Comparing IPCW With Traditional Competing Risk Methods in Estimating the Association Between HDL-C and AAA Repair/Rupture

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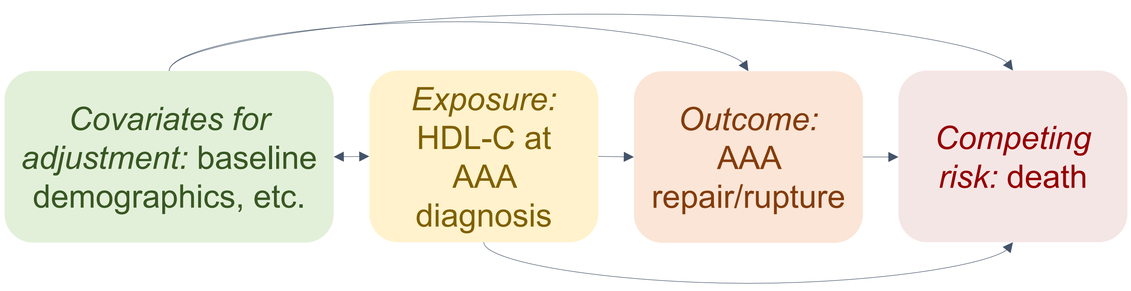
Background

Real world pharmacoepidemiology is often complicated by competing events, which can preclude outcomes and bias naïve survival estimates. The choice of competing risk method shapes both the estimand and its interpretation.

As an illustration, **AAA repair/rupture occurs amid a substantial competing risk of death**, making methodological choices particularly consequential. We compared three methods:

1. **Cause-specific Cox** (asking an etiologic question);
2. **Fine-Gray** (prognostic);
3. **Inverse probability of censoring weights** (IPCW; etiological).



Methods

We conducted a **retrospective study** using data on Clalit members with newly diagnosed AAA between 2014-2025.

We evaluated the association between **HDL-C at AAA diagnosis and time to AAA repair/rupture**.

For IPCW, we extended the typical application (which applies a single weight per individual) by using **time-updated stabilized weights**, derived from a Cox model for time until death; weights were recalculated at each event time contributing to the AAA likelihood.

All models were adjusted for baseline demographics, comorbidities, laboratory values, and medications.

IPCW diagnostics

IPCW achieved **good covariate balance**, with standardized mean differences (SMDs) between the weighted / censored and unweighted / uncensored populations below 0.1 throughout most of the follow-up (Figure 1).

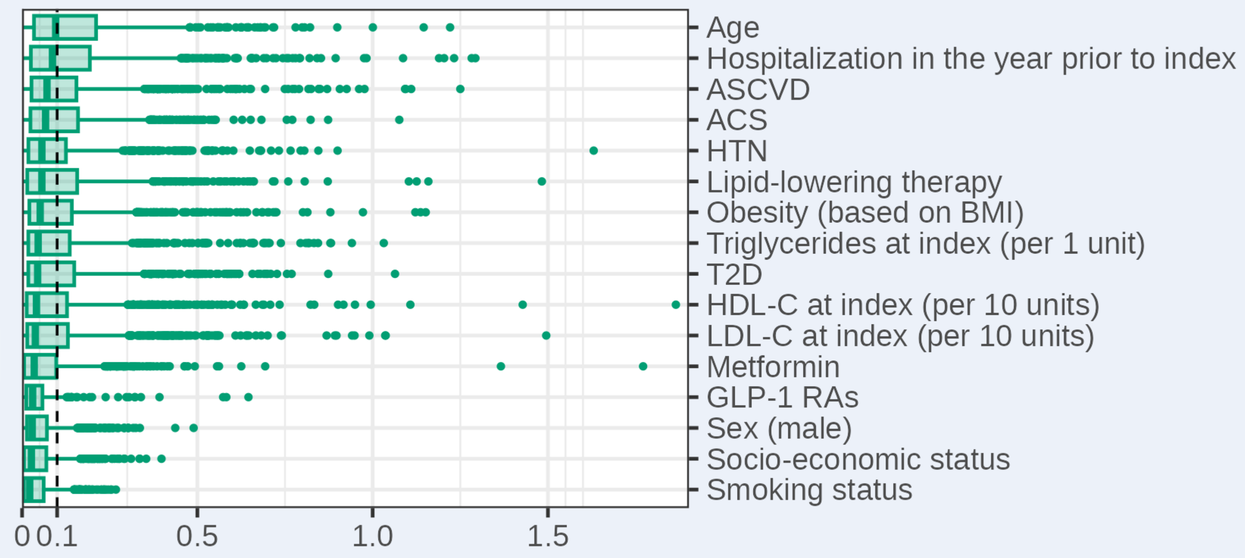


Figure 1. Distribution of SMD at event times

Results & interpretation

	Hazard ratio (95% CI)	Interpretation	Risk set
Cause-specific	0.92 (0.88-0.96)	An increase of 10 mg/dL in HDL-C is associated with a 5-8% decrease in the rate of AAA repair/rupture in …	… those who are still alive and event free.
Fine-Gray	0.95 (0.91-0.99)		… those who are still event-free.
IPCW	0.93 (0.88-0.98)		… the hypothetical situation in which no-one dies.

All approaches estimate **consistent hazard ratios** (p-values ≤ 0.01), with **different interpretations**.

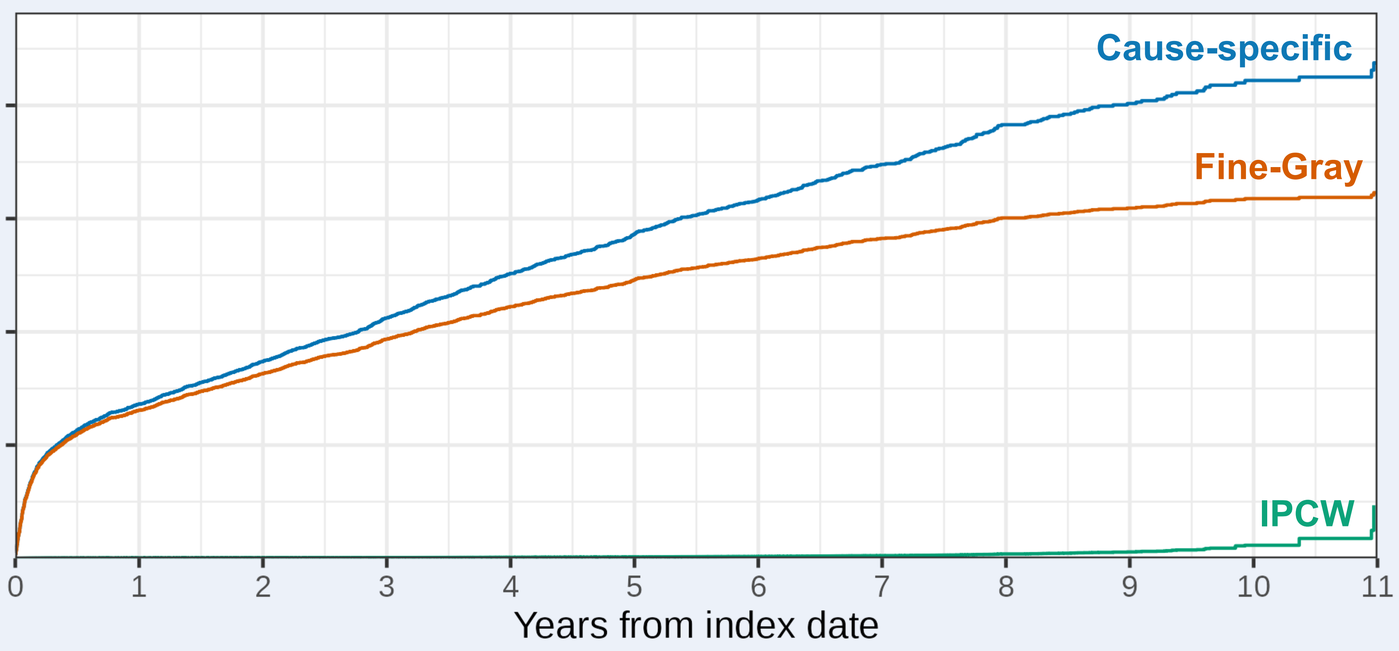


Figure 2. Predicted cumulative incidence for different methods

The predicted 10-year cumulative incidence **varied substantially** across methods: 40%, 30%, and 2%, respectively (Figure 2).

The difference between the first two is expected since Fine-Gray retains deceased individuals in the risk set.

The **IPCW estimate is implausibly low,** suggesting that **residual confounding remains** – those with poor health (i.e., at higher risk of both repair/rupture and death) were insufficiently upweighted.

Conclusions

- Lower HDL-C is consistently associated with faster AAA progression across methods, but interpretation depends on the competing risk framework.
- Careful identification of all potential confounders is needed when using IPCW with a competing risk of death.