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Fluid intelligence and psychiatric disorders in a population representative sample of US adolescents

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Abstract

Importance—Despite long-standing interest in the association of psychiatric disorders with intelligence, few population-based studies of psychiatric disorders have assessed intelligence.

Objectives—To investigate the association of fluid intelligence with past-year and lifetime psychiatric disorders, disorder age-of-onset, and disorder severity in a nationally-representative sample of U.S. adolescents.

Design—Dual-frame national sample of adolescents ascertained from schools and households from the National Comorbidity Survey Replication-Adolescent Supplement, collected 2001–2004.

Setting—Face-to-face household interviews with adolescents and questionnaires from parents.

Participants—The sample included 10,073 adolescents with valid data on fluid intelligence.

Exposures—DSM-IV mental disorders were assessed with the World Health Organization Composite International Diagnostic Interview, and included a broad range of fear, distress, behavior, substance use and other disorders. Disorder severity was measured with the Sheehan Disability Scale.

Main Outcomes—Fluid intelligence quotient (IQ) measured with Kaufman Brief Intelligence Test, normed within the sample by six-month age groups.

Results—Lower mean IQ was observed among adolescents with past-year bipolar disorder (predicted Mean [M]=94.2, p<0.01), attention-deficit/hyperactivity disorder (M=96.3, p<0.01), oppositional defiant disorder (M=97.3, p<0.01), conduct disorder (M=97.1, p=0.02) substance disorders (M=96.5–97.6, p=0.02 to <0.01) and specific phobia (M=97.1, p<0.01) after adjustment

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for a wide range of potential confounders. Intelligence was not associated with post-traumatic stress disorder, eating disorders, and anxiety disorders other than specific phobia, and was positively associated with major depression. Associations of fluid intelligence with lifetime disorders that had remitted were attenuated compared to past-year disorders, with the exception of separation anxiety disorder. Across disorders, higher disorder severity was associated with lower fluid intelligence.

Conclusions—Numerous psychiatric disorders are associated with reductions in fluid intelligence; associations are generally small in magnitude. Stronger associations of current than past disorders with intelligence suggest that active symptoms of psychopathology interfere with cognitive functioning, although longitudinal studies are needed to determine the extent to which changes in fluid intelligence precede or follow the onset of psychiatric disorders. Early identification and treatment of children with mental disorders in school settings is critical to promote academic achievement and long-term success.

Keywords

intelligence; psychopathology; mental disorders; adolescence; bipolar; conduct disorder; PTSD

Introduction

Many forms of psychopathology involve disruptions in cognitive functioning. These encompass attention, memory, language processing, and executive functions.[1–7] Given these patterns, there has been long-standing interest in the association of psychiatric disorders with intelligence.

Intelligence is a complex construct that has inspired voluminous literatures regarding its definition, measurement, and implications. Modern conceptualizations typically acknowledge a general intelligence factor (often referred to as *g*) as well as narrower, more specific abilities (e.g., processing speed, visuospatial reasoning, working memory).[8–10] The specific abilities encompassing intelligence continue to be debated,[11,12] but a widely-accepted model of cognitive abilities distinguishes between fluid and crystallized intelligence as two primary components.[13] Fluid intelligence reflects reasoning and the ability to solve novel problems; crystallized intelligence reflects knowledge and skills that are the result of experience and learning.[14] Analysis of the structure of cognitive abilities underlying intelligence suggests that fluid reasoning loads most strongly onto the generalized intelligence factor[15] and is indistinguishable from *g*.[16]

To what extent are psychiatric disorders associated with fluid intelligence? Modern examination of intelligence and psychopathology has been primarily limited to relatively small, clinical samples. Poor performance on intelligence tests has been documented in individuals with ADHD,[17–21] conduct disorder and oppositional defiant disorder (ODD),[22–29] and PTSD.[5,6,30] Associations of intelligence with depression and anxiety disorders are inconsistent across studies.[3132,3322,34] The degree to which intelligence is associated with most psychiatric disorders remains an open question, given inherent biases in studies comprised of clinical samples and the lack of population-based studies that measure intelligence.

One particularly important question is whether associations of intelligence with psychiatric disorders reflect that low intelligence is a risk factor for psychopathology or that changes in cognitive functioning are a consequence of developing a psychiatric disorder. While prospective data are optimal to adjudicate between these possibilities, to date such evidence exists only for disruptive behavior problems, indicating that low intelligence prospectively predicts life-course persistent antisocial behavior, particularly for males.[25,35] If low intelligence associated with other psychiatric disorders reflects a consequence rather than risk factor for psychopathology, we would expect associations of intelligence to be stronger among individuals who currently meet criteria for a disorder as compared to those who have met criteria in the past but do not currently. In contrast, if low IQ is a risk factor for psychiatric disorders, we should observe associations of similar magnitude for both current and past disorders with IQ.

In the current report, we investigate the association of fluid intelligence with a wide range of psychiatric disorders in a nationally representative sample of US adolescents. We present intelligence estimates for adolescents who currently meet criteria for fear, distress, behavior, and substance disorders as well as for those who met criteria in the past but not currently, and further examine associations between fluid intelligence and psychiatric disorders by age-of-onset and severity of disorder.

Methods

Sample

Data were drawn from the National Comorbidity Survey Adolescent Supplement (NCS-A), a nationally representative, face-to-face survey of 13–18 year olds sampled from the continental United States in 2001–2004.[36] The sample was selected through a dual-frame design, with adolescents recruited from both schools and households.[37–39] The sample included 10,148 English-speaking adolescents, 10,073 (99.3%) with valid outcome data that were analyzed in the present study. Sample weights were created based on the 2000 Census. More details are on NCS-A sampling and weighting procedures are available elsewhere.[38–40]

Written informed consent from adults and assent from adolescents were obtained. Each participant received $50 for participation. The Human Subjects Committees of Harvard Medical School and the University of Michigan approved recruitment and consent procedures; the Institutional Review Board of Columbia University approved the current analysis.

Measures

Kaufman Brief Intelligence Test (K-BIT).[41,42]—Adolescents completed the fluid intelligence portion of the K-BIT, which assesses fluid reasoning with 48 items. This task uses abstract matrices similar to those developed by Raven,[43] which are prototypical measures of fluid reasoning and general intelligence.[44] The K-BIT Matrices test involves a series of progressively more challenging items. Test administration was discontinued when an adolescent responded incorrectly to all items in a set (sets include 5 items initially and 4

items for the last two sets). The K-BIT (and its revision, the KBIT-2) is widely used among children,[41,45–51] adolescents,[52–54] and adults;[55–57] the items on the K-BIT have well documented reliability across these samples, and results across samples correlate with re-assessments, suggesting that the interpretation of results across samples has strong validity. Hereafter, we refer to fluid intelligence on the K-BIT as IQ.

K-BIT norms were created specifically for the NCS-A by the test developer and co-author (Kaufman), as the NCS-A is considerably larger than the original normative sample for the K-BIT; in addition, the KBIT was published in 1990, so its norms were outdated. Raw scores were generated based on the K-BIT manual for 92.62% of tests, which were administered and scored exactly as prescribed. An additional 7.08% of tests could be scored despite deviations in test administration. For example, some respondents were only asked the most difficult item in each set. In these cases, the K-BIT score was imputed based on the number of correct items and the level at which they met discontinuation criteria. A small percentage of cases (0.3%) were excluded due to invalid test administration. Scores were normed within six-month age groups to mean (M) 100 and standard deviation (SD) 15. The K-BIT Matrices test demonstrated good internal consistency (Cronbach's alpha=0.90), comparable to the value of .88 reported in the K-BIT manual for ages 13–19.[41] Exploratory factor analyses indicated that a one-factor model adequately fit the data.

Psychiatric diagnoses—An adolescent version of the Composite International Diagnostic Interview (CIDI) for DSM-IV was used to assess psychiatric disorders.[58–60] Disorders were grouped into five empirically-defined clusters:[61] 1) *fear disorders* (specific phobia, agoraphobia, social phobia, panic disorder); 2) *distress disorders* (separation anxiety disorder, PTSD, major depressive episode/dysthymia, generalized anxiety disorder [GAD]); 3) *behavior disorders* (ADHD, ODD, conduct disorder, eating disorders); 4) *substance disorders* (alcohol and drug abuse, with or without dependence); and 5) bipolar disorder. ADHD is based on parent-report only. ODD and depression combined parent- and child-report of symptoms using an "or" rule.[62,63] Children and parents who endorsed symptoms of each psychiatric disorder were asked about the age symptoms began. Clinical reappraisal of children comparing CIDI diagnoses to those assessed with a clinical interview showed good concordance.[59]

Disorder Severity

Respondents who met criteria for a diagnosis completed The Sheehan Disability Scales[64] assessing the extent to which symptoms of the disorder interfered with home life, school or work, family relationships, and social life on a 0–10 Likert scale. Consistent with prior research,[65,66] severe impairment was operationalized as a score of 7 or higher in any one of the four domains.

Covariates

Parental education (< high school, high school graduate, some college, college degree or more), parental income (<1.5, 1.5–3, 3.1–6, >6 times the poverty level), race/ethnicity (non-Hispanic White, non-Hispanic Black, Asian, Other), age, nativity, number of siblings, and birth order were adjusted for in all models. The mean K-BIT score when all covariates were

at their reference level was 102.2. In addition, lifetime disorders other than the focal disorder being examined were adjusted for using dichotomous indicators of any fear, any distress, any behavior, any substance, and bipolar disorder.

Statistical analysis

We examined mean levels of fluid intelligence among those meeting criteria for past-year and lifetime psychiatric disorders using linear regression. Effect sizes were estimated using Cohen's d. We examined the distribution of low (<1 SD below the mean), average (within 1 SD of the mean), and high (>1 SD above the mean) fluid intelligence across disorder groups, and estimated associations with past-year and lifetime psychiatric disorders using generalized logit models. Sample sizes for each disorder group (past year, lifetime but not current, and by age-of-onset) as well as the no disorder group, are provided in Table 1; cells with insufficient sample size (<10) were not analyzed. In Supplementary Table 1, we provide cell sizes for those with a current disorder that began in the past year and for those with a current disorder that began prior to the past year. Finally, we examined whether sex and parent income moderated the associations of mental disorders with fluid intelligence and found no evidence of effect modification. All analyses were estimated with survey design weights; standard errors estimated with Taylor series linearization implemented in SAS© version 9.4 for Windows.[67] A false discovery rate (FDR) correction for multiple comparisons was applied to all analyses given the large number of statistical tests.[68]

Results

Fluid intelligence and past-year psychiatric disorders

Table 2 shows adjusted means and standardized betas for the association between fluid intelligence and past-year psychiatric disorder, as well as lifetime (but not past-year) disorder (see Supplementary Table 2 for unadjusted means). Past-year bipolar disorder was associated with the lowest average fluid intelligence (M=94.2, p<.01) followed by behavior disorders, with ADHD, conduct disorder, and ODD each falling significantly below the population mean (M=96.3–97.3, p-values ranging from 0.02 to <0.01). Past-year substance disorders were also associated with low IQ (M=96.5–97.6, p-values ranging from 0.02 to <0.01). Of the fear and distress disorders, only past-year specific phobia (M=97.1, p=0.001) was associated with low fluid intelligence. Past-year major depression was associated with slightly higher fluid intelligence (M=100, p<0.01) compared to those with no distress disorders. Fluid intelligence decreased as the number of current disorders increased. Effects sizes for these associations are provided in Supplementary Table 3. In Supplementary Table 4, we separate current disorders into those that began in the past 12 months versus those that began earlier. There were no significant associations between IQ and psychopathology for disorders that began in the past 12 months (however sample sizes were small).

Fluid intelligence and lifetime psychiatric disorders

Adjusted means of fluid intelligence for those meeting criteria for a lifetime but not current disorder are in Table 2 (see Supplementary Table 5 for adjusted means for lifetime disorders, regardless of past-year status). Associations with fluid intelligence were uniformly attenuated compared to past-year disorders, with one exception: past separation anxiety

disorder was associated with low IQ (M=97.2, p=0.01). No association was observed between fluid intelligence and number of lifetime disorders.

Distribution of fluid intelligence by psychiatric disorder

Table 3 describes the proportion of adolescents with high, medium, and low IQ by psychiatric disorder status. Adjusted multinomial odds ratios for these distributions are in Table 4. Multiple past-year disorders had a larger proportion of adolescents in the low IQ range than those without a disorder, including bipolar disorder, all behavior disorders, alcohol abuse, separation anxiety disorder, specific phobia, and agoraphobia. The pattern was largely similar for lifetime but not past-year disorders, but was significant only for separation anxiety disorder, conduct disorder, and drug abuse. In Supplementary Table 6, we provide distributions of high, middle, and low IQ separating current disorders into those beginning in the past year vs. earlier.

Fluid intelligence by psychiatric disorder severity

Table 5 shows associations between disorder severity and fluid intelligence. Greater disorder severity was associated with lower IQ across a wide range of disorders including all fear disorders, GAD, ODD, eating disorders, alcohol abuse, and bipolar disorder.

Fluid intelligence by psychiatric disorder age-of-onset

Supplementary Tables 7–9 provide unadjusted mean differences in IQ, IQ distributions, and adjusted associations as a function of disorder age-of-onset. Few differences emerged by disorder age-of-onset.

Discussion

The present study represents the first population-based study examining association of fluid intelligence with psychiatric disorders in U.S. youth. Our analysis generates three central conclusions.

First, past-year bipolar disorder, disruptive behavior disorders, and substance abuse were most strongly associated with low fluid intelligence. Lower IQ has been documented among youths with these disorders in clinical samples.[17–29,69,70] Our population estimates indicate that mean IQ was approximately 1/3 of a standard deviation (~5 points) lower than average among youths with bipolar disorder, behavior disorders, and substance abuse.

The associations of behavior disorders with IQ were stronger for current disorders than for disorders that had remitted. This could reflect either that behavior disorder symptomatology interferes with cognitive functioning, producing low IQ primarily for those with active symptoms, or that low IQ is observed among adolescents with behavior disorders that are chronic and involve more severe symptoms. Few adolescents had behavior disorder onsets in the past year, indicating that current disorders primarily reflect chronic cases, and low IQ was most consistently observed for adolescents with the most severe disorders. Prospective studies have documented low IQ as a precursor of behavior disorder onset.[25,35] Our finding that adolescents with more chronic, severe forms of behavior disorder are most likely to have

lower IQ is in line with these findings, although it does not rule out the possibility that IQ changes after onset of disorder explains at least a portion of the observed associations.

Second, most fear and distress disorders were not associated with low IQ, with the exception of specific phobia and separation anxiety disorder, which are among the earliest-onset fear and distress disorders.[61] Specific phobia, in particular, has been shown to explain a meaningful proportion of later-onset mental disorders.[71] These disorders thus appear to represent an early liability to internalizing psychopathology; our results suggest that this liability may be associated with low IQ. Past-year specific phobia was associated with IQ but lifetime disorder was not. Specific phobia is often a persistent condition,[71,72] and this pattern could reflect an association of low IQ with persistent, but not transient, phobia. Alternatively, it may be that current symptoms of phobia interfered with performance due to test anxiety. In contrast, separation anxiety was related to IQ when experienced prior to the past year but not currently. Given the high prevalence of these disorders,[71,73] greater research is needed on neuropsychological correlates of early-onset fear and distress disorders.

We found no association between PTSD and IQ. This diverges from prior research, which has consistently demonstrated that low IQ is a risk factor for PTSD onset after trauma.[30,74–76] However, most prior work has been conducted in military samples returning from active combat. Military samples are not representative of the general population, nor are they composed of adolescents in our age range. Further, considerable disagreement exists regarding the validity of the association between IQ and PTSD in military samples,[77,78] as IQ may select service members into degree of combat exposure. Our results are not consistent with theories that low IQ is a vulnerability factor for the development of PTSD after trauma, at least among youth.

Third, past-year depression was associated with slightly higher mean IQ, though we should note that the effect size was small, but statistically significant due to the high prevalence of major depression in adolescence.[79] It has frequently been argued that children with very high IQ may exhibit higher rates of bipolar disorder,[80–82] as well as social withdrawal and avoidance.[83] We find no support for a link between high IQ and bipolar disorders at the population level, but the observed association with depression warrants further exploration, as children with higher IQ may present with unique mental health concerns.

IQ was ascertained at the time of the interview, precluding an assessment of the reciprocal relation between mental disorders and cognitive ability. Although some of the variance in IQ is stable over early development,[84,85] there is also substantial plasticity in IQ.[43,84,86,87] while we cannot establish temporality, the associations of IQ with past-year disorders were consistently stronger than for lifetime disorders that had remitted. Although this could reflect a stronger influence of current symptoms on IQ than the reverse, the most plausible interpretation of this pattern is that current symptoms reflect the most persistent disorders, suggesting that lower IQ is associated with chronic psychopathology rather than transient disorders. Future studies should examine this possibility, as measures of disorder duration were substantially co-linear with age-of-onset, given the young age of NCS-A participants.

Taken together, these findings indicate that children and adolescents with psychiatric disorders face challenges in learning, memory, and reasoning. This underscores the need for early identification of children with mental disorders to provide academic accommodations and treatment in order to promote long-term success. Although accommodations are often made for children with ADHD and behavior problems, our findings suggest that children with early-onset fear and distress disorders and adolescents with substance use disorders may also require individualized education plans and support. These findings also provide fruitful hypotheses for future research. For example, children with psychiatric disorders face lower educational and occupational functioning; these results suggest that fluid intelligence may be a mechanism in this pathway, given that higher IQ is associated with better school performance.[87,88] This remains to be examined in future studies.

In addition to the limitation of a single time point of measurement of IQ, other limitations should be considered. The K-BIT was administered by lay interviewers, which may have increased the frequency of protocol deviations in test administration. Such deviations could have led to worse performance among children with test-taking difficulties (e.g., ADHD or test anxiety). However, the K-BIT has been validated in children with intellectual disability and other challenges,[50,53,54] and the reliability of K-BIT Matrices was comparable for the present sample and the standardization sample. Further, the K-BIT is a “Level B” test, which permits examiners without high qualifications to administer and interpret it. Psychosis was not assessed in NCS-A given low prevalence in this age group, precluding evaluation of associations with IQ. Finally, given the cross-sectional assessment, recall bias in reports of past disorders likely contributed to under-reporting of past disorders, particularly those that were low in severity. This would make the IQ associations with lifetime disorders overestimates as they reflect more severe cases. Longitudinal data are needed to determine the extent to which early-onset psychiatric disorders that remit influence IQ.

Conclusions

The present study is the largest assessment of IQ in U.S. children ever conducted, and results demonstrate robust associations of IQ with a broad psychiatric disorders, most notably for bipolar disorders and behavior disorders—including ADHD, ODD, and conduct disorder, as well as specific phobia, separation anxiety, and substance disorders. Although associations of IQ with bipolar disorder and behavior disorders are consistent with prior research from clinical samples, those with fear and distress disorders reveal novel relationships not observed in prior studies and call into question others, including the lack of a relationship with PTSD. Together, these findings reflect the potential role of cognitive factors in the etiology of diverse forms of psychopathology, as well as how mental disorders may influence cognitive ability. Most importantly, this work highlights the critical importance of early identification and treatment of mental disorders in youth and the potential utility of accommodations in school settings for children with a wide range of psychiatric disorders in order to promote long-term success.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Kaufman earns royalties from Pearson on other Kaufman tests, but the Kaufman Brief Intelligence Test (K-BIT) is no longer published or available for purchase.

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Table 1

Sample sizes for each disorder group used in the analysis (N=10,073)

	Past 12 month disorders, all ages				*Prior to past 12-month but not current disorder, all ages*				*Age of onset*		
	Total	**Low (%)**	**Middle (%)**	**High (%)**	**Total**	**Low (%)**	**Middle (%)**	**High (%)**	***4–8***	***9–12***	***13–17***
I. Fear disorders											
Specific phobia	1621	365	1058	198	357	58	253	46	1628	315	35
Agoraphobia	217	55	126	36	73	18	45	10	125	117	48
Social phobia	1273	256	848	169	147	35	89	23	556	640	224
Panic disorder	191	35	136	20	44	12	28	4	78	86	71
No lifetime fear disorder	7164	1249	4824	1091	7164	1249	4824	1091			
II. Distress disorders											
Separation anxiety disorder	162	42	107	13	44	142	387	72	484	187	92
Post-traumatic stress disorder	288	50	194	44	95	24	59	12	107	102	174
Major depressive episode/dysthymia	949	182	638	129	408	70	278	60	207	495	655
Generalized anxiety disorder	176	41	111	24	121	25	80	16	66	98	133
No lifetime distress disorder	4473	818	3036	619	4473	818	3036	619			
III. Behavior disorders											
ADHD	247	70	149	28	183	45	121	17	327	78	23
Oppositional defiant disorder	488	113	328	47	554	117	352	85	294	430	318
Conduct disorder	333	90	216	27	249	65	158	26	184	384	297
Eating disorders	311	76	195	40	241	51	159	31	42	194	316
No lifetime behavior disorder	8103	1401	5483	1219	8103	1401	5483	1219			
IV. Substance disorders											
Alcohol abuse	504	110	344	50	170	36	116	18	4	51	619
Drug abuse	548	107	376	65	328	64	234	30	4	81	791
No lifetime substance disorder	8912	1620	5951	1341	8912	1620	5951	1341			
V. Other disorders											
Bipolar disorder	113	32	69	12	22	6	15	1	20	47	68
No lifetime bipolar disorder	8831	1591	5905	1335	8831	1591	5905	1335			

Table 2

Variation in fluid intelligence* as a function of psychiatric disorders in a population representation sample of adolescents (N=10,073)

	Past 12 month disorders, all ages				***Lifetime, but not 12 months disorders, all ages***			
	Mean IQ	**SE**	**Beta**	**p value+**	**Mean IQ**	**SE**	**Beta**	**p value+**
I. Fear disorders								
Specific phobia	97.1	0.39	−1.31	0.001	99.1	0.76	−0.11	0.89
Agoraphobia	98.8	0.98	−0.45	0.65	98.2	1.66	−1.12	0.50
Social phobia	98.6	0.43	−0.51	0.25	97.4	1.17	−1.67	0.15
Panic disorder	98.4	1.04	−0.90	0.39	97	2.1	−2.34	0.27
No fear disorder	99.1	0.22	--	--	99.1	0.22	--	--
II. Distress disorders								
Separation anxiety disorder	96.8	1.13	−1.89	0.10	97.2	0.61	−1.56	0.01
Post-traumatic stress disorder**	99.7	0.88	0.94	0.29	96.8	1.46	−1.92	0.19
Major depressive episode/dysthymia	100	0.5	1.32	0.01	99.7	0.72	1.07	0.14
Generalized anxiety disorder	97.6	1.11	−1.12	0.32	96.7	1.3	−2.05	0.12
No distress disorder	98.8	0.25	--	--	98.8	0.25	--	--
III. Behavior disorders								
ADHD	96.3	0.91	−2.91	0.002	97.2	1.05	−2.02	0.05
Oppositional defiant disorder	97.3	0.66	−1.81	0.007	98.6	0.62	−0.5	0.42
Conduct disorder	97.1	0.82	−1.94	0.02	97.6	0.91	−1.44	0.12
Eating disorders	97.9	0.82	−1.28	0.12	98.4	0.91	−0.81	0.374
No behavior disorder	99.1	0.21	--	--	99.1	0.21	--	--
IV. Substance disorders								
Alcohol abuse	96.5	0.67	−2.6	<.001	97.6	1.1	−1.49	0.18
Drug abuse	97.6	0.64	−1.44	0.02	97.9	0.81	−1.18	0.14
No substance disorder	99.1	0.21	--	--	99.1	0.21	--	--
V. Other disorders								
Bipolar disorder	94.2	1.69	−4.97	0.004	98.3	3.05	−0.9	0.77
No bipolar disorder	99.2	0.21	--	--	99.2	0.21	--	--
VI. Total number of disorders								
Exactly one disorder	98.2	0.42	−0.99	0.02	99.7	0.51	0.88	0.09

	Past 12 month disorders, all ages				*Lifetime, but not 12 months disorders, all ages*			
	Mean IQ	**SE**	**Beta**	**p value[+]**	**Mean IQ**	**SE**	**Beta**	**p value[+]**
Exactly two disorders	98.2	0.54	−0.97	0.08	97.5	1.08	−1.25	0.24
Three or more disorders	97.8	0.43	−1.36	0.002	95.9	1.76	−2.93	0.10
No disorder	98.8	0.21	--	--	98.8	0.21	--	--

[*] Scores were first normed in the sample by six-month age groups for mean of 100 and standard deviation of 15. Predicted means were estimated from linear regression models controlling for parental education; race/ethnicity, age, nativity (US born versus not), number of siblings, birth order, and non-focal disorder groups.

[**] Among those with a lifetime exposure to a potentially traumatic event (N=6160, 61.2% of the total sample).

[+] P-values are for the comparison between each disorder category to a reference group of no disorder in that category. For example, mean IQ among those with specific phobia is compared to those with no fear disorder. All p-values are false discovery rate adjusted.

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Table 3

Proportion of adolescents with fluid intelligence in low, middle, and high range as a function of psychiatric disorders in a population representation sample of adolescents (unadjusted) (N=10,073)

	Past 12 month disorders, all ages				***Prior to past 12-month but not current disorder, all ages***			
Range (N total)	**Low (n=1852) (%)**	**Middle (n=6757) (%)**	**High (n=1464) (%)**	**p-value[+]**	**Low (n=1852) (%)**	**Middle (n=6757) (%)**	**High (n=1464) (%)**	**p-value[+]**
I. Fear disorders								
Specific phobia	22.52	65.27	12.21	<.001	16.25	70.87	12.89	0.36
Agoraphobia	25.35	58.06	16.59	0.03	24.66	61.64	13.7	0.36
Social phobia	20.11	66.61	13.28	0.21	23.81	60.54	15.65	0.36
Panic disorder	18.32	71.2	10.48	0.26	27.27	63.64	9.09	0.36
Any fear disorder	21.05	66.19	12.77	<.001	20.73	66.45	12.82	0.005
No fear disorder	17.51	67.38	15.12	--	17.43	67.34	15.23	--
II. Distress disorders								
Separation anxiety disorder	25.93	66.05	--	0.02	23.63	64.39	11.98	0.03
Post-traumatic stress disorder**	17.36	67.36	15.28	0.37	25.26	62.11	12.63	0.61
Major depressive episode/dysthymia	19.18	67.23	13.59	0.61	17.16	68.14	14.71	0.84
Generalized anxiety disorder	23.3	63.07	--	0.37	20.66	66.12	13.22	0.84
Any distress disorder	18.14	67.13	14.73	0.37	20.53	66.08	13.39	0.06
No distress disorder	20.52	66.63	12.85	--	17.82	67.35	14.84	--
III. Behavior disorders								
ADHD	28.34	60.32	11.34	0.001	24.59	66.12	9.29	0.05
Oppositional defiant disorder	23.16	67.21	9.63	0.001	21.12	63.54	15.34	0.20
Conduct disorder	27.03	64.86	8.11	<.001	26.1	63.45	10.44	0.01
Eating disorders	24.44	62.7	12.86	0.02	21.16	65.98	12.86	0.42
Any behavior disorder	24.64	64.55	10.8	<.001	22.89	64.67	12.44	0.01
No behavior disorder	17.6	67.4	15	--	17.29	67.67	15.04	--
IV. Substance disorders								
Alcohol abuse	21.83	68.25	9.92	0.01	21.18	68.24	10.59	0.23
Drug abuse	19.53	68.61	11.86	0.18	19.51	71.34	9.15	0.04
Any substance disorder	20.47	68.59	10.94	0.01	19.98	69.42	10.59	0.009

	Past 12 month disorders, all ages				*Prior to past 12-month but not current disorder, all ages*			
Range (N total)	**Low (n=1852) (%)**	**Middle (n=6757) (%)**	**High (n=1464) (%)**	**p-value[+]**	**Low (n=1852) (%)**	**Middle (n=6757) (%)**	**High (n=1464) (%)**	**p-value[+]**
No substance disorder	18.19	66.94	14.87	--	18.18	66.78	15.05	--
V. Other disorders								
Bipolar disorder	28.32	61.02	10.62	0.02	27.27	68.18	4.55	0.29
No bipolar disorder	18.27	67.15	14.58	--	18.25	67.15	14.6	--
VI. Total number of disorders								
Exactly one disorder	19.14	68.32	12.54	0.64	16.89	67.57	14.59	0.76
Exactly two disorders	16.2	69.91	13.89	0.64	22.54	68.79	8.67	0.76
Three or more disorders	22.49	66.05	11.45	0.22	25.4	65.08	9.52	0.76
Any disorder	20.14	67.56	12.3	0.22	18.34	67.62	14.04	0.88
No disorder	18.19	67.03	14.78	--	18.39	67.02	14.59	--

[**] Among those with a lifetime exposure to a potentially traumatic event (N=6160, 61.2% of the total sample)

[+] P-values are for chi-square comparisons between each disorder category to a reference group of no disorder in that category. For example, mean IQ among those with specific phobia is compared to those with no fear disorder. All p-values are false discovery rate adjusted.

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Table 4

Multinomial logistic regression models measuring the odds of high, medium, or low fluid intelligence by age of onset of each disorder (N=10,073) *

	Past 12 month and Lifetime disorders, all ages					*Lifetime but not Past 12 month disorder, all ages*				
	Low OR	**95% C.I.**	**Middle OR**	**95% C.I.**	**High**	**Low OR**	**95% C.I.**	**Middle OR**	**95% C.I.**	**High**
I. Fear disorders										
Specific phobia	1.20	(1.0 – 1.5)	1.06	(0.9 – 1.3)	--	1.08	(0.7 – 1.6)	1.21	(0.9 – 1.7)	--
Agoraphobia	0.70	(0.4 – 1.1)	0.59	(0.4 – 0.9)	--	1.22	(0.5 – 2.7)	0.90	(0.4 – 1.8)	--
Social phobia	1.02	(0.8 – 1.3)	1.02	(0.8 – 1.2)	--	1.17	(0.7 – 2.0)	0.79	(0.5 – 1.3)	--
Panic disorder	1.11	(0.6 – 2.0)	1.25	(0.8 – 2.0)	--	2.14	(0.7 – 6.9)	1.45	(0.5 – 4.2)	--
II. Distress disorders										
Separation anxiety disorder	1.70	(0.9 – 3.3)	1.46	(0.8 – 2.7)	--	1.38	(1.0 – 1.9)	1.04	(0.8 – 1.4)	--
Post-traumatic stress disorder **	0.73	(0.5 – 1.1)	0.81	(0.6 – 1.1)	--	1.21	(0.6 – 2.5)	0.93	(0.5 – 1.8)	--
Major depressive episode/dysthymia	0.86	(0.7 – 1.1)	0.94	(0.8 – 1.2)	--	0.81	(0.6 – 1.2)	0.93	(0.7 – 1.2)	--
Generalized anxiety disorder	1.40	(0.8 – 2.4)	0.92	(0.6 – 1.5)	--	1.35	(0.7 – 2.6)	1.05	(0.6 –1.8)	--
III. Behavior disorders										
ADHD	1.79	(1.1 – 2.9)	1.06	(0.7 – 1.6)	--	1.62	(0.9 – 2.9)	1.33	(0.8 –2.2)	--
Oppositional defiant disorder	1.52	(1.1 – 2.2)	1.26	(0.9 – 1.7)	--	1.06	(0.8 – 1.4)	0.85	(0.7 – 1.1)	--
Conduct disorder	1.69	(1.1 – 2.7)	1.23	(0.8 – 1.9)	--	1.38	(0.8 – 2.3)	1.05	(0.7 – 1.6)	--
Eating disorders	1.10	(0.7 – 1.7)	0.90	(0.6 – 1.3)	--	1.11	(0.7 – 1.8)	0.99	(0.7 – 1.5)	--
IV. Substance disorders										
Alcohol abuse	1.98	(1.4 – 2.9)	1.69	(1.2 – 2.3)	--	1.59	(0.9 – 2.9)	1.47	(0.9 – 2.5)	--
Drug abuse	1.39	(1.0 – 2.0)	1.36	(1.0 –1.8)	--	1.72	(1.1 – 2.7)	1.72	(1.2 – 2.6)	--
V. Other disorders										
Bipolar disorder	2.30	(0.9 – 5.9)	1.20	(0.5 – 3.0)	--	3.76	(0.4 – 34.6)	3.10	(0.4 – 25.0)	--
VI. Total number of disorders										
Exactly one disorder	1.11	(0.9 – 1.4)	1.12	(0.9 – 1.3)	--	0.87	(0.7 – 1.1)	0.94	(0.8 – 1.2)	--
Exactly two disorders	1.08	(0.8 – 1.4)	1.10	(0.9 – 1.4)	--	1.90	(1.0 – 3.5)	1.63	(0.9 –2.8)	--
Three or more disorders	1.42	(1.1 – 1.8)	1.19	(1.0 – 1.5)	--	2.20	(0.8 – 5.8)	1.51	(0.6 – 3.6)	--

* Models were adjusted for parental education; race/ethnicity, age, nativity (US born versus not), number of siblings, birth order, and non-focal disorder groups

** Among those with a lifetime exposure to a potentially traumatic event (N=6160, 61.2% of the total sample)

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Table 5

Variation in fluid intelligence* as a function of severity of psychiatric disorders in a population representation sample of adolescents (N=10,073)

	Disorder severity low, all ages		***Disorder severity high, all ages***			
	Mean IQ	**SE**	**Mean IQ**	**Beta**	**SE**	**p value+**
I. Fear disorders						
Specific phobia	99.0	0.20	94.5	−4.44	0.72	<.001
Agoraphobia	98.9	0.20	95.2	−3.71	1.04	<.001
Social phobia	98.9	0.20	96.9	−2.05	0.62	0.001
Panic disorder	98.9	0.20	96.3	−2.58	1.03	0.01
II. Distress disorders						
Separation anxiety disorder	98.8	0.20	96.4	−2.48	1.75	0.16
Post-traumatic stress disorder**	98.8	0.20	99.2	0.38	1.21	0.75
Major depressive episode/dysthymia	98.8	0.20	99.6	0.82	0.60	0.18
Generalized anxiety disorder	98.9	0.20	96.3	−2.55	0.92	0.006
III. Behavior disorders						
ADHD	98.8	0.20	99.2	0.34	2.36	0.89
Oppositional defiant disorder	98.9	0.20	96.4	−2.50	0.98	0.01
Conduct disorder	98.6	0.32	97.9	−0.73	0.45	0.13
Eating disorders	98.8	0.20	91.1	−7.71	3.29	0.02
IV. Substance disorders						
Alcohol abuse	98.9	0.20	93.3	−5.56	1.15	<.001
Drug abuse	98.8	0.20	97.2	−1.65	1.37	0.23
V. Other disorders						
Bipolar disorder	98.9	0.20	96.5	−2.43	0.74	0.001

*Scores were first normed in the sample by six-month age groups for mean of 100 and standard deviation of 15. Predicted means were estimated from linear regression models controlling for parental education; race/ethnicity, age, nativity (US born versus not), number of siblings, birth order, and non-focal disorder groups

**Among those with a lifetime exposure to a potentially traumatic event (N=6160, 61.2% of the total sample)

+P-values are for the comparison between each disorder category to a reference group of no disorder in that category. For example, mean IQ among those with specific phobia is compared to those with no fear disorder. All p-values are false discovery rate adjusted.