Comparison of Coronary Artery Bypass Grafting and Percutaneous Coronary Intervention Using a Quantitative Benefit-Risk Assessment

Xuan Zhang[1], Lejia Hu[1], Hal Yapici[1], Kunal J. Lodaya[1], Sibyl H. Munson[1], Fabian D'Souza[1], Weiqi Jiao[1], Hayden W. Hyatt[1], Rahul Rajkumar[1], Nicholas Bettencourt[1]
[1] Boston Strategic Partners, Inc.

BACKGROUND

- Coronary artery bypass grafting (CABG) has long been the standard of care for treating coronary artery disease (CAD) due to its established long-term efficacy
- Percutaneous coronary intervention (PCI), a less invasive alternative, has gained traction; however, clinical studies comparing the two have yielded conflicting results regarding patient outcomes
- To evaluate these treatment options more systematically, we applied Quantitative Benefit-Risk Assessment (qBRA)—a structured, data-driven approach for quantifying the trade-offs between clinical benefits and risks of medical interventions

OBJECTIVE

This study aims to compare the outcomes of CABG and PCI for the treatment of CAD by incorporating patients' perspectives into a real-world assessment to inform the assessment of benefit-risk balance.

OR
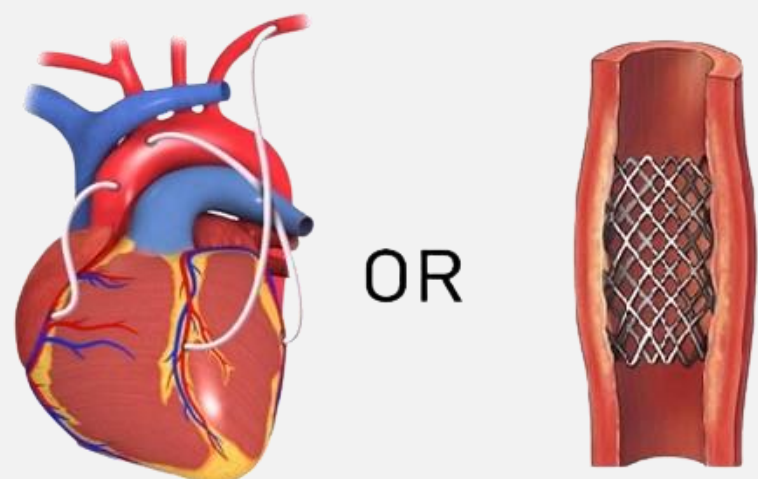
STUDY DATASET

This study used the National COVID Cohort Collaborative (N3C) database, a nationwide clinical database, aggregating electronic health records, to identify patients undergoing CABG or PCI procedure between 2017 and 2021.

METHODS

- To evaluate whether treatment effects differed by patient profile, outcome analyses were stratified by two distinct patient clusters identified using the K-means clustering algorithm
- Propensity score matching was employed to align patients in the two groups (CABG vs PCI) using age, gender, year of surgery, acute coronary insufficiency (CI), EuroScore II, and U.S. geographic region
- The methodological framework of this study was based on the qBRA 5-step guidelines: research question, model development, preference elicitation, analysis, and communication of results[1]
- Critical endpoints including rates of 3-year mortality, stroke, myocardial infarction (MI), revascularization, and extended index hospital length of stay (top 25% of durations) were selected
- Preferences for the outcome variables were quantified using discrete choice experiments, with weights derived from patient preferences[2] (Figure 1)

qBRA 5-Step Framework

Research Question → Model Development → Preference Elicitation → Analysis → Communication of Results
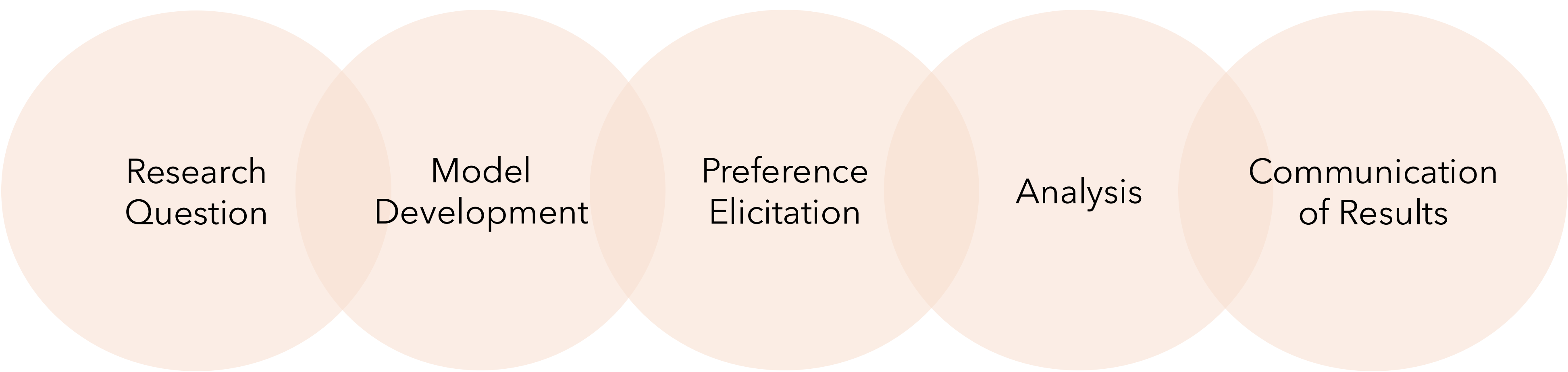
RESULTS

- The two patient clusters differed significantly in baseline demographics and characteristics: Cluster A included healthier patients (lower acute CI rates, lower EuroScore II) with earlier treatment dates and lower proportions in the Midwest or South as compared to cluster B
- CABG was associated with lower 3-year rates of mortality, stroke, and MI compared to PCI (Figure 1). While revascularization rates were similar between the two groups, fewer PCI patients experienced extended index hospital stays
- Both clusters A and B favored CABG based on aggregated scores (0.26 in cluster A vs. 0.22 in cluster B), with a stronger preference in cluster A

CONCLUSIONS

- Using the qBRA framework, this study highlights that CABG may be associated with more favorable outcomes than PCI among patients with CAD
- By incorporating patient preferences, qBRA provides a valuable tool for advancing patient-centered clinical decision support

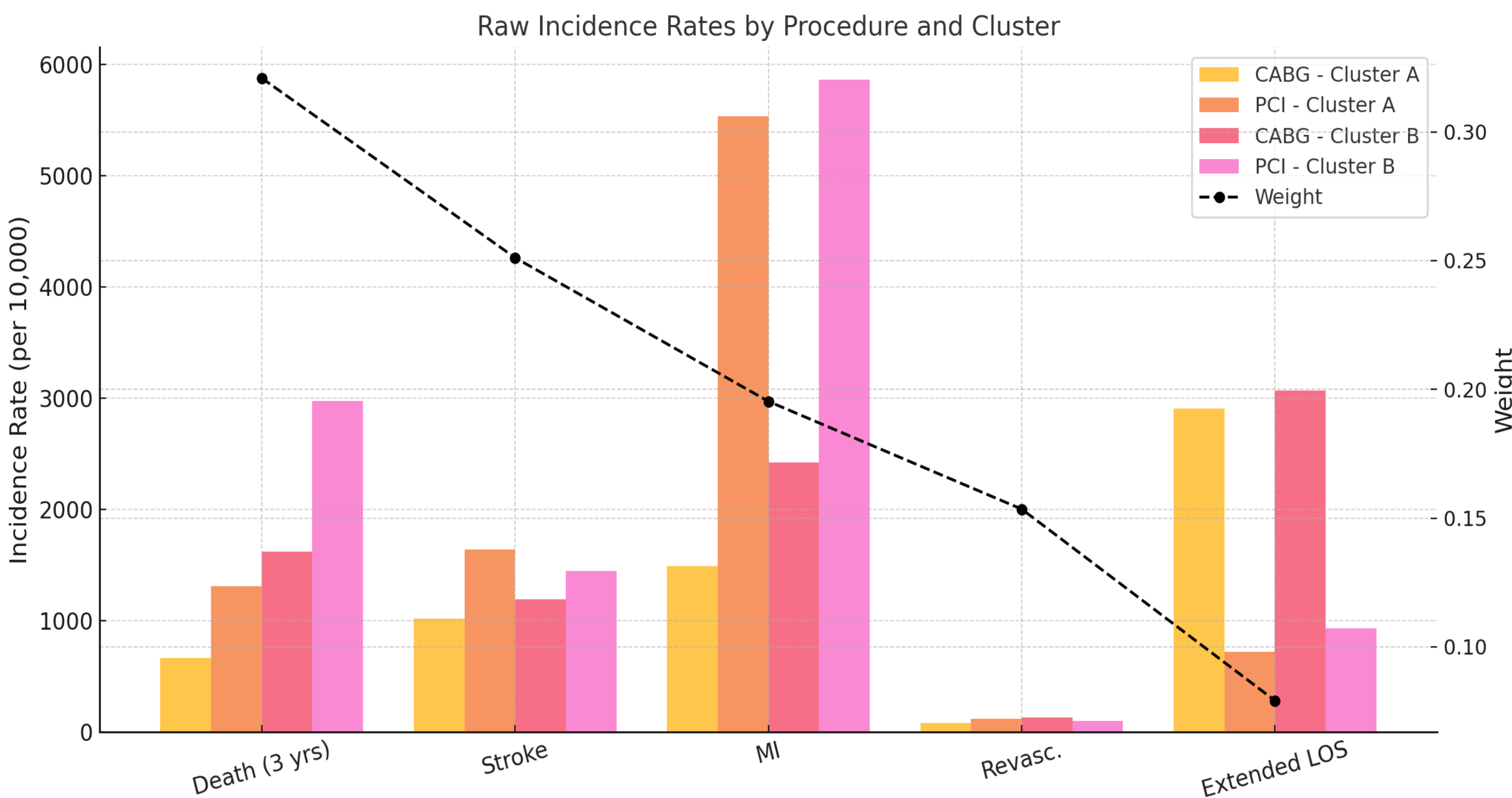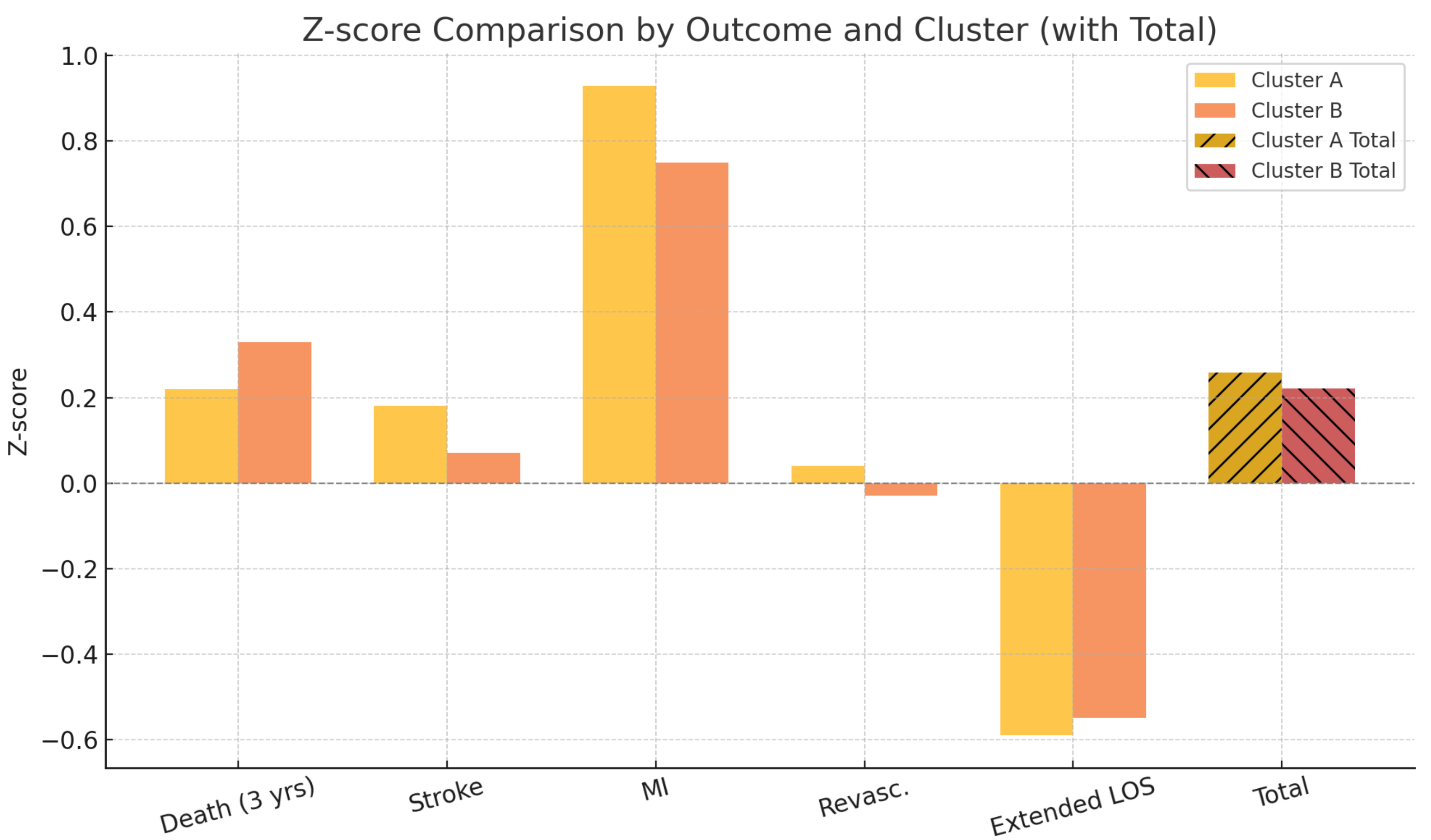## Figure 1. Raw Incidence Rates with Corresponding Values

Figure 2. Z-score Comparison by Outcome and Cluster (with total/aggregated score)

REFERENCES

1. Tervonen T, Veldwijk J, Payne K, et al. Quantitative benefit-risk assessment in medical product decision making: A good practices report of an ISPOR task force. Value Health. 2023;26(4):449–460. https://doi.org/10.1016/j.jval.2022.12.006
2. Tong BC, Huber JC, Ascheim DD, et al. Weighting composite endpoints in clinical trials: essential evidence for the heart team. Ann Thorac Surg. 2012;94(6):1908–1913