



# RESEARCH FINDS AUTISM, ADHD AND TOURETTE SYNDROME ARE STRONGLY LINKED

This article is a review of the following research: Yang, Z., Wu, H., Lee, P. H., Tsetsos, F., Davis, L. K., Yu, D., Lee, S. H., Dalsgaard, S., Haavik, J., ... Paschou, P. (2021). Investigating Shared Genetic Basis Across Tourette Syndrome and Comorbid Neurodevelopmental Disorders Along the Impulsivity-Compulsivity Spectrum. *Biological psychiatry*, S0006-3223(21)00038-X. Advance online publication.

In 2019, an in-depth study showed close genetic relationships in the following seven psychiatric disorders: Autism Spectrum Disorder (ASD), Attention-Deficit/Hyperactivity Disorder (ADHD), Schizophrenia (SCZ), Bipolar Disorder (BIP), Major Depression (MD), Tourette Syndrome (TS), Obsessive-Compulsive Disorder (OCD) and Anorexia Nervosa (AN).<sup>1</sup>

It is worth noting that many of these genetically similar conditions occur together. For example, it is estimated that more than half of all individuals who have been diagnosed with ASD also have signs of ADHD.<sup>2</sup> It is also estimated that more than half of all individuals with TS have OCD or ADHD, and up to 20 percent of individuals with TS are diagnosed with ASD.<sup>3</sup>

Many of the researchers who were involved in the 2019 study wanted to further investigate the shared genetic composition of comorbid, early onset neurodevelopmental disorders: ASD, ADHD, TS and OCD.

## The Study

The study investigated the genetics of the 93,294 participants. All participants had one or more of the four conditions.

The researchers looked at single letter changes to the DNA (variants) that were shared by any two of the four conditions.

The researchers tested for common genetic factors in ASD, ADHD, TS, and OCD by using genomic structural equation modeling.

## Results

The study showed that **ASD, ADHD** and **TS** highly correlated with one another. The researchers identified 13 regions of the genome that have variants tied to ASD, ADHD and TS. Eleven of these regions were not identified in the 2019 study, showing an even stronger genetic relationship among the three conditions than previously thought.

The newly identified regions were expressed in the brain, specifically the hypothalamus, the pituitary glands and the adrenal glands.

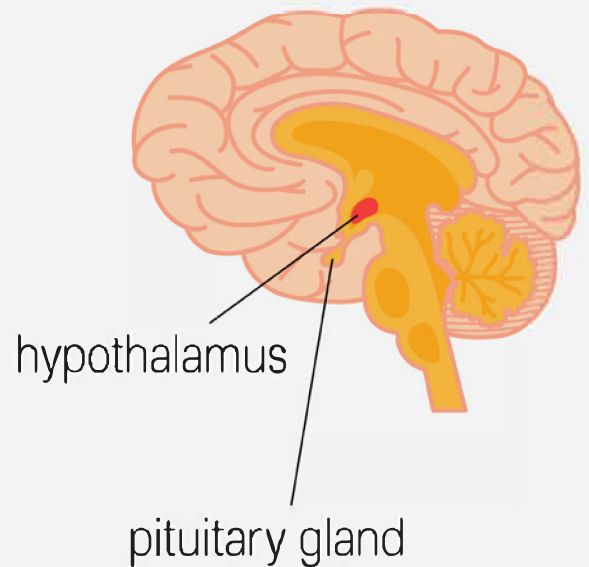
The researchers identified some common genes in the TS-ADHD-ASD association, including LINC00461 (chromosome 5), which is highly expressed in the visual cortex, and SORCS3, which is known to regulate neuronal viability in many pathways.

Overall, the genes highly correlated in TS, ADHD and ASD were primarily expressed in various brain regions, including the frontal cortex, basal ganglia, hypothalamus, cerebellum, amygdala, and hippocampus.

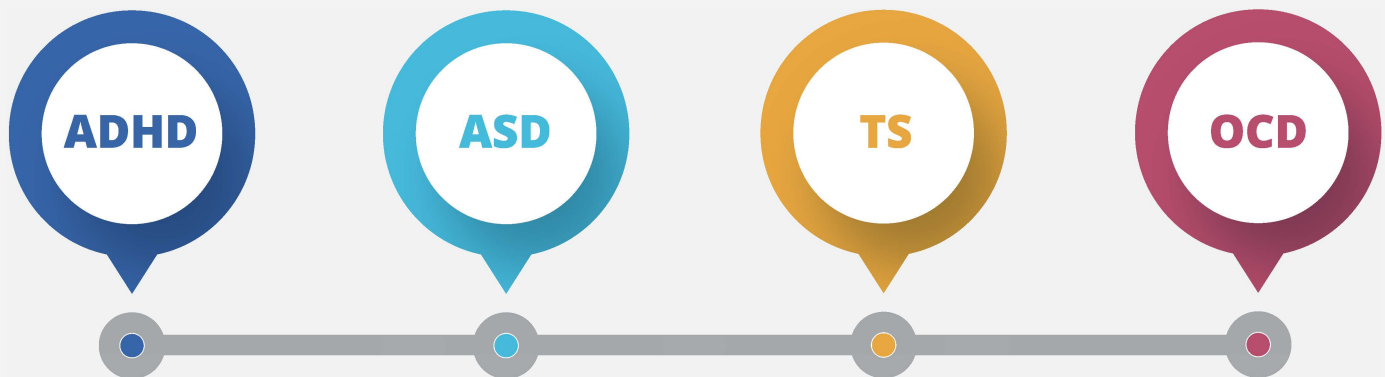
In addition, the study showed that **TS** and **OCD** highly correlated, but in a separate grouping than TS-ASD-ADHD. It also revealed that **ASD** and **OCD** do not show high genetic correlations.

### What this Means for Me

Based on the results found in this study, the research team — led by Dr. Peristera Paschou from Purdue University (West Lafayette, Indiana) — hypothesized that these four disorders lie on a continuum, running from ADHD on one end, through ASD and TS, to OCD on the other end. The researchers have labelled this the Impulsivity-Compulsivity Spectrum.



### The Impulsivity-Compulsivity Spectrum



Overall, this study confirms clinical observations since TS and OCD are commonly seen together, as are ASD and ADHD.

This information is important for parents and primary care physicians. It is becoming apparent that, genetically, children who are diagnosed with one neurological disorder are at high risk for others as well. The idea of a diagnosis should not be singular in focus. While the process can be more complex, it is better to address all symptoms and consider multiple diagnoses. With more accurate diagnoses, it is possible to optimize care and treatment. Parents should be vigilant in documenting all symptoms, especially the ones that may not fit into a classic diagnosis of autism. This may give professionals insight to other co-occurring conditions that the child may have.

Written By Autism Advocate Parenting Magazine

#### References

1. Lee, P.H. et al. (2019). Genomic Relationships, Novel Loci, and Pleiotropic Mechanisms across Eight Psychiatric Disorders. *Cell*, 179(7), 1469–1482.e11.
2. National Resource Center of ADHD. (2018). ADHD and Autism Spectrum Disorder. *Children and Adults with Attention-Deficit/Hyperactivity Disorder (CHADD)*. <https://chadd.org/wp-content/uploads/2019/03/ADHD-and-Autism-Spectrum-Disorder.pdf>
3. Cravedi, E., Deniau, E., Giannitelli, M., Xavier, J., Hartmann, A., & Cohen, D. (2017). Tourette syndrome and other neurodevelopmental disorders: a comprehensive review. *Child and Adolescent Psychiatry and Mental Health*, 11, 59.

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