Heritability in cognitive performance in large-scale studies can be assessed by computer-based testing

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INTRODUCTION: Many psychiatric diseases, such as schizophrenia and Attention Deficit Hyperactivity Disorder (ADHD), are complex polygenic disorders with cognitive deficits. Quantitative trait locus analyses in genome-wide scans may be particular useful to study such disorders. Large sample sizes are necessary for these studies, and it is necessary to have an efficient way to measure cognitive variables. Here, we test the hypothesis that computerized neurocognitive testing will be able to efficiently identify heritability in cognitive performance in a large psychiatric sample.

METHODS: A total of 267 parent-child dyads (N=534) were obtained from a database of results from a computerized neurocognitive test battery, CNS Vital Signs (CNSVS). Subjects with acquired brain disorders were excluded, allowing for focus on polygenic psychiatric disorders such as mood disorders, schizophrenia, and ADHD. Correlations were determined between parent-child dyads, as well as between the same child group and non-related adults. The non-related adults were matched to the parent group for age, gender, education, and race. Univariate regression analyses were done to determine the magnitude of performance in children accounted for by their parents.

RESULTS: Multiple significant positive correlations in neurocognitive test performance were found in parent-child dyads, in 14 standard score test domains, including an overall composite index , as well as the domains of Psychomotor Speed, Cognitive Flexibility, Nonverbal Reasoning, Working Memory, and Executive Function (all p's <.001). By comparison, significant positive correlations were found between the matched parent and child groups for only one domain: Psychomotor Speed ($p<.01$). For each of the domains found to be significantly correlated, parent performance accounted for 5-10% of child performance. Parent performance accounted for a greater proportion of variability in child performance than did non-parent adult performance for each domain.

CONCLUSIONS: These findings are consistent with the results of twin studies that demonstrate significant heritability in tests of general neurocognitive ability. Computerized testing is an effective tool to efficiently identify heritability in cognitive performance, and may be useful in large-scale studies that attempt to identify genetic bases of polygenic diseases and predict response variability in pharmacological trials.