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Using Novometrics to Disentangle Complete Sets of Sign-Test-Based Multiple-Comparison Findings

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Prior empirical comparison of the timeline follow-back (TLFB, dummy-coded as 1) *vs*. Drinker Profile (DP, coded as 2) methods of quantifying alcohol consumption in treatment research reported pairwise sign tests comparing these methods separately on four categorical ordinal outcomes: abstinent=1; light=2; moderate=3; heavy=4 (Table 1). It was concluded: "The direction of differences for the abstinent and medium categories approached significance (with unprotected alpha criterion at .05) with the DP more often yielding higher estimates of abstinent days and lower estimates of medium days. The DP significantly more often yielded lower estimates of light days" (p. 27). This example is used to illustrate the use of novometric analysis to disentangle complete sets of sign-test-based pairwise comparison outcomes, including ties.

Prior research[1,2] omitted the equivocal sign-test outcomes from analysis so the resulting class variable has two categories (i.e., DP< TLFB *vs*. DP>TFLB), and thus EO-CTA analysis—that requires a binary class variable—is feasible.[3,4] In contrast, novometric statistical analysis[4] can be conducted for any class variable regardless of its metric, and is used presently to disentangle the complete set of sign-test-based findings—including the tied values.

Clearly seen in Table 1, the "DP=TLFB" outcome represents the intermediate value on a categorical interval "sign-test-based-finding" scale ranging from "DP<TLFB" (coded as 1) on one pole (end) of the scale, through the intermediate outcome "DP =TLFB" (coded as 2), to "DP>TLFB" on the other pole (coded as 3).[4]

Table 1: Summary of Pairwise Sign Tests Comparing TFLB vs. DP Drinking Outcomes[1]

Sign Test Finding	Abstinent	Light	Medium	Heavy
DP < TLFB	19	25	20	22
DP = TLFB	10	30	32	17
DP > TLFB	32	6	9	22

Exploratory novometric analysis[4] was conducted using sign-test-based-finding as an ordered class variable, and score on the 4-point drinking outcome scale as an ordered attribute. A single optimal model was identified, and is

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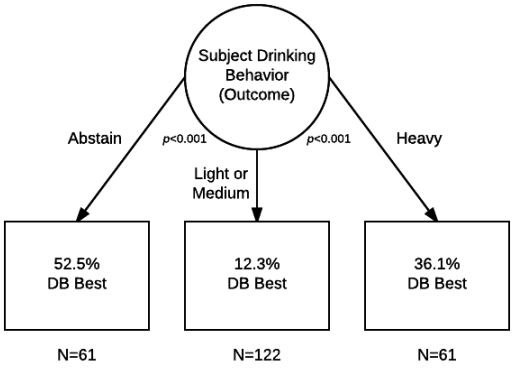
thus the globally optimal (GO) model[4] (stable in LOO analysis) in this application (Figure 1).

Figure 1: Novometric Model Disentangling Sign-Test-Based Pairwise Comparisons



The model indicates that compared to the TFLB method, for 52.5% (4 in 8) of 61 subjects who abstained, 36.1% (3 in 8) of 61 heavy drinkers, and 12.3% (1 in 8) of 122 light or medium drinkers, DP was the superior *(vs*. equivalent or inferior) method for quantifying an individual's drinking behavior—based on sets of pairwise sign tests. Table 2 presents the confusion matrix for this model. As seen, the GO model accurately classifies 61.1% (3 in 5) of actual DB≤TLFB sign-test-based pairwise comparisons, and 78.3% (4 in 5) of actual DB> TLFB sign-test-based pairwise comparisons, yielding moderate ESS=39.4.

Table 2: Confusion Matrix for GO Model

		Predicted Sign-Test		
		DP≤TLFB	DP>TLFB	
Actual	DB≤TLFB	107	68	61.1%
Sign-Test	DB>TLFB	15	54	78.3%

These results reveal that the DB method is best suited for assessing the drinking behavior of about half the people who abstain. Failure to identify a model that clearly differentiated the ambivalent *vs*. non-ambivalent findings suggests neither method of quantifying drinking behavior is clearly superior for assessing any of the subject "groups" as defined presently on the basis of quantity of drinking, and discriminated vis-à-vis pairwise sign tests.

References

[1]Cervantes EA, Miller WR, Tonigan JS (1994). Comparison of timeline follow-back and averaging methods for quantifying alcohol consumption in treatment research. *Assessment*, *1*, 23-30.

[2]Yarnold PR (2016). Using EO-CTA to disentangle sets of sign-test-based multiple-comparisons. *Optimal Data Analysis*, *5*, 158-159.

[3]Yarnold PR, Bryant FB (2015). Obtaining an enumerated CTA model via automated CTA software. *Optimal Data Analysis*, *4*, 54-60.

[4]Yarnold PR, Soltysik RC (2016). *Maximizing predictive accuracy*. Chicago, IL: ODA Books. DOI: 10.13140/RG.2.1.1368.3286

Author Notes

The study analyzed publically available data. No conflict of interest was reported.