

Impact of ADHD and Internalizing Disorder Symptoms on Substance Use Initiation Among Adolescents

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Introduction

- The estimated number of children aged 3 – 17 years ever diagnosed with ADHD in the U.S. is 6 million (9.8%)¹
- ADHD is associated with earlier Substance Use (SU), more frequent SU, and quicker escalation of SU among adolescents²
- Impairments associated with ADHD may impact social functioning leading to internalizing disorders (INT) (e.g., anxiety, depression), which are also highly comorbid with substance use disorders (SUDs)³
- Adolescence is a critical period of brain development with heightened neural plasticity and early SU may have a detrimental impact on brain development⁴
- Less is known about whether INT symptoms may serve as an indirect pathway for the association between ADHD symptoms and SU initiation

Study Aims

- Examine the mediating role of INT symptoms on the relationship between ADHD symptoms and SU initiation (ages 11 - 13)

Methods

- The Adolescent Brain Cognitive Development (ABCD) study is a multi-site longitudinal study following 9- and 10-year-old youth into early adulthood
- Data was obtained from ABCD study data release 4.0 and the present study included n = 4,075 ABCD children who were substance naïve at baseline (age: 9-10) and the 1 year follow-up (age: 10-11)
- SU initiation was defined as trying any non-prescribed substance (e.g., alcohol, tobacco, cannabis, non-prescribed medications)
- ADHD symptoms and INT symptoms were assessed with the Child Behavior Checklist (CBCL) and substance use was captured using the Timeline FollowBack interview
- Mediation analysis examined the mediating effect of INT symptoms on the relationship between ADHD symptoms and SU initiation

Table 1. Sample Characteristics (n = 4,075)

| Variable | Mean | SD | Range |
|-------------------------|----------|----------|--------------|
| Age - Baseline | 9.95 | 0.62 | 8.92 – 11.08 |
| CBCL ADHD Symptoms | 52.86 | 5.31 | 50 – 80 |
| CBCL INT Symptoms | 48.46 | 10.44 | 33 – 87 |
| Sex | N | % | |
| Female | 1,999 | 49.08 | |
| Ethnicity | N | % | |
| Hispanic | 770 | 18.90 | |
| Race | N | % | |
| White | 2883 | 70.78 | |
| Outcome Variable | N | % | |
| SU Initiation | 411 | 10.1 | |
| No SU Initiation | 3,664 | 89.9 | |

¹ T-scores were used for all CBCL subscales.

Figure 1. Conceptual Mediation Model

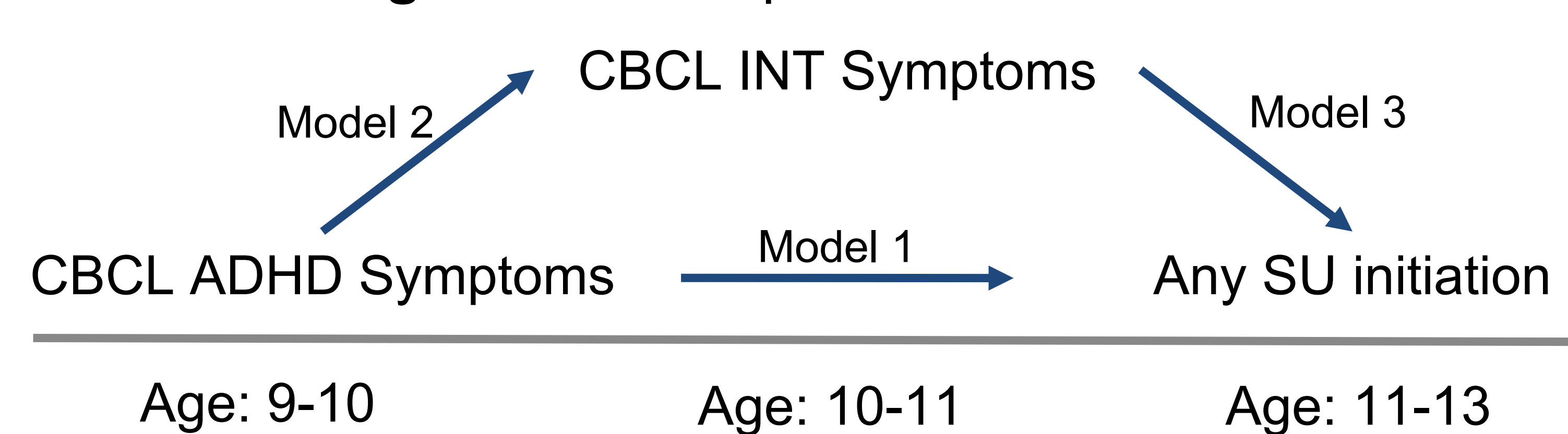


Table 2. Results of Mediation Analysis

| Variable | Estimate | 95% CI | p |
|--|----------|-------------|------|
| Average Causal Mediation Effect (ACME) | -0.00008 | -0.0004 – 0 | 0.53 |
| Average Direct Effect (ADE) | 0.0008 | 0.0002 – 0 | 0.03 |
| Total Effect | 0.0007 | 0.0001 – 0 | 0.04 |

Results

- 10.1% of participants initiated substance use
- Alcohol was the most common substance reported followed by nicotine and cannabis
- Model 1:** Effect of ADHD symptoms on SU Initiation - ADHD symptoms significantly predicted SU initiation (OR = 1.02, 95% CI = 1.00 and 1.04)
- Model 2:** Effect of ADHD symptoms on INT symptoms - ADHD symptoms significantly predicted INT symptoms (Estimate = 0.68, SE = 0.03, $p < 0.01$)
- Model 3:** Effect of INT symptoms on SU Initiation controlling for ADHD Symptoms - INT symptoms did not significantly predict SU Initiation (OR = 1.00, 95% CI = 0.99 and 1.00)
- INT symptoms did not mediate the effect of ADHD symptoms and SU initiation ($p = 0.53$)

Conclusions

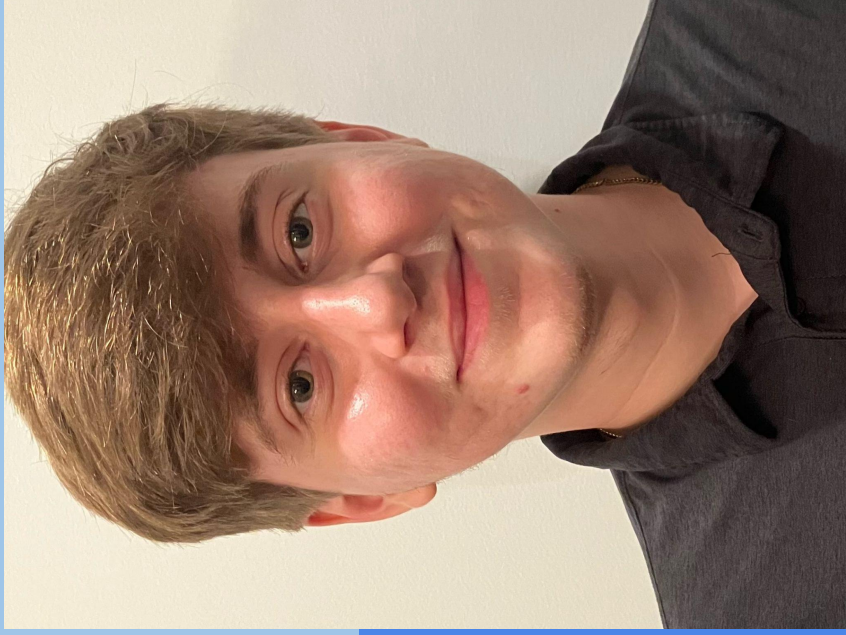
- ADHD symptoms independently predicted internalizing disorders (INT) symptoms and substance use (SU) initiation
- INT symptoms did not independently predict SU initiation, nor did they mediate the effect of ADHD symptoms on SU initiation
- The age at which INT symptoms was measured may not capture the age period in which INT symptoms start to impact the association between ADHD symptoms and SU initiation
- Future research could examine if INT symptoms mediate the association between ADHD and initiation or use of specific substances (i.e., alcohol)

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References

- Centers for Disease Control (2022). Data and statistics about ADHD. *Centers for Disease Control* <https://www.cdc.gov/ncbddd/adhd/data.html>
- Molina, B. S. G., Howard, A. L., Swanson, J. M., Stehli, A., Mitchell, J. T., Kennedy, T. M., Epstein, J. N., Arnold, L. E., Hechtman, L., Vitiello, B., & Hoza, B. (2018). Substance use through adolescence into early adulthood after childhood-diagnosed ADHD: findings from the MTA longitudinal study. *Journal of child psychology and psychiatry, and allied disciplines*, 59(6), 692–702. <https://doi.org/10.1111/jcpp.12855>
- Jones, T. M., Epstein, M., Hill, K. G., Bailey, J. A., & Hawkins, J. D. (2019). General and Specific Predictors of Comorbid Substance Use and Internalizing Problems from Adolescence to Age 33. *Prevention science : the official journal of the Society for Prevention Research*, 20(5), 705–714. <https://doi.org/10.1007/s11211-018-0959-5>
- Lees, B., Debenham, J., & Squeglia, L. M. (2021). Alcohol and Cannabis Use and the Developing Brain. *Alcohol research : current reviews*, 41(1), 11. <https://doi.org/10.35946/arc.v41.1.11>



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