

Net Reclassification Improvement and Integrated Discrimination Improvement for analysis of biomarkers of Acute Kidney Injury

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Relationship between NRI and IDI

The IDI and the NRI for a two-category model are related. Pencina et al 2011 (section 5)¹ demonstrated that for a two-category (single-threshold, u) NRI:

$$NRI(u) = \Delta Sensitivity(u) + \Delta Specificity(u)$$

where u is the risk threshold. Let ref refer to the reference model, new to the new model, Sn to Sensitivity and Sp to Specificity, therefore:

$$NRI(u) = (Sn_{new}(u) - Sn_{ref}(u)) + (Sp_{new}(u) - Sp_{ref}(u))$$

Integrate with respect to u ,

$$\int_0^1 NRI(u) du = \left(\int_0^1 Sn_{new}(u) du - \int_0^1 Sn_{ref}(u) du \right) + \left(\int_0^1 Sp_{new}(u) du - \int_0^1 Sp_{ref}(u) du \right) \quad (1)$$

Pencina² defined the integrated sensitivity as

$$IS = \int_0^1 Sn(u) du$$

and Integrated one minus specificity as

$$IP = \int_0^1 (1 - Sp(u)) du$$

Applying this to equation (1) yields

$$\begin{aligned} \int_0^1 NRI(u) du &= (IS_{new} - IS_{ref}) + (IP_{ref} - IP_{new}) \\ &= IDI_{events} + ISI_{nonevents} \\ &= IDI \end{aligned}$$

That is the IDI is the integral of the two-category NRI over all possible thresholds.

1. Pencina MJ, D'Agostino RB, Steyerberg EW: Extensions of net reclassification improvement calculations to measure usefulness of new biomarkers. *Stat Med* 30: 11–21, 2011
2. Pencina MJ, D'Agostino RB, Vasan RS: Evaluating the added predictive ability of a new marker: From area under the ROC curve to reclassification and beyond. *Stat Med* 27: 157–172, 2008