Predictors of response to behavioral therapy in children with Tourette syndrome – results of the machine learning study

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Background:

While behavioral therapy is considered to be the first line treatment of Tourette syndrome (TS) both according to the guidelines of the European Society for the Study of Tourette Syndrome and the American Academy of Neurology, it is still not clear what could be the predictors of best treatment response. Preliminary studies have demonstrated that the presence of tic medication, greater tic severity and positive participant expectancy predicted greater tic improvement. On the contrary, the presence of some co-existing psychiatric disorders, in particular, anxiety disorder or attention deficit hyperactivity disorder, as well as the presence of premonitory urge predicted lower tic reduction. However, this topic has been explored in only two studies and have applied standardized analytical methodology. The purpose of this study is to determine possible predictors of symptom response to behavioral therapy in children with TS using selected machine learning approaches.

Methods:

Data were aggregated from 126 children (aged 9-17 years) with impairing TS or chronic tic disorder who were enrolled in randomized controlled trial (NCT00218777) testing the efficacy of comprehensive behavioral intervention for tics (CBIT) for tic reduction in children. The participants were randomly assigned to 8 sessions during 10 weeks of behavior therapy (n=61) or a control treatment consisting of supportive therapy and education (n=65). We compared standardized logistic regression model with two multivariable approaches in order to elucidate possible predictors of treatment response: recursive partitioning and random forests. Post-treatment Yale Global Tic Severity Scale (YGTSS) reduction of $\leq$ 30% indicated response.

Results and Conclusions:

Logistic regression did not consistently identify significant multivariate predictors. Recursive partitioning and machine learning found ADHD to predict response, with model accuracy ranging between 67% and 76%, and adequate sensitivity (67%-78%) and specificity (70% to 85%). Post-hoc analyses indicated that treatment responders had significantly lower rates of ADHD (p=0.04) than non-responders. It can therefore be concluded that multivariable approaches may be superior to regression for identifying predictors of treatment response for pediatric TS. These results may be helpful to identify evidence-based, low cost measurement approaches for identifying TS-affected youth who are likely to benefit from CBIT, which may inform clinical decision making.