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## ROC Analysis in SPSS

The ROC procedure in SPSS allows us to evaluate the performance of classification into two categories from a continuous variable.

The statistics resulting from the ROC analysis include the ROC curve and associated levels of sensitivity and specificity for classification rates given each unit change in the score scale. The area under the curve and a confidence interval are also provided.

*The Test Variable* is the measure or continuous score used to make classification decisions.

*The State Variable* is the criterion classification, or true category to which the participants belong. The value of the State Variable indicates the category to be considered *positive*.

It is assumed, in the ROC analysis, that increasing values on the test variable indicate a higher likelihood that the participants belong to one category, whereas lower values suggest the participants belong to the other category. The analyst must select which direction is *positive*.

It is assumed that the *true* category is known.

## SPSS Procedures

In SPSS, it is important to be consistent in setting up the analysis. These steps should be followed:

1. The outcome measure should be coded into a dichotomous variable that is consistent with the classification of At-Risk = 1 and Not-At-Risk = 0. Or in the case of RTI models, this could be Tier 1 = 0 and Tier 2/3 = 1. Or Tier 2 = 0 and Tier 3 = 1. The idea is that the more intense tiers include the more at-risk kids.
2. Select this at-risk variable as the State Variable.
3. In the Value for the State Variable, enter a 1 (predicting who is at-risk).
4. You want to include a Display of the ROC Curve with Diagonal reference line and the Standard Error and Confidence Interval.
5. In the Options dialogue window, be sure to specify the Test Direction, which indicates the directions in which the scores go to indicate at-risk scores. In IGDIs 2.0, "smaller test results indicate more positive test," meaning lower IGDI scores indicates more likely need for Tier 2 or 3 intervention. When the Value for the State Variable indicates at-risk kids needing Tier 2 intervention, then the "smaller test results indicate more positive test."
6. It is helpful to also obtain the Case Processing Summary, the ROC Curve Graph, and the Area Under the Curve table to complete interpretation of the ROC analyses.

The statistical hypothesis test available for the ROC analysis is one regarding the area under the curve. Regarding the area under the curve, its standard error, confidence interval, and associate *p*-value under the $H_0$: Area under the curve = .5, are provided.

### *Example*

ROC analysis with the Picture Naming Wave 1 measure logit score (Test variable) in classifying children on Oral Language Tier Levels (State variable) as classified by teachers. The test statistic associated with a ROC analysis, signifying the statistical significance of classification, is based on the area under the curve. "Area" is the probability that a score for a randomly selected positive case (Tier 2/3) is lower than the score for a randomly selected negative case (Tier 1). The ROC analysis suggests successful classification based on PN, Area = .782, $p < .001$.

*Area Under the Curve*

Test Result Variable: Picture Naming Measure Wave 1

| Area | Std. Error[a] | Asymptotic Sig.[b] | Asymptotic 95% Confidence Interval | |
|---|---|---|---|---|
| | | | Lower Bound | Upper Bound |
| .762 | .023 | .000 | .717 | .807 |

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

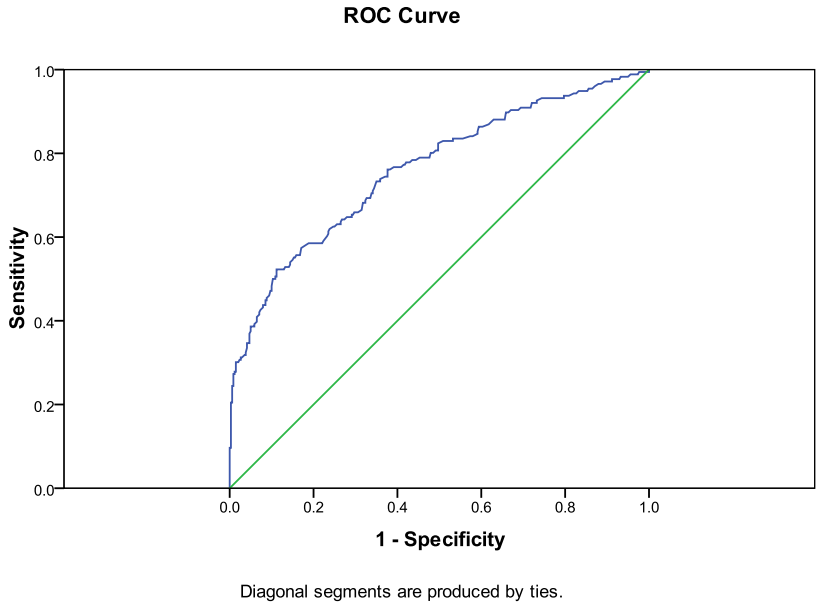


*Figure 1*. ROC curve of Sensitivity/Specificity balance for Picture Naming Wave 1.

The cut score that yields .70 sensitivity and .66 specificity is 1.90 logits. Although based on Figure 2, the maximal value on both metrics is about .68,associated with a score of 1.81.

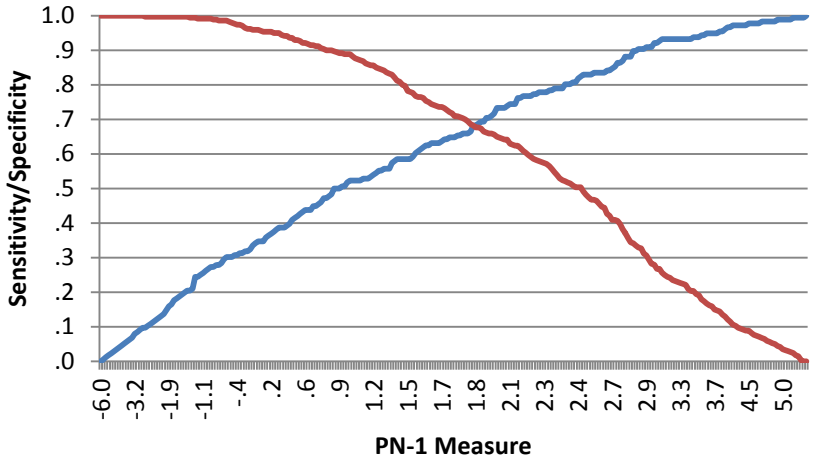


*Figure 2*. Illustration of the point of intersection of sensitivity (increasing line) and specificity (decreasing line) for PN Wave 1.