



9-17-2010

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### Recommended Citation

Bryant, Fred B.; Millstein Coakley, Rachael; Holmbeck, Grayson; and Yarnold, Paul R.. Manual vs. automated CTA: Psychosocial Adaptation in Young Adolescents with Spina Bifida. *Optimal Data Analysis*, 1, : 55-58, 2010. Retrieved from Loyola eCommons, Psychology: Faculty Publications and Other Works,

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# Manual vs. Automated CTA: Psychosocial Adaptation in Young Adolescents with Spina Bifida

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Compared to the manually-derived model, the enumerated CTA model was 20% more parsimonious, 3.6% more accurate and 30% more efficient, and was more consistent with *a priori* hypotheses.

A prospective study of how individual- and family-level multimethod, multi-informant attributes predict psychosocial adaptation (scholastic success, social acceptance, positive self-worth) in early adolescence was conducted for a sample of 68 families of children with spina bifida and 68 comparison families of healthy children.<sup>1</sup> Manually-derived CTA indicated that intrinsic motivation, estimated verbal IQ, behavioral conduct, coping style, and physical appearance best predicted psychosocial adaptation in early adolescence: health status was not a factor in the model. The model correctly classified 77.8% of the total sample, yielding ESS=55.0.

An enumerated CTA model was obtained by automated software for the same data used in manual analysis.<sup>2</sup> To be consistent between analyses, attributes were only allowed to enter the model if their associated ESS was stable (did not diminish) in jackknife validity analysis. The enumerated model is illustrated in Figure 1, and performance comparisons are given in Table 1.

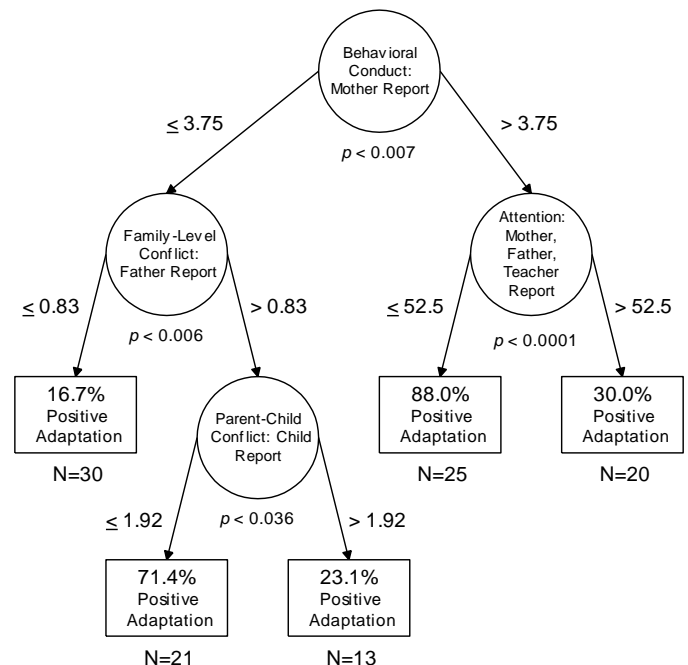


Figure 1: Enumerated CTA Model Predicting Psychosocial Adaptation in Young Adolescence

Table 1: Comparing Performance of Manually-Derived vs. Enumerated CTA Models

		<i>Predicted Class Status</i>			<i>Predicted Class Status</i>		
		Manual CTA Model			Enumerated CTA Model		
		Non-Positive Adaptation	Positive Adaptation		Non-Positive Adaptation	Positive Adaptation	
<i>Actual Class Status</i>	Non-Positive Adaptation	40	16	71.4	49	9	84.5
	Positive Adaptation	10	51	83.6	14	37	72.6
		80.0	76.1		77.8	80.4	
Total N Classified		117			109		
PAC (%)		77.8			78.9		
Model ESS		55.0			57.0		
Number of Attributes		5			4		
Model Efficiency		11.0			14.3		

Note: Values given to the right of the Positive Adaptation *columns* are the specificity (for non-positive adaptation) and sensitivity (for positive adaptation), and values given under the Positive Adaption *row*, beneath columns, are the negative (for non-positive adaptation) and positive (for positive adaptation) predictive values.<sup>3</sup> Total N classified varies as a function of missing data. PAC=percentage accuracy in classification=100% x (sum of correctly classified observations)/(total N classified).<sup>3</sup> ESS=effect strength for sensitivity, a normed index on which 0 is the level of classification accuracy that is expected by chance, and 100 is perfect accuracy.<sup>3</sup> The number of attributes in the CTA model is given, and model efficiency is defined as model ESS divided by number of attributes; is expressed in terms of mean ESS-units-per-attribute; and is a measure of the mean level of explanatory power per attribute which is used in the model—commonly, as “bang-for-the-buck”.<sup>3</sup>

The enumerated model used four attributes rather than five as used in the manual model, and thus it was 80% as complex, or 20% more parsimonious, than the manually-derived model. Compared to the manual model the enumerated model yielded greater ESS (3.6%), PAC (1.4%), efficiency (30%), specificity (18.3%), and positive predictive value (5.7%). In contrast, the manual model had greater sensitivity (15.2%) and negative predictive value (2.8%) than the enumerated model.

The enumerated model predicted 80.4% accurately that 42.2% of the sample would have a positive adaptation, and identified 72.6% of all subjects experiencing positive adaptation. And, the enumerated model predicted 77.8% accurately that 57.8% of the sample would have a non-positive adaptation, identifying 84.5% of all subjects experiencing non-positive adaptation.

The size of sample strata identified by the enumerated model is relatively homogeneous: the largest strata (N=30, 27.5% of classified sample) is 1.3-times larger than the smallest strata (N=13, 11.9% of classified sample). And,

all of the attributes loading in the model influenced the classification decisions which were made for a substantial portion of the sample. The percentage of observations classified in part on the basis of their score on the attribute was: Behavioral Conduct (100% of sample); Family-Level Conflict (58.7%), Attention (41.3%) and Parent-Child Conflict (31.2%).

The automated CTA model has several important similarities to the manually-derived CTA model. First, as with the manual model, neither health status (spina bifida *vs.* able-bodied) nor socioeconomic status emerged as factors in the automated model. This suggests that both CTA models were able to identify factors that were more predictive of psychosocial adaptation than the group differences often identified in pediatric research. Second, the factor “behavioral conduct in the classroom” emerged as being highly significant in both models. This demonstrates consistency between the models and reinforces the relationship between behavioral control in the classroom and psychosocial adaptation.

There were also important differences between the two models. Counter to our original hypotheses, the *manually derived model* did not identify any family-level variables, nor did it include any variables based on mother or father report. In contrast, the *automated CTA model* supported our original hypothesis by identifying two family-level variables in the model and including three variables based in part on mother and father report. Another difference between the two models is that in the manual model all of the factors were based on characteristics of the child and two of the factors represented more internalized child qualities (i.e., intrinsic motivation, coping style). In comparison, only half of the automated model focused on child factors and these included only externalized or observable behaviors (i.e., conduct, attention).

In summary, the automated model presents a more parsimonious way of classifying

this sample and supports the researchers’ original hypotheses by including family-level factors and information from multiple informants (parents, teachers, child). However, it identifies a substantially different constellation of factors in the classification of psychosocial adaptation as compared to the manual model. Many theoretically important factors that emerged in the manual model that are well supported in pediatric research on psychosocial adaptation (e.g., motivation, IQ, coping style, and attractiveness) were not included in the automated model. Instead, the automated model selected a narrower constellation of factors that was highly focused on behavioral presentation and family-level conflict. These models likely represent two theoretically viable and empirically supported paths to psychosocial adaptation.

## References

- <sup>1</sup>Coakley RM, Holmbeck GN, Bryant FB. Constructing a prospective model of psychosocial adaptation in young adolescents with spina bifida: an application of optimal data analysis. *Journal of Pediatric Psychology* 2006, 31:1084-1099.
- <sup>2</sup>Yarnold PR, Soltysik RC. Manual *vs.* automated CTA: optimal preadmission staging for inpatient mortality from *Pneumocystis carinii* pneumonia. *Optimal Data Analysis* 2010, 1:50-54.
- <sup>3</sup>Yarnold PR, Soltysik RC. *Optimal data analysis: a guidebook with software for Windows*. APA Books, Washington, DC, 2005.

## Author Notes

Completion of this manuscript was supported in part by research grants from the March of Dimes Birth Defects Foundation (12-FY01-0098) and the National Institute of Child Health and Human Development (RO1 HD048629). The authors wish to thank Ann Walsh Johnson, Joy Ito, Pat McGovern, Pat Braun, Caroline

Anderson, David McLone, John Lubicky, the Spina Bifida Association of Illinois, the staff of the spina bifida clinics at Children's Memorial Hospital, Shriners Hospitals for Children, Chicago, and Loyola University of Chicago Medical Center. We also thank numerous undergraduate and graduate research assistants for help with data collection and data entry. Most

importantly, we gratefully acknowledge the contributions to this study by the parents, children, teachers, and health professionals who participated over many years. Correspondence: Rachael M. Coakley, Children's Hospital Boston, Pain Treatment Service, 333 Longwood Ave, 5th Floor, Boston, MA 0215. eMail: [rachael.coakley@childrens.harvard.edu](mailto:rachael.coakley@childrens.harvard.edu).