

The Interplay of Mental Health Burden and Cognitive Development in Childhood and Adolescence: Insights from the ABCD Study

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Abstract

Mental health disorders commonly emerge during childhood and early adolescence and are often associated with cognitive difficulties. However, longitudinal evidence examining how cumulative mental health burden relates to cognitive development in population-based samples remains limited. The purpose of this study was to evaluate the relationship between mental health burden and cognition from childhood to early adolescence. We analysed longitudinal population-based data from the Adolescent Brain Cognitive Development Study to compare cognitive performance between participants classified at baseline (9–11 years) as having (1) no mental health disorder ($n = 8846$); (2) one mental health disorder ($n = 1406$); or (3) multiple (i.e., two or more) mental health disorders ($n = 434$) based on the Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS) for DSM-5. Cognitive outcomes assessed using the NIH Toolbox were administered across two or three timepoints over a four-year period. Repeated measures ANOVAs tested for main effects of time and group, and time x group interactions. Across all tasks there was a significant effect of time, with effect sizes ranging from moderate to large ($\eta^2p\ 0.04\text{--}0.26$). There was a very small effect of group ($\eta^2p < .01$) for all tasks except for picture vocabulary. The no disorder group performed significantly better than the multiple disorder groups across all tasks, and better than the one disorder group on pattern comparison processing speed. Group x time interaction effects were only observed on the picture vocabulary and pattern comparison processing speed tasks, although the effect sizes were very small ($\eta^2p < .01$). These findings suggest that cumulative burden of multiple mental health disorders is associated with reduced cognitive performance. While trajectories of cognitive development from childhood to early adolescence are similar regardless of mental health burden, individuals with multiple disorders consistently exhibit poorer cognition. The magnitude of these differences is small, indicating the impact of comorbidity on cognition is modest, but persistent over time.

Background

Although childhood and adolescence represent critical periods of growth and development, they are also frequently marked by the onset of mental health disorders (1, 2). Cognitive impairments are widespread across these disorders, with deficits observed across multiple cognitive domains including attention, memory, executive function, and processing speed, regardless of diagnostic category (3–7). While cognitive dysfunction is recognised as a transdiagnostic feature of mental health disorders (8), the broader implications of cumulative mental health burden, and how cognitive function may differ in individuals with multiple co-occurring disorders, remains poorly understood. A recent systematic review of substance use and bipolar disorder found that individuals with comorbid diagnoses exhibited greater cognitive impairment compared to those with bipolar disorder alone (9). However, most of the research in this area has focused on clinical populations, leaving gaps in our understanding of cognition in broader, community-based samples. Although cross-sectional studies indicate poorer cognitive function with increased mental health burden (9, 10), longitudinal evidence remains extremely limited. This hampers our ability to understand how cognitive functioning changes over time and whether cognitive trajectories differ according to varying levels of mental health burden. This highlights the need for a structured approach that measures cognition across multiple timepoints using consistent, validated, and well standardised cognitive assessments.

To address these key limitations, this study leverages data from the Adolescent Brain Cognitive Development (ABCD) study, a large community-based population sample of children with four years of longitudinal follow-up(11). We investigate the relationship between mental health burden and cognition from childhood to early adolescence. The primary research question investigates whether children experiencing greater mental health burden (i.e., multiple disorders) at baseline exhibit distinct cognitive trajectories over time that differ from children with no disorder or a single disorder. We hypothesised that children with greater mental health burden (i.e., multiple disorders), will exhibit poorer cognitive performance compared to individuals with no disorders or a single disorder. Additionally, we anticipate that cognitive trajectories will remain stable regardless of disorder status.

Methods

Participants We used longitudinal data from ABCD Release 5.1, including data across three timepoints; baseline ($n = 11,868$), 2-year follow-up ($n = 10,972$), and 4-year follow-up ($n = 4754$) (<http://dx.doi.org/10.15154/z563-zd24>). Children aged 9–11 years at baseline were recruited via school systems across 21 sites in the United States between 2016 and 2018. Recruitment across the 21 study sites was geographically distributed to ensure demographic and socioeconomic diversity. The ABCD study protocols were approved by a central institutional review board at the University of California, San Diego. Informed consent was obtained from all participants as part of the original study. All procedures were performed in accordance with the relevant guidelines and regulations. Further details of recruitment are available elsewhere (11). Sample demographics are available in Table 2. Children were excluded if they were not fluent in English, had a parent not fluent in English or Spanish, had a major medical or neurological condition, a gestational age < 28 weeks, or birth weight < 1,200g. Additional exclusion criteria included a contraindication to magnetic resonance imaging, a history of traumatic brain injury, a current diagnosis of schizophrenia, moderate/severe autism spectrum disorder, intellectual disability, or alcohol/substance use disorder.

Table 2
Descriptive Statistics of Sample at Baseline

Age (M, SD) [range] years	No disorder (n = 8846)	One disorder (n = 1406)	Multiple disorders (n = 434)	p ^a
	9.9 (0.6) [8.9–11.1]	9.9 (0.6) [8.9–11.1]	9.9 (0.6) [8.9–11.1]	> .05
Sex (N, % female)	4403 (49.8)	631 (44.9)	145 (33.4)	< .001
Race (N, %)				
American Indian or Alaska Native	285 (3.2)	58 (4.2)	16 (3.7)	> .05
Asian	609 (6.9)	73 (5.2)	21 (4.8)	> .05
Black/African American	1765 (20.0)	328 (23.4)	121 (27.9)	< .001
Native Hawaiian or other Pacific Islander	57 (0.6)	7 (0.5)	2 (0.5)	> .05
White	6590 (74.7)	1042 (74.3)	322 (74.2)	> .05
Other	577 (6.5)	105 (7.5)	25 (5.8)	> .05
Unknown	122 (1.4)	18 (1.3)	4 (0.9)	> .05
Ethnicity (N, %)				
Hispanic/Latino/Latina	1775 (20.3)	274 (19.9)	55 (12.7)	< .001
Parental education (N, %)				< .001
Without high school diploma	561 (5.49)	72 (5.1)	21 (4.9)	
Highschool graduate without college education	913 (10.3)	150 (10.7)	35 (8.1)	
Some college education	2455 (27.8)	476 (33.9)	166 (38.2)	
Degree from 4-year college or more	4906 (55.5)	704 (50.3)	212 (48.8)	
Total household income (N, %)				< .001
<\$16,000	733 (9.0)	138 (10.5)	46 (11.6)	
\$16,000 to <\$35,000	814 (10.1)	146 (11.1)	55 (13.8)	
\$35,000 to <\$50,000	666 (8.2)	132 (10.1)	34 (8.5)	
\$50,000 to <\$75,000	1095 (13.5)	201 (15.4)	61 (15.3)	
\$75,000 to <\$100,000	1188 (14.7)	187 (14.3)	60 (15.0)	
\$100,000 to <\$200,000	2579 (31.9)	369 (28.2)	115 (28.7)	
>\$200,000	1021 (12.6)	135 (10.3)	29 (7.2)	
WISC V Matrix Reasoning Total Raw Score (M, SD)	18.1 (3.8)	17.8 (4.0)	17.1 (3.9)	< .001
ADHD (N, %)	0 (0)	319 (22.7)	326 (75.1)	
Any ODD/CD (N, %)	0 (0)	357 (25.4)	330 (76.0)	
Any anxiety disorder (N, %)	0 (0)	690 (49.1)	246 (56.7)	
Any depressive disorder (N, %)	0 (0)	6 (0.4)	13 (13.0)	
Any bipolar disorder (N, %)	0 (0)	2 (0.1)	16 (3.7)	
Any eating disorder (N, %)	0 (0)	28 (2.0)	32 (7.4)	
PTSD (N, %)	0 (0)	0 (0.0)	6 (1.4)	
Any substance and/or addictive disorder (N, %)	0 (0)	11 (0.8)	9 (2.1)	
Suicidal ideation/self-harm (N, %)	117 (1.3)	63 (4.5)	48 (11.1)	

^a p values were estimated using one-way ANOVA for continuous variables and chi-square tests for categorical characteristics. Any ODD/CD = at least 1 of ODD, CD childhood onset, or CD adolescent onset present; Any anxiety disorder = at least 1 of panic disorder, agoraphobia, separation anxiety disorder, social anxiety disorder, specific phobia, or generalised anxiety disorder present; Any depressive disorder = at least 1 of disruptive mood dysregulation disorder, persistent depressive disorder, or major depressive disorder present; Any bipolar disorder = at least 1 of bipolar II currently hypomanic, bipolar II currently depressed, bipolar I currently depressed, bipolar I currently hypomanic, or bipolar I currently manic present; Any psychotic disorder = at least 1 of schizophrenia, schizophreniform disorder, or schizoaffective disorder present; Any eating disorder = at least 1 of binge eating disorder, anorexia nervosa binge eating/purging subtype, or anorexia nervosa restricting subtype, or bulimia nervosa present.

Mental health burden We classified participants into three groups: (1) no disorder, (2) one disorder, and (3) multiple (i.e., two or more) disorders. Classification was based on the presence of mental health disorder(s) at baseline as assessed by the computerised Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS) for DSM-5. Parents/guardians completed all K-SADS modules at baseline. Mental health disorder(s) present at baseline included any depressive disorder; any bipolar disorder; any anxiety disorder; any eating disorder; attention-deficit/hyperactivity disorder; any disruptive behaviour; any substance and/or addictive disorder. Obsessive-compulsive disorder (OCD) was excluded entirely from the sample due to previously identified diagnostic uncertainty (12, 13). Participants who did not meet criteria for any of the above disorder/s were classified into the no disorder group.

NIH Toolbox cognition measures Participants were administered all seven cognitive tasks from the NIH Toolbox at baseline. We selected five tasks for analysis based on the availability of longitudinal data. This included picture vocabulary, oral reading recognition, picture sequence memory, list sorting working memory, and pattern comparison processing speed. All tasks were repeated at 2- and 4-year follow-up, except for list sorting working memory which was only repeated at 4-year follow-up. The dimensional change card sort task was not analysed as it was only administered at baseline. The flanker inhibitory control and attention task was not analysed as a different flanker task was administered at follow-up due to issues with administering the original task remotely during the COVID-19 pandemic. We selected raw scores and theta scores as the primary outcome measure(s) instead of corrected and standardised scores. These measures are preferred in longitudinal analyses of behavioural change due to their precision in capturing absolute change over time (14, 15). Further details on the NIH Toolbox tasks are available in Table 1.

Table 1
Description of NIH Toolbox tasks

Task	Description	Primary outcome measure(s)	Cerebral network	Cognitive function
Picture Vocabulary	The participant listens to an audio recording of a word while viewing four photographic images displayed on the iPad screen and is instructed to choose the image that best represents the word's meaning.	Theta score – overall ability/performance	Left hemisphere(27)	General language vocabulary knowledge.
Oral Reading Recognition	The participant is instructed to read and pronounce letters and words as accurately as possible. The test administrator evaluates each attempt as correct or incorrect.	Theta score – overall ability/performance	Left hemisphere(27)	Reading decoding skill.
Picture Sequence Memory	The participant is asked to memorise longer sequences of illustrated objects and activities, presented in a specific order alongside corresponding audio-recorded phrases. Participants are then tasked with recalling the demonstrated sequence over two learning trials, with sequence lengths ranging from 6 to 18 pictures based on age.	Raw score – overall ability/performance	Temporal lobe(28)	Episodic memory.
List Sorting Working Memory	The participant is presented with images of various foods and animals are shown alongside corresponding audio recordings and written text. Participants are instructed to recall and repeat the items in order of size, from smallest to largest, initially focusing on a single category (either animals or foods, referred to as 1-list) and then on two categories (foods followed by animals, referred to as 2-list).	Raw score – total correct	Fronto-parietal(29)	Working memory.
Pattern Comparison Processing Speed	The participant is presented with two pictures and is tasked with quickly deciding whether the images are identical.	Raw score – total correct	Frontal(30, 31)	Processing speed.

Statistical analyses Repeated measures ANOVAs were performed using jamovi (version 2.6) to examine changes in cognitive performance over time. Cognitive performance on the NIH Toolbox tasks was assessed at baseline, 2-year follow-up, and 4-year follow-up as within-subject factors. Mental health burden at baseline was included as a between-subjects factor with three levels: no disorder, one disorder, or multiple disorders. The analysis tested for main effects of time and group, as well as their interaction to determine whether cognitive performance differed over time across groups. Post-hoc comparisons were conducted using Tukey's HSD to assess differences between groups. Effect sizes were reported using partial eta squared (η^2) and interpretation followed standard guidelines: $\eta^2 = 0.01$ indicates a small effect, $\eta^2 = 0.06$ a medium effect, and $\eta^2 \geq 0.14$ a large effect (16). Assumption checks (sphericity violations) were addressed using Greenhouse-Geisser corrections when necessary. Statistical significance was set at $p < .05$. Both unadjusted and adjusted analyses were conducted. Unadjusted analyses examined the primary effects without covariates. Due to the known effects of socioeconomic status on cognitive performance and to ensure that observed group comparisons are not distorted by differences in socioeconomic factors, we included parental education and combined household income as covariates (17). To address potential confounding by social and demographic factors, all primary analyses were adjusted for demographic variables that differed between mental health burden groups.

Participants were excluded from analysis if diagnostic data were missing at baseline or cognitive data were missing at any of the timepoints. To determine whether the included sample for analysis is reflective of the overall baseline sample we conducted chi-square and independent samples t-tests to compare the two groups at baseline.

Results

Descriptive statistics Table 2 shows sample characteristics for each group at baseline. No disorder prevalence at baseline was 82.8% ($n = 8846$), one disorder 13.2% ($n = 1406$) and multiple disorders 4.1% ($n = 434$). A greater proportion of participants in the multiple disorders group were male (66.6%) compared to the no disorder (55.1%) and single disorder (50.2%) groups. Disorder stability across the four-year follow up period was low. By year 4, 8.5% ($n = 282$) of participants who had no disorder at baseline were classified as having one disorder, while 1.8% ($n = 59$) transitioned to multiple disorders. Among

those with one disorder at baseline, 68.7% (n = 367) no longer met diagnostic criteria, whereas 7.9% (n = 42) progressed to multiple disorders. Of participants with multiple disorders at baseline, 46.2% (n = 61) no longer had a disorder at year 4, while 23.5% (n = 31) retained a single disorder. Results of statistical analysis including final sample sizes can be found in Table 3 and Fig. 1. We compared baseline demographic differences between participants with and without any missing data (see supplement material). Compared to those with missing data, the included sample had: a smaller proportion of Black/African American participants, a greater proportion of White participants, a greater proportion of 4-year college educated participants, a greater proportion of participants with total household income >\$75,000, a smaller proportion of participants with multiple disorders, and higher scores on NIH toolbox tasks. Adjustments using socioeconomic factors as covariates did not meaningfully alter the effects, with patterns of significance and effect sizes remaining consistent across models. Similarly, results from the demographic-adjusted models were consistent with the primary analyses. Adjusting for sex, race, ethnicity, parental education, and household income did not meaningfully change the pattern or magnitude of associations between mental health burden and cognitive performance. As a result, unadjusted results are presented here, and adjusted results can be accessed in supplemental materials.

Table 3
Results of unadjusted repeated measures ANOVA

Measure	Baseline Mean (SE)			Year 2 Mean (SE)			Year 4 Mean (SE)			N		
	No disorder	1 disorder	2+ disorder	No disorder	1 disorder	2+ disorder	No disorder	1 disorder	2+ disorder	No disorder	1 disorder	2+ disorder
Picture Vocabulary	0.71 (0.03)	0.74 (0.07)	0.68 (0.15)	1.60 (0.03)	1.59 (0.08)	1.25 (0.16)	2.58 (0.03)	2.66 (0.08)	2.28 (0.16)	3190	516	122
Oral Reading	-0.10 (0.04)	-0.31 (0.10)	-0.72 (0.20)	1.20 (0.04)	1.00 (0.10)	0.58 (0.21)	2.72 (0.04)	2.66 (0.11)	2.22 (0.22)	3153	515	121
Picture Sequence	13.7 (0.11)	13.4 (0.27)	12.0 (0.56)	18.2 (0.11)	17.5 (0.28)	15.8 (0.58)	16.8 (0.13)	16.3 (0.32)	14.6 (0.66)	3219	531	123
List Sorting	16.2 (0.05)	16.1 (0.13)	15.5 (0.26)	NA	NA	NA	18.4 (0.05)	18.2 (0.13)	17.7 (0.27)	3341	545	135
Pattern Comparison	38.7 (0.15)	37.5 (0.35)	36.6 (0.73)	45.8 (0.15)	44.4 (0.39)	45.3 (0.74)	51.5 (0.17)	50.9 (0.39)	49.2 (0.81)	2285	400	94
NA = Not Administered.												

Effect of time on cognitive performance Across all NIH Toolbox tasks a significant main effect of time was observed (Table 3). Large effect sizes were observed on the picture vocabulary ($\eta^2p = 0.18$), oral reading recognition ($\eta^2p = 0.23$), and pattern comparison processing speed tasks ($\eta^2p = 0.26$), with a medium effect observed on the list sorting working memory task ($\eta^2p = 0.09$), and a small effect observed on the picture sequence memory task ($\eta^2p = 0.04$).

Effect of mental health burden on cognitive performance Across all NIH Toolbox tasks, except for picture vocabulary, there was a significant main effect of group, although effect sizes were very small ($\eta^2p < .01$) (Table 3). Post hoc comparisons revealed no difference in performance between the no disorder and one disorder group. The exception was the pattern comparison processing speed task, on which children with no disorder performed better than both the one disorder and multiple disorders groups. However, children in the no disorder group performed significantly better than those in the multiple disorders group on the oral reading recognition, picture sequence memory, and list sorting working memory tasks. Additionally, picture sequence memory showed a significant difference between the one disorder and multiple disorders group, with children in the one disorder group demonstrating better performance than those with multiple disorders.

Time and mental health burden interaction effects A significant interaction effect between time and group was observed on the picture vocabulary and pattern comparison processing speed tasks. Children in the no disorder group showed greater improvement over time compared to those with one or multiple disorders, however the effect size was very small ($\eta^2p < .01$). No significant interaction effects were identified for the other NIH Toolbox tasks.

Discussion

This study leveraged the large, longitudinal ABCD dataset to examine how mental health burden shapes cognitive development from childhood to early adolescence. Our findings reveal a consistent pattern; while cognitive abilities improve over time across all children, those with multiple co-occurring mental health disorders exhibit persistent disadvantages in several domains. These results underscore the cumulative impact of psychiatric comorbidity on cognition and highlight processing speed as a potential early marker of vulnerability.

Processing speed, a sensitive and foundational marker Processing speed showed significant differences between all three groups, including between the no disorder and one disorder groups. This suggests that processing speed may be particularly sensitive to mental health burden, even at lower levels. As a foundational cognitive skill, slowed processing speed can impair the efficiency of encoding, retrieving, and manipulating information, ultimately acting as a bottleneck that compounds deficits in memory, executive control, and learning. The observed group differences highlight a distinction between immediate vs. long-term cognitive demands, pointing to differing neural mechanisms that underpin these functions. Slower processing speed may reflect broader inefficiencies in neural communication, a pattern commonly reported in neuroimaging studies of individuals with mental health difficulties (8, 18). Its sensitivity to even lower levels of mental health burden suggests that processing speed may serve as an early cognitive marker of risk, potentially preceding more pronounced impairments in other domains. This interpretation aligns with prior research indicating that processing speed is particularly susceptible to

disruptions in attention, mood, and motivation, core features of many psychiatric disorders (19). While working memory and episodic memory, are associated with prefrontal and temporal lobe function, respectively, and can be influenced by slower processing speeds, performance in these domains is often preserved through compensatory cognitive strategies, such as increased cognitive effort (20). This may explain why individuals with lower levels of mental health burden continue to perform adequately on memory-related tasks despite slowed processing. However, as mental health burden increases, the capacity to compensate may be overwhelmed. In such cases, slower processing speed may not only reflect a primary vulnerability but also act as a limiting factor that exacerbates broader cognitive dysfunction.

Memory, a domain impacted by cumulative burden Cognitive performance differed significantly between individuals with and without mental health disorder/s, although overall effect sizes were small. A more nuanced pattern emerged when comparing the no disorder, one disorder, and multiple disorder groups. On tasks assessing episodic and working memory, children with a single disorder performed similarly to those with no disorder. In contrast, children with multiple disorders showed significantly poorer performance, suggesting a cumulative impact of mental health burden on memory function. The compounding effect is further evidenced by significantly poorer episodic memory performance in children with multiple disorders compared to those with a single disorder.

Importantly, by stratifying participants into single versus multiple disorder groups, we were able to isolate the impact of cumulative psychiatric burden, an approach that helps disentangle the effects of comorbidity from those of individual disorders. While a single disorder may not substantially impair memory, the presence of multiple co-occurring disorders appears to contribute to measurable disruptions in memory functioning. Although previous studies have documented memory difficulties in individuals with mental health disorders (8, 21, 22), much of this literature has focused on clinical populations, where severe cases, individuals seeking treatment, and complex comorbidities are over-represented. Our use of a large, community-based sample allows for a more precise delineation of how disorder load relates to cognitive performance, revealing subtle impairments that may be obscured in smaller or clinically biased samples.

Crystallised abilities, stability with subtle disruption Vocabulary performance remained stable across groups, reinforcing the notion that long-term verbal knowledge is robust even in the presence of mental health burden. This aligns with the view that crystallised abilities are typically stable across the lifespan(23). As crystallised knowledge reflects accumulated verbal and academic skills, it closely parallels standard measures of intelligence. The absence of group effects on vocabulary supports this interpretation. However, oral reading was compromised in children with multiple disorders, suggesting that even simple one-word reading tasks may be sensitive to elevated mental health burden. This finding is consistent with prior research showing increased rates of psychiatric disorders among individuals with reading difficulties, and a higher prevalence of reading problems in children with multiple comorbid conditions(24, 25). While crystallised abilities are generally less vulnerable to short-term cognitive disruptions than fluid reasoning tasks(23, 26), the observed differences in reading likely reflect challenges in reading-related cognitive processes, such as attention, processing speed or motivation, rather than fundamental difficulties in verbal intelligence. These subtle disruptions may indicate that oral reading, though crystallised in nature, also draws on dynamic cognitive resources that are more susceptible to mental health burden.

Stability over time, persistent cognitive differences Across all groups, children showed steady improvements in cognitive performance over the four-year period, reflecting developmental gains. However, differences in cognitive abilities between children with and without mental health disorders were already present at the start of the study, and these differences remained consistent over time. Even though many children's diagnostic status fluctuated, their cognitive performance did not fully catch up. By year four, nearly 70% of children who initially had one disorder and 50% of those with multiple disorders no longer met diagnostic criteria. Yet, the cognitive gaps between groups persisted. This raises important questions about the relationship between mental health and cognition; are these cognitive differences a consequence of psychiatric symptoms, or do they reflect underlying vulnerabilities that exist before symptoms emerge? Previous research suggests that cognitive difficulties often linger even after symptom remission(20). Our findings reinforce this idea and suggest that cognitive challenges may not simply mirror current mental health status, they may reflect deeper, more enduring traits. Whether these cognitive inefficiencies increase the risk of developing mental health problems, or whether even brief episodes of distress leave lasting cognitive traces, remains an open question. Future research should explore longer-term trajectories from early development, and how changes in mental health over time relate to shifts in cognitive functioning, to better understand the complex bidirectional relationship.

Strengths of the current study Clinical studies often emphasise a large degree of cases with complex heterogeneities, making it difficult to disentangle the cognitive effects of single versus multiple mental health disorders. These sampling biases limit generalisability and obscure subtler patterns of cognitive functioning. By leveraging, a large, population-based community sample, our study captures a broader and more representative cohort of children and adolescents with mental health conditions. This design enables the detection of more nuanced cognitive differences that may not emerge in smaller or clinically biased samples. As a result, our findings offer a more comprehensive and ecologically valid assessment of how mental health burden relates to cognition.

Limitations While this study provides valuable insights into the relationship between mental health burden and cognitive function over time, several limitations should be considered when interpreting the findings. First, our analysis did not examine all aspects of cognition, and the exclusion of functions such as attention and executive function, limits our understanding of the relationships between mental health burden and these broader aspects of cognitive functioning. Second, our findings are based on a four-year developmental window, meaning conclusions can only be drawn within this specific period. Given that cognition continues to develop across adolescence and into early adulthood, further longitudinal analyses are necessary to capture the longer-term trends, and potential shifts in the relationship between mental health burden and cognitive outcomes. The ABCD study is expected to continue until participants reach ages 19–20, which will provide opportunities for extending these analyses into early adulthood.

Implications for practice Despite these limitations, this study provides valuable insights into the relationship between mental health burden and cognitive function from childhood to early adolescence. These findings have important clinical and educational implications. While children with mental health disorders showed slightly lower cognitive performance on average, the magnitude of these differences was small. These findings suggest subtle but robust

vulnerabilities. In educational and clinical contexts, support should continue to be guided by individual functional needs rather than diagnostic status or the presence of comorbidities alone. An important educational implication is that children with mental health disorders may struggle cognitively even in the absence of a formal learning disorder. These difficulties can stem from slower processing speed, which affects their ability to efficiently absorb, retrieve and manipulate information in academic settings. As mental health burden increases, a broader range of cognitive abilities, including working memory, may be impacted, reinforcing the need for structured academic accommodations. Schools can implement targeted strategies such as extended time on tasks, reduced time pressure, and chunking information using visual aids, all of which can help alleviate the impact of slowed cognitive processing on learning outcomes.

Clinicians should account for cognitive inefficiencies when developing treatment strategies, educational accommodations, and therapeutic interventions, ensuring that psychiatric care addresses both mental health symptoms and cognitive function. Further longitudinal research is critical in this space to better understand the directionality of the relationship between mental health burden and cognition over time. Future work should examine how changes in mental health burden over time (e.g., reductions, stability, or increases across timepoints) relate to individual cognitive development. This approach would provide greater clarity on whether fluctuations in mental health are linked to meaningful changes in cognitive functioning.

Conclusions

In summary, this study demonstrates that while cognitive abilities improve across development, children with greater mental health burden consistently exhibit poorer cognitive performance. Processing speed emerged as a particularly sensitive domain, showing deficits even in children with a single disorder, while memory and reading difficulties were more pronounced in those with multiple disorders. These findings highlight the cumulative toll of psychiatric comorbidity on cognitive functioning and underscore the importance of early identification and sustained support. Crucially, cognitive disparities remained stable over time, even as many children no longer met diagnostic criteria, suggesting that cognitive vulnerabilities may persist beyond symptom remission. Future research should explore how fluctuations in mental health status relate to cognitive change, and whether targeted interventions can mitigate long-term cognitive impacts in children with mental health disorders.

Declarations

Ethics approval and consent to participate

The ABCD study's protocols were approved by a central institutional review board at the University of California, San Diego. Secondary data analysis was completed on deidentified data; no further IRB approval was required. This study was performed in accordance with the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing Interests

Prof Coghill has received honoraria from Medice, Novartis, Servier and Takeda and royalties from Cambridge University Press and Oxford University Press. Ms. Mehmed, A/Prof Mulraney and A/Prof Payne have reported no biomedical financial interests or potential conflicts of interest.

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Author Contribution

Conceptualisation: DC, JP, MM; Methodology: YM, MM, JP, DC; Software: YM; Validation: YM; Formal analysis: YM; Investigation: YM; Resources: YM; Data Curation: YM; Writing – Original Draft: YM; Writing – Review & Editing: DC, JP, MM; Visualisation: YM; Supervision: DC, JP, MM.

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Data Availability

Data used in the preparation of this article were obtained from the Adolescent Brain Cognitive Development (ABCD) Study (<https://abcdstudy.org>), held in the NIMH Data Archive (NDA). This is a multisite, longitudinal study designed to recruit more than 10,000 children age 9-10 and follow them over 10 years into early adulthood. The ABCD Study® is supported by the National Institutes of Health and additional federal partners under award numbers U01DA041048, U01DA050989, U01DA051016, U01DA041022, U01DA051018, U01DA051037, U01DA050987, U01DA041174, U01DA041106, U01DA041117, U01DA041028, U01DA041134, U01DA050988, U01DA051039, U01DA041156, U01DA041025, U01DA041120, U01DA051038, U01DA041148, U01DA041093, U01DA041089, U24DA041123, U24DA041147. A full list of supporters is available at <https://abcdstudy.org/federal-partners.html>. A listing of participating sites and a

complete listing of the study investigators can be found at https://abcdstudy.org/consortium_members/. ABCD consortium investigators designed and implemented the study and/or provided data but did not necessarily participate in the analysis or writing of this report. This manuscript reflects the views of the authors and may not reflect the opinions or views of the NIH or ABCD consortium investigators. The ABCD data repository grows and changes over time. The ABCD data used in this report came from Data Release Version 5.1. DOIs can be found at <http://dx.doi.org/10.15154/z563-zd24>.

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Figures

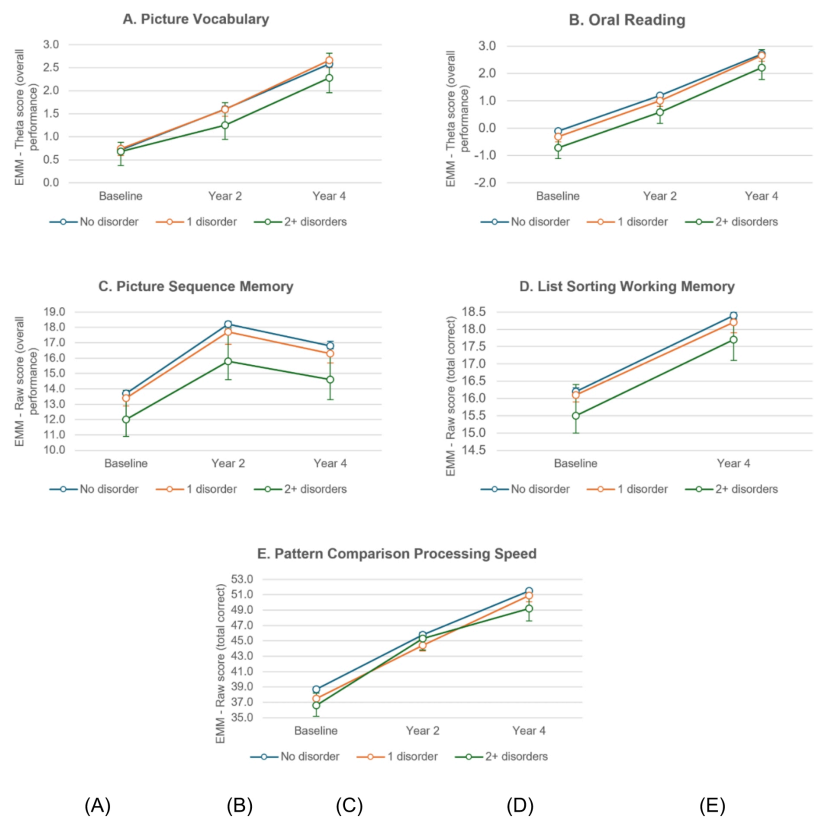


Figure 1
Graphs illustrating cognitive performance across disorder groups.

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