Illustrating How 95% Confidence Intervals Indicate Model Redundancy

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In novometric analysis\(^1\)\(^-\)\(^2\) exact 95% confidence intervals (CIs) are computed for overall model performance and for model endpoints. When CIs overlap for two or more endpoints a model is said to be redundant, meaning that the domain of the outcome cannot be distinguished between overlapping endpoints. This research note provides an illustration of model redundancy.

For models found within a descendant family identified by the minimum denominator selection algorithm\(^1\)\(^-\)\(^2\) it is not uncommon for 95% CIs of two or more model endpoints\(^3\)\(^-\)\(^4\) to overlap.\(^5\)\(^-\)\(^7\) When such redundancy occurs the overlapping endpoints fail to provide unique estimates of the outcome (class) variable prevalence: that is, the difference between the endpoints is not statistically reliable.

This note illustrates such redundancy for an example involving research investigating in-hospital mortality for a sample of 1,660 patients hospitalized with HIV-associated *Pneumocystis carinii* pneumonia.\(^8\) The final (UniODA\(^4\)) and next-to-final (CTA\(^3\)) models in the descendant family are compared. Both models included a continuous measure of severity-of-illness, and the CTA model included a binary indicator of whether the observation had sudden weight loss.

As seen for the CTA model (Figure 1), counting from the left, the 95% CI of the first and second, second and third, and third and fourth endpoints overlapped. The difference in mortality point estimates for the first and second, second and third, and third and fourth endpoints are thus not statistically reliable. This indicates redundancy across the model domain.

![Figure 1: Redundant CTA Model](image-url)
In contrast, 95% CIs for the endpoints of the UniODA model (Figure 2) didn’t overlap, and thus there is no evidence of redundancy: the difference between the point estimates is statistically reliable (total N between models differ due to missing values).

![Severity of Illness Score Diagram]

- **≤ 80.5**
  - 2.9% Mortality
    - [95% CI: 1.6-4.3%]
  - N = 857
- **> 80.5**
  - 19.5% CI
    - [95% CI: 15.7-23.6%]
  - N = 548

Figure 2: Non-redundant UniODA Model

References


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