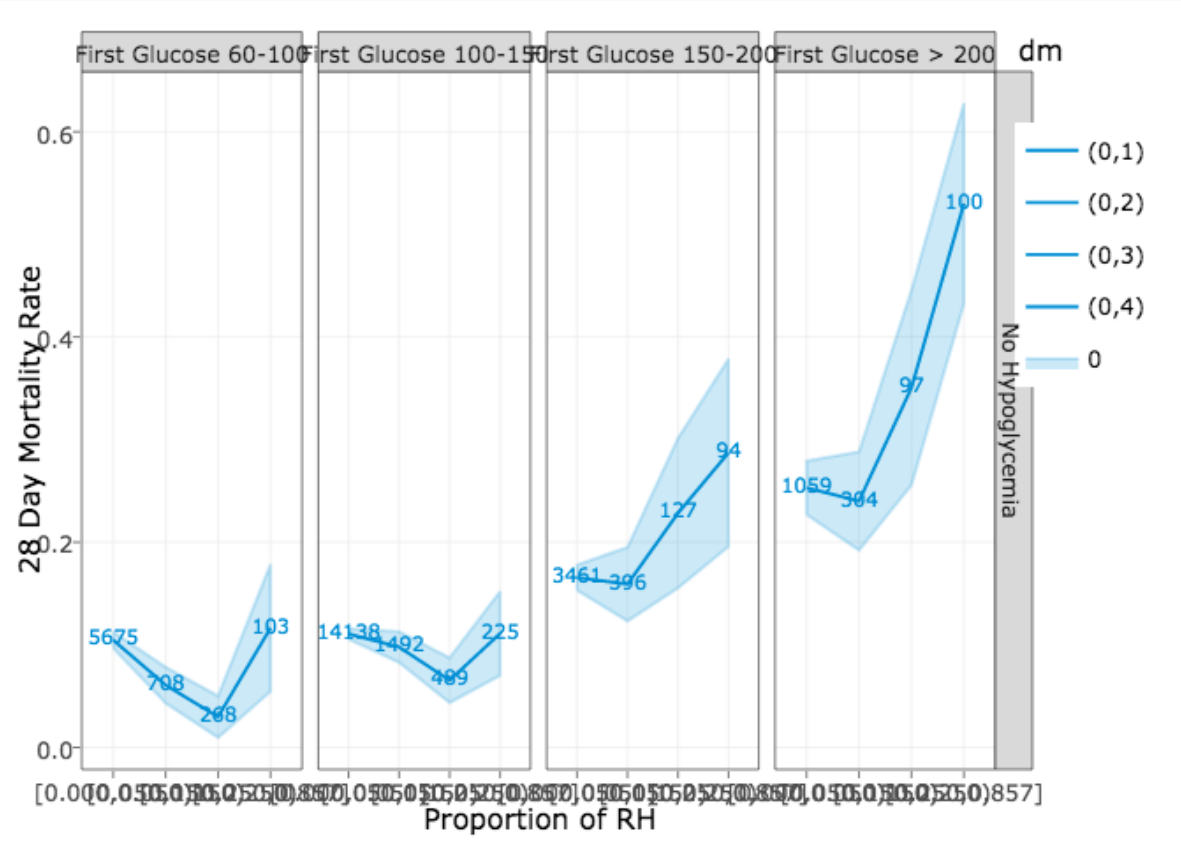
RH / Non-Diabetics

- RH has effect on short-term mortality in non diabetic patient with higher initial glucose level
- Different signals between diabetics and non-diabetics and also the first blood sugar level



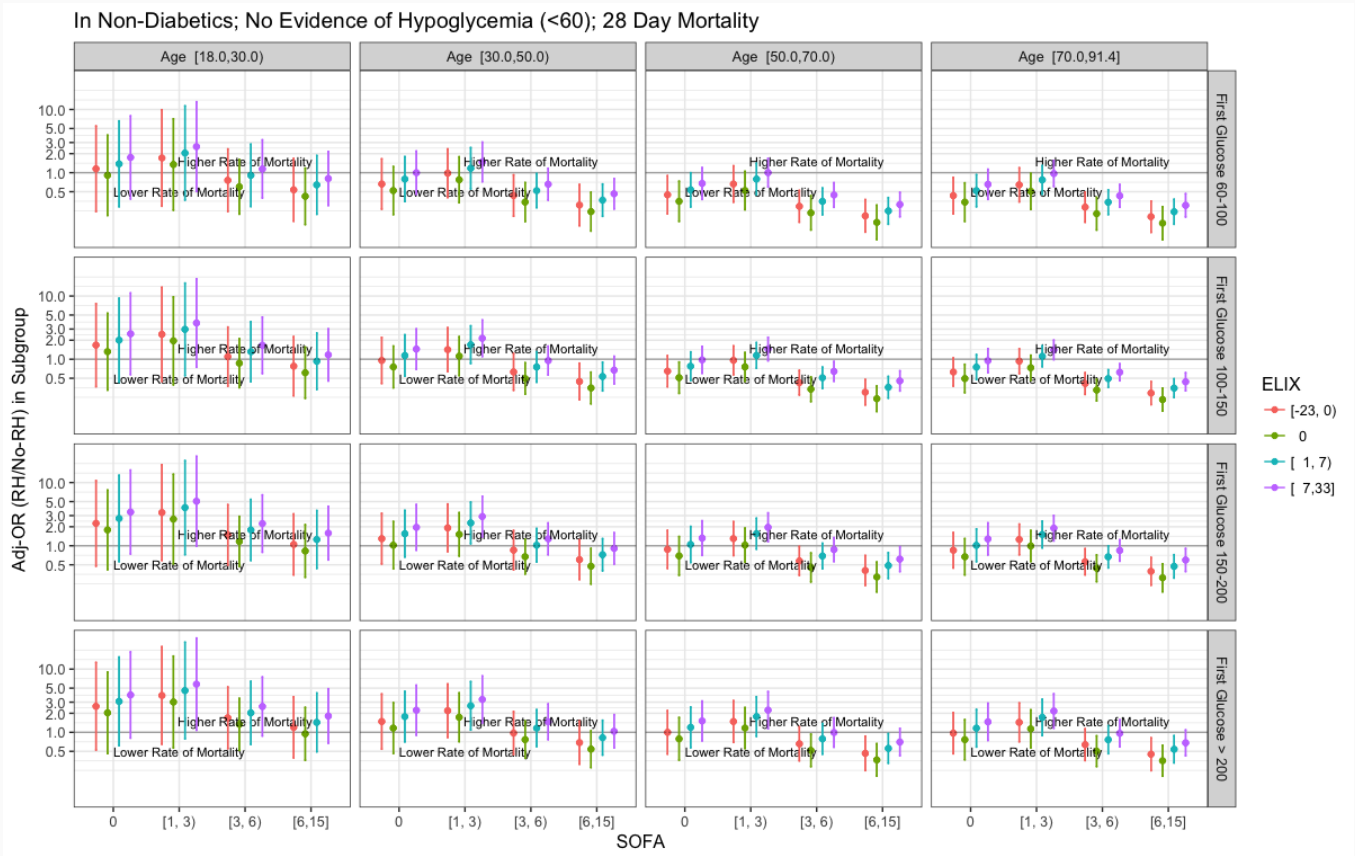
RH Dose Dependent Effect

- Focusing on non-diabetics... (28736 admissions)
- RH has dose dependent effect on the short-term mortality of non diabetic patients with higher initial glucose level
- Might suggest some causality



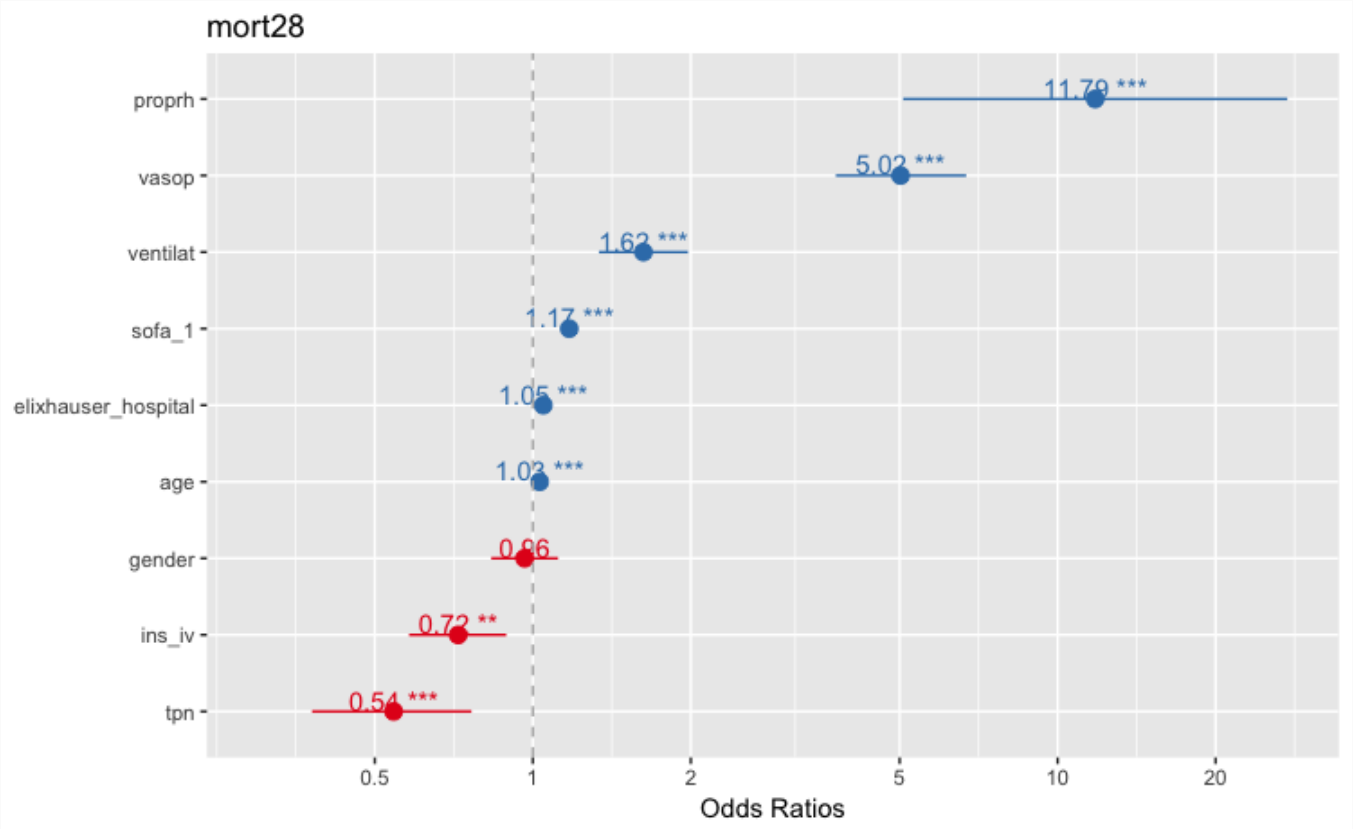
Considering Covariates

- Logistic regression with stepwise model selection (Akaike Information Criteria, AIC)
- Younger / higher initial glucose / low SOFA / abnormal Elixhauser



Considering Covariates

- Logistic regression (28-day mortality)
- Non-diabetics / Higher initial glucose ($\geq$ 150 mg/dl)



Summary

- In non-diabetics (28736 admissions)
  - RH has dose dependent association with the increasing short-term morality
  - Young age, lower SOFA score, other morbidities and higher initial glucose level $\rightarrow$ RH-associated short-term mortality $\uparrow$
- Pros: large cohort and fine data granularity
- Cons: potential confounders, single-center, causation
- Next: Philips eICU, revisiting insulin
- May change the ICU glucose control strategy in the future
- Acknowledgement
  - Dr. Francisco Salgueiro, Dr. Rinaldo Bellomo
  - HST.953 staff, MIMIC developers, John, Sharon