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# A Preliminary 'Shortlist' of Individual, Family, and Social-Community Assets to Promote Resilience in Pediatric ADHD

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## Abstract

**Background:** Understanding factors that promote resilience in pediatric ADHD is important though highly understudied. Aims: The current study sought to provide a preliminary 'shortlist' of key individual, family, and social-community assets among children with ADHD.

**Methods and Procedures:** The study included well-characterized, clinically-evaluated samples of children with ($n$=108) and without ADHD ($n$=98) ages 8–13 years ($M$=10.31; 41.3% girls; 66.5% White/Non-Hispanic). All subsets regression and dominance analysis identified the subset of predictors that accounted for the most variance in broad-based resilience for children with ADHD and their relative importance. Findings were compared for children with versus without ADHD as preliminary evidence regarding the extent identified assets are promotive, protective, or conditionally helpful.

**Outcomes and Results:** Higher levels of peer acceptance, social skills, and academic performance were top predictors of resilience among children with ADHD. Better child working memory, attention, *higher* levels of hyperactivity, older age, and fewer parent self-reported mental health concerns were also identified as predictors of resilience in ADHD. Both overlapping and unique factors were associated with resilience for children with versus without ADHD.

**Conclusions and Results:** These results, if replicated, provide a strong preliminary basis for strength-based basic/applied research on key assets that promote resilience in ADHD.

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CRediT authorship contribution statement

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**Keywords**

resilience; positive youth development; ADHD

Attention-deficit/hyperactivity disorder (ADHD) is a chronic neurodevelopmental disorder (American Psychiatric Association, 2013), and affects approximately 5% of school-aged children (Polanczyk et al., 2014). ADHD is highly heterogenous in presentation and long-term outcomes, with the majority of children with ADHD experiencing clinically significant impairments in peer, family, and/or academic functioning (Kofler et al., 2016). To date, most ADHD research has adopted a deficit-focused perspective, with decades of evidence identifying risk factors and deficit reduction strategies (e.g., evidence-based treatments) for this high-risk population. Critically, however, there is limited research utilizing strength-based approaches for the study and treatment of ADHD (Dvorsky & Langberg, 2016).

## The Positive Youth Development Framework

In this context, the present study utilizes the strength-based Positive Youth Development (PYD) framework to examine predictors of *resilience* in children with ADHD. The PYD framework defines resilience as a dynamic interaction between individual and context, where youth situated at the high-end of a risk continuum exhibit patterns of adaptive functioning despite vulnerability to negative outcomes conveyed by that high-risk (Lerner, 2009). The term *protective* is often used to describe assets that confer adaptive effects only or principally for children with a high level of risk (e.g., a diagnosis of ADHD), whereas *promotive* is used to describe assets that are similarly beneficial regardless of a child's risk level (Masten, 2014).

Currently, over 50 years of wide-ranging resilience research has identified a subset of assets that consistently protect or promote resilience among children with diverse risk and sociocultural contexts. Masten (2014) nicknamed these core assets the "shortlist," and classified them into three fundamental adaptive systems: (1) *individual* (knowledge, skills, and abilities internal to the child that promote resilience), (2) *family* (benefits conveyed via interactions with caregivers), and (3) *social-community* (the child's broader support system). It is also increasingly recognized that (a) some assets that promote positive outcomes in the general population may not confer the same benefits for children at high-risk (Condo et al., 2022); and (b) some risk factors for adverse outcomes in the general population may instead confer protective effects for high-risk children (Chan et al., 2022a, 2022b) – a phenomenon we refer to as *conditionally helpful* (Weinersmith & Earley, 2016).

## ADHD and Resilience

The study of resilience in ADHD is particularly challenging given replicated evidence ADHD is associated with deficits in most, if not all, promotive assets identified for neurotypical children. For example, on the level of individual mechanisms, children with ADHD have been repeatedly found to have underdeveloped executive and socioemotional functioning (Graziano & Garcia, 2016; Kofler et al., 2016), and elevated risk for academic underachievement (DuPaul & Langberg, 2015). Within the family domain, childhood

ADHD is frequently associated with maladaptive parenting styles in comparison to parents of children without ADHD (Healey et al., 2011). Regarding social-community mechanisms, children with ADHD are at high-risk for peer rejection (Hoza, 2007).

Nonetheless, with few exceptions, meta-analytic evidence indicates the magnitude of these impairments in ADHD are small to medium. These effect sizes thus suggest that at the *group level* children with ADHD may have fewer individual, family, and social-community assets than neurotypical children. However, on the *individual level* only a minority of children with ADHD are likely to be impaired in any given domain. For example, the meta-analytic effect size of $d$=0.71 for ADHD-related deficits in academic achievement (Frazier et al, 2007) suggests only 43% of children with ADHD have academic impairments based on converting effect sizes into population non-overlap estimates (Zakzanis, 2001). Stated differently, up to 57% of children may have positive academic outcomes, and assuming a normal distribution, a minority may even be thriving academically. In fact, Biederman et al. (1998) found only 20% of adolescents with ADHD performing poorly across school, social, and emotional domains, whereas 60% were unimpaired in at least one domain, and 20% were functioning as well as their neurotypical peers in all three domains. More recently, Chan et al. (2022a) found that the majority of children with ADHD (50%-60%) were perceived by their parents and/or teachers to be as resilient or even *more* resilient than their same age/sex neurotypical peers.

## ADHD and Masten's 'Shortlist'

The ADHD and resilience literature is still emerging, with significant strides already achieved (e.g., Chan et al., 2022a; Dvorsky et al., 2018), yet critical limitations remain. For example, in Dvorsky & Langberg's (2016) review of the ADHD and resilience literature, they note that with a few exceptions, most conclusions regarding positive outcomes in pediatric ADHD are based on reinterpreting results originally framed in terms of negative outcomes. Of the few studies that have framed their findings in positive terms, most were not grounded in developmental science and did not have specific hypotheses related to resilience (Dvorsky & Langberg, 2016). In context of the aforementioned limitations, the most robust evidence for predicting resilience in ADHD is within the social-community and family domains. Peer acceptance has been shown to buffer against poor academic performance and executive dysfunction for youths with ADHD (e.g., Dvorsky et al., 2016; Fredrick et al., 2021). Compelling evidence also supports the protective effects of positive parenting, including reduced ADHD symptom severity (Healey et al., 2011) and social problems (Kawabata, 2012). The study of protective effects at the individual-level for children with ADHD is still preliminary, though the available evidence suggests better cognitive abilities (IQ), better math achievement, more anxiety, and less oppositional defiance are associated with resilience as perceived by parents and/or teachers (Chan et al., 2022a). Additionally, positive self-perceptions in children with ADHD may buffer against depression and other internalizing symptoms (Mikami & Hinshaw, 2006).

## Current Study

The present study adopts the positive youth development framework to investigate individual, family, and social-community assets that have been associated with resilience in the developmental and/or ADHD literatures, and examine the extent to which these assets (a) are associated with resilience in children with ADHD; and (b) promote resilience similarly in children with versus without ADHD. Based on Dvorsky and Langberg's (2016) review of resilience and ADHD, we predicted family and social-community assets, particularly social/peer acceptance and positive parent-child relationships, would be associated with resilience in children with ADHD. While literature on individual assets and resilience in ADHD is limited, we also predicted better developed child cognitive abilities and self-regulation skills would predict resilience for these children given the evidence reviewed above. We did not have specific hypotheses regarding asset(s) that would function differently for children with versus without ADHD due to paucity of prior research.

## Method

### Participants

The sample comprised of 206 children aged 8–13 years ($M$=10.31, $SD$=1.41; Table 1) from the Southeastern United States who were included in our initial study of resilience in ADHD (Chan et al, 2022a). None of the assets listed in Table 2 were investigated in our previous report. Children were recruited/referred through community resources from 2015–2019 for participation in a clinical research study of neurocognitive mechanisms underlying pediatric attention/behavior problems. All caregivers/children gave informed consent/assent, and Institutional Review Board approval was obtained/maintained. Sample race/ethnicity was mixed with White/Non-Hispanic (66.5%), Hispanic (9.7%), Black (13.1%), Asian (3.4%), and multiracial children (7.3%). All participants spoke English.

### Group Assignment

All children and caregivers completed a comprehensive evaluation that included detailed semi-structured clinical interviewing using the Kiddie Schedule for Affective Disorders and Schizophrenia for School-Aged Children (K-SADS; Kaufman et al., 1997), parent- and teacher-rating scales from the Behavior Assessment System for Children (BASC-2/3 Reynolds & Kamphaus, 2015), and ADHD Rating Scale for DSM-IV/5 (ADHD-RS-4/5; DuPaul et al., 2016). A psychoeducational report was provided to parents.

Children that met all following criteria were included in the ADHD group ($n$=108): (1) DSM-5 diagnosis of ADHD Combined ($n$=80), Inattentive ($n$=26), or Hyperactive/Impulsive presentation ($n$=2) based on K-SADS and all available clinical information; (2) borderline/clinical elevations on at least one parent and one teacher ADHD subscale (i.e., >90$^{th}$ percentile); and (3) current impairment based on parent-report. Children with any ADHD subtype/presentation were eligible given the instability of ADHD subtypes (Valo & Tannock, 2010). To improve generalizability (Wilens et al., 2002), children with comorbidities were included. Our standard assessment battery also included additional standardized measures as needed. Comorbidities reflect clinical consensus best estimates

and included oppositional defiant disorder (ODD, 29.6%), anxiety disorders (21.3%), autism spectrum disorder (ASD, 10.2%), and depressive disorders (4.6%). A subset of children with ADHD screened positive for specific learning disorders (SLD) in reading (12.0%) and/or math (17.6%) defined by score(s)>1.5 SD below age-norms on one or more subtest(s) of the KTEA-3 (Kaufman & Kaufman, 2014) Academic Skills Battery reading/math subtests. Thirty-three children (30.6%) with ADHD were prescribed psychostimulants.

The Non-ADHD group comprised 98 consecutive case control referrals who did not meet ADHD criteria, and included both neurotypical children and children with mental disorders other than ADHD. Neurotypical children (66.3%) had normal developmental histories and nonclinical parent/teacher ratings and were recruited through community resources. Clinically-referred and evaluated children who did not meet ADHD criteria were also included in the Non-ADHD group. These Non-ADHD disorders were included to control for comorbidities in the ADHD group, and included diagnoses of anxiety (19.4%), autism spectrum (8.2%), depressive (4.1%), SLD-reading (3.1%), SLD-math (3.1%) and oppositional defiant (1.0%) disorders. The ADHD and Non-ADHD groups did not differ significantly in the proportion of children with clinical disorders other than ADHD (anxiety, depression, ASD; $p>.16$); the ADHD group had a higher proportion of ODD as expected ($p<.001$).

The first 57 Non-ADHD participants underwent identical evaluations to the ADHD group. Due to funding constraints, the final 41 Non-ADHD participants completed abbreviated evaluations that included parent Behavioral Assessment System for Children (BASC-2/3; Reynolds & Kamphaus, 2015) and ADHD-RS-5, a 1-subtest IQ screener, and detailed developmental, medical, educational, and mental health histories. Teacher BASCs were obtained for a subset of the abbreviated cases recruited during the school year ($n=12$). Neurotypical children that received the abbreviated evaluation had slightly lower SES ($M=46.44$ vs. 53.15; $p=.02$) and parent-reported ADHD inattentive symptoms ($M=50.29$ vs. 56.25; $p=.01$), but did not differ from the full evaluation subgroup in age, IQ, parent-reported hyperactivity-impulsivity symptoms, or sex (all $p>.11$). Children were excluded if they presented with (a) gross neurological, sensory, or motor impairment, (b) history of a seizure disorder, psychosis, or intellectual disability, or (c) non-stimulant medications that could not be withheld for testing.

## Measures

**Psychometrically-Defined Resilience—**The *Behavioral Assessment System for Children* (BASC-2/3; Reynolds & Kamphaus, 2015) parent and teacher forms consist of 139–175 items that assess clinical and adaptive behaviors in children and adolescents ages 2–21. Psychometric support includes high internal consistency ($\alpha=.85$-$.96$) and 1–10 week test-retest reliability ($r=.84$-$.90$). Age- and sex-normed T-scores were obtained via conversion of raw scores based on the national standardization sample (N=1,419 per form). The parent and teacher Resiliency subscales were used to assess resilience (12–13 items; 4-Point Likert scale; e.g., “is resilient,” “recovers quickly after a setback”). Higher scores indicate higher levels of parent/teacher-perceived resilience. Correlations between the BASC-2 and BASC-3 Resiliency subscale are high based on both parent- and teacher-report

(*r*=.84-.92). The concurrent validity of these scales has been supported via associations with global and specific indices of adaptation to risk (e.g., Happer et al., 2017; Zaharakis et al., 2018), and via sensitivity to detect treatment-related improvements from interventions specifically designed to increase resilience (Habayeb et al., 2017).

**Individual, Family, and Social-Community Predictors—**Please see Table 2 for a detailed description of the 24 candidate individual, family, and social-community assets assessed in the current study, along with their definitions, indicators, scoring, and psychometric evidence. These assets were selected based on prior evidence from the ADHD and/or developmental literatures (e.g., Masten's 2014 'shortlist') that they predict and/or are associated with resilience as described above. For *individual assets,* we included measures of academic competence, emotion regulation, intellectual functioning (IQ), inhibitory control, working memory, self-esteem, and social skills. *Family assets* included measures of parent-child attachment, positive parenting, and positive parental mental health. *Social-community assets* included measures of peer acceptance as well as school/community involvement. 'Table 1' demographic variables examined in our prior study were also included for completeness (psychostimulant medication status, socioeconomic status, ADHD symptom severity, and comorbidities including diagnosis of SLD, internalizing disorder, ODD, and ASD). When data from multiple informants were available for a questionnaire-based predictor, we selected the informant considered the best reporter of that construct based on empirical evidence. Child neurocognitive variables requiring post-processing are described in more detail in Table 2.

## Data Analysis Overview

All-subsets regression followed by dominance analysis (Azen & Budescu, 2003) were used to identify the relative importance of the candidate individual, family, and social-community factors shown in Table 2 for protecting/promoting resilience in children with and without ADHD. Because dominance analysis is currently limited to 10 predictors (Azen & Budescu, 2003), we first conducted 'all-subsets' regression analysis that computes the $R^2$ values for all possible combinations of predictors at all possible set sizes (Miller, 2002). To choose the subset of predictors that produces the highest $R^2$ value while balancing parsimony, a 'diminishing returns' technique which reflects the point at which a significant increase in $R^2$ from subsets $n$ to $n$+1 predictors is no longer found (i.e., $\Delta R^2 < .01$) was used (Speece et al., 2010).

After identifying the best subset of predictors for each outcome (parent- and teacher-reported resilience), separately for children with and without ADHD, we used dominance analysis to rank order the contributive importance of each of the <10 predictors selected via the all-subsets/diminishing returns analysis. Dominance analysis is a form of multiple regression, and was selected over alternative regression-based approaches (e.g., stepwise deletion) due to well-documented problems with the latter (e.g., Henderson & Denison, 1989) and advantages to the former (Azen & Budescu, 2003). That is, dominance analysis conserves power by statistically establishing levels of dominance (i.e., relative importance) for each predictor, thus enabling identification of a preliminary 'shortlist' of resilience assets for children with ADHD. In dominance analysis, the contributive value of each independent

variable for predicting the outcome is determined via bootstrapping, where the total and unique $R^2$ of each predictor for all possible combinations of entered predictors is computed. This was done with the R package Dominance Analysis ("dominanceanalysis"; Navarrete & Soares, 2020) using 1,000 bootstrapped re-samples.

Each pair of predictors within the model is tested against each other to determine whether they pass tests for complete, conditional, and/or general dominance (Azen & Budescu, 2003). *Complete dominance* occurs when a predictor adds unique variance to the outcome over and above a competitor variable in all pairwise comparisons across all possible combinations of other predictors being included/excluded from the model. A weaker form of dominance is *conditional dominance*, which occurs when a predictor adds unique variance over a competitor variable only within a subset of models with *n* predictors. Lastly, weaker still is *general dominance*, when a predictor variable's overall unique variance (averaged across each subset of models) is greater than the unique variance of the competitor predictor. Separate tests are run to evaluate complete, conditional, and general dominance; however, if complete dominance is present tests for conditional/general dominance are not needed as the former subsumes the latter (similarly, if conditional dominance is present, tests for general dominance are not needed).

Results of these pairwise comparisons are not interpreted via traditional null-hypothesis significance tests (i.e., *p*-values); instead, results are interpreted via $R^2$ values and a set of dominance statistics based on the 1,000 bootstrapped resamples. Within each level of dominance, a predictor is determined to be dominant over the other based on the *Dij* metric, which reflects the dominance of predictor *i* over predictor *j*. A value of 1 indicates that predictor *i* dominates predictor *j*; 0 indicates that predictor *j* dominates predictor *i*, and 0.5 indicates neither predictor is more important than the other. For variables that demonstrate dominance, the mean *Dij* (*mDij*) metric is evaluated to estimate the strength of that dominance, with values closer to 0 or 1 indicating clear directional dominance, whereas values closer to 0.5 provide evidence for indeterminate dominance. Additional dominance estimates include *Pij*, which reflects the proportion of bootstrapped resamples where *Dij*=1.0; and *Rep*, which is a *reproducibility estimate* which reflects the proportion of bootstrap samples that replicated the reported effect, where values close to 1.0 indicate more robust results.

A total of four dominance analysis models were run to examine predictors of parent- versus teacher-perceived resilience in children with and without ADHD. Separate models for parent- and teacher-reported resilience were run given the expectation different factors may promote resilience in the home and school setting. Separate models were run based on ADHD status, given our interest in identifying an initial 'shortlist' of assets for children with ADHD, and preliminary examination of the extent to which the same assets promote resilience for children with versus without ADHD.[1]

[1]Of note, we considered including ADHD status as a moderator, but to our knowledge moderator analysis is not yet available for all-subsets regression/dominance analysis. We judged the benefits of the all-subsets/dominance approach for narrowing-down the relatively large pool of candidate assets to be more beneficial at this early stage than a moderator-based approach to estimating whether a given predictor shows statistically larger magnitude prediction of resilience for children with vs. without ADHD. Thus, our conclusions regarding each asset's status as promotive/protective/conditionally helpful should be considered preliminary and based on

### Power Analysis

For our primary analyses, with $\alpha$=.05, power (1-$\beta$)=.80, and the 10 best predictors of resilience (dominance analysis is currently limited to 10 predictors as noted above; Azen & Budescu, 2003), our sample size of 108 (ADHD group) and 98 (Non-ADHD group) are powered to detect total $R^2$>.15 and $R^2$>.16, respectively (Tang, 2014). Thus, the study is sufficiently powered to detect clinically meaningful effects and address its primary aims.

## Results

### Preliminary Analyses

All independent/dependent variables were screened for univariate outliers, defined as values greater than 3 *SD* above/below the within-group mean. Twenty-three (0.4%) datapoints were identified as outliers and corrected to the most extreme value 3 *SD* above/below the within-group mean. Data were missing completely at random (Little's MCAR test: $\chi^2$=784.62, $p$=.08) and imputed using expectation maximization based on all available data. This process affected 6.2% of data points. Parent and teacher ADHD ratings were higher for the ADHD versus Non-ADHD group as expected (Table 1). The ADHD group was slightly older ($M$=10.53 vs 10.13; $p$=.03) and had slightly lower IQ scores ($M$=102.47 vs 107.32; $p$=.01), but did not differ from the non-ADHD group in SES ($p$=.72).

### Primary Analyses

#### What are the best predictors of resilience in children with ADHD?

**Parent perceived resilience.:** Of the 24 candidate predictors entered into the model, the all-subsets regression identified a subset of 8 unique predictors that collectively explained 39% of the variance in parent-reported resilience ($R^2$=.39). Adding additional predictors to the model failed to increase the total $R^2$ (i.e., $\Delta R^2$<.01). Dominance analysis indicated complete dominance for all pairwise combinations of predictors. Reporting is truncated for readability; see supplementary Tables 1–4 for all dominance estimates. In order of relative importance, children with ADHD who were perceived as more resilient by their parents tended to have better social skills ($R^2$=.20), are *not* prescribed psychostimulant medication ($R^2$=.06), have parents with fewer self-reported mental health concerns ($R^2$=.04), have lower levels of ADHD inattentive symptoms ($R^2$=.03), are more accepted by their peers ($R^2$=.03), have *higher* levels of ADHD hyperactivity/impulsivity symptoms ($R^2$=.01), reside in a *lower* socioeconomic status household ($R^2$=.01), and are older ($R^2$=.01).

**Teacher perceived resilience.:** Of the 24 candidate predictors, the all-subsets regression identified 10 unique predictors (all $\Delta R^2$>.01) that collectively explained 41% of the variance in teacher reported resilience ($R^2$=.41). Complete dominance was established for all pairwise combinations. Children with ADHD who are perceived as more resilient by their teachers tend to be more accepted by their peers ($R^2$=.13), exhibit more academic competence ($R^2$=.11), be male ($R^2$=.05), possess better working memory abilities ($R^2$=.04), not have a co-occurring diagnosis of ODD ($R^2$=.02) or ASD ($R^2$=.01), and have better social skills

whether it was an important/dominant significant predictor for one vs. both groups, rather than based on a statistical test of whether it explains significantly more variance for one group vs the other.

($R^2$=.02). Interestingly, children with ADHD who are perceived as more resilient by their teachers also tend to be *less* emotionally regulated ($R^2$=.01), have *less* parental involvement ($R^2$=.01), and have *lower* self-esteem ($R^2$=.01).

### What are the best predictors of resilience in children without ADHD?

**Parent perceived resilience.:** Of the 24 candidate predictors entered, the all-subsets regression identified 10 unique predictors (all $\Delta R^2$>.01) that collectively explained 61% of the variance in parent reported resilience ($R^2$=.61). Of note, ODD was dropped from the parent model due to unbalanced cell sizes (i.e., only 1 non-ADHD child was diagnosed with ODD). Complete dominance was found for the majority of the predictors, with the exception of four predictors that only passed the test for conditional dominance (emotion regulation>age>sex>parental involvement). Collectively, the results indicate that children without ADHD who are perceived as more resilient by their parents tend to (in order of relative importance) exhibit more academic competence (average unique $R^2$=.14), have better social skills ($R^2$=.13), have fewer inattention symptoms ($R^2$=.09), have better emotion regulation ($R^2$=.09), not have an internalizing disorder diagnosis ($R^2$=.05), and be older ($R^2$=.04) and male ($R^2$=.02). In addition, children without ADHD who are perceived as more resilient by their parents tend to have *less* parent-child involvement (average $R^2$=.02) despite *better* parent-child attachment (average $R^2$=.02). Unexpectedly, they also tend to have slightly *lower* working memory abilities ($R^2$=.01).

**Teacher-perceived resilience.**

Of the 24 candidate predictors entered, the all-subsets regression identified 10 unique predictors (all $\Delta R^2$>.01) that collectively explained 55% of the variance in teacher reported resilience ($R^2$=.55). Complete dominance was found for all predictors, with the exception of parent-child communication that only passed the test for general dominance. Collectively, results indicate children without ADHD who are perceived as more resilient by their teachers tend to exhibit more academic competence (average unique $R^2$=.14), have better social skills ($R^2$=.12), not have an internalizing disorder diagnosis ($R^2$=.09), experience more peer acceptance ($R^2$=.06) and *lower* levels of parent-child communication ($R^2$=.05), not have a diagnosis of ASD ($R^2$=.04) or SLD ($R^2$=.02), be older (average $R^2$=.01), and have parents with fewer self-reported mental health concerns ($R^2$=.01) and higher levels of parental involvement ($R^2$=.01).

**Summary—**Taken together, several *promotive* factors were significantly associated with higher levels of parent- and/or teacher-perceived resilience in both the ADHD and Non-ADHD analyses. These included more academic competence (ADHD $R^2$=.11, Non-ADHD $R^2$=.14), being older (ADHD $R^2$=.01, non-ADHD $R^2$=.01-.04) and male (ADHD $R^2$=.05, non-ADHD $R^2$=.02), experiencing fewer inattention symptoms (ADHD $R^2$=.03, non-ADHD $R^2$=.09) and not having co-occurring diagnoses (ADHD $R^2$=.01-.02, non-ADHD $R^2$=.02-.09). The following factors showed descriptively higher $R^2$ values for the ADHD relative to Non-ADHD sample, tentatively suggesting that better social skills (ADHD $R^2$=.13-.20, non-ADHD $R^2$=.12-.13), higher levels of peer acceptance (ADHD $R^2$=.03-.13, non-ADHD $R^2$=.06), and better parental mental health (ADHD $R^2$=.04, non-ADHD $R^2$=.01) may be *protective* for children with ADHD. Additional *protective* factors

associated with resilience only for children with ADHD included better-developed working memory ($R^2$=.04), *more* symptoms of hyperactivity-impulsivity ($R^2$=.01), and *not* taking psychostimulant medication ($R^2$=.06). Lastly, several factors were significantly associated with parent-/teacher-perceived resilience only for the Non-ADHD group, including better parent-child communication ($R^2$=.05), better developed emotion regulation skills ($R^2$=.09), and higher levels of parent-child attachment ($R^2$=.02) and parental involvement ($R^2$=.01). None of the studied predictors were classified as *conditionally helpful.*

## Discussion

The present study was the first to identify a preliminary 'shortlist' of key individual, family, and social-community assets that promote resilience for children with ADHD. Our discussion focuses on the subset of predictors that excitingly explained a substantial 40%-60% of the variance in parent/teacher perceived resilience, beginning with factors identified as most important based on the dominance analyses.

Peer acceptance and social skills were the two strongest predictors of parent and/or teacher reported resilience in children with ADHD. These assets yielded descriptively greater benefits (higher $R^2$ values) for children with versus without ADHD, suggesting a *protective* effect for children with ADHD. These results are aligned with the well-documented benefits of peer acceptance for buffering against adversity/stressors, especially for children at high-risk for adverse outcomes (Dvorsky et al., 2018; Fredrick et al, 2021). Our results, however, differed from prior studies indicating minimal to no benefits of traditional social skills training for children with ADHD (Evans et al., 2018). In contrast, our findings are more aligned with newer friendship coaching interventions that appear to produce more robust improvements in social functioning and downstream improvements in mood (Smit et al., 2022).

Academic competence was another top predictor of resilience and exerted a *promotive* effect (i.e., similar benefits irrespective of ADHD status). Indeed, academic competence has been associated with myriad factors associated with resilience among at-risk youth, including more positive school orientation and higher levels of teacher expectations/encouragement (Alvord & Grados, 2005). Alternatively, given the cross-sectional nature of our data, it is possible parent/teacher judgment of a child as resilient may be based on successful academic/social functioning, rather than academic/social success making a child more resilient *per se*. Nevertheless, while higher academic success reflects a key promotive factor, it is itself an outcome of a host of individual, family, and social-community factors. Future ADHD research may benefit from examining factors that promote academic success (and the assets identified herein) toward a more complete picture of optimal resources likely to promote thriving.

Our results further revealed children with ADHD whose parents perceive them to be more resilient were *less* likely to be prescribed psychostimulant medication, though the strength of this association was smaller (i.e., approximately half) of the prior described assets. This finding is consistent with evidence indicating a parent's choice to pursue psychostimulant medication is often driven by concern regarding their child's ADHD-related impairments

(Coletti et al., 2012). Stated differently, a parent who perceives their child to be more resilient may be less likely to feel their child requires medical treatment (Chan et al., 2022a). In addition, despite our use of age- and sex-normed measures, boys were perceived to be more resilient than girls by their parents/teachers. Limited work has examined sex effects on resilience in children, though preliminary research suggests school-aged girls are more likely than their male peers to seek social support when coping with adversity (Sun & Stewart, 2007). While help-seeking behaviors have been associated with resilience (Hom et al., 2020), adults may view such behaviors as indications female students/children are less capable of adapting and thus less resilient than their male peers. This hypothesis is undoubtedly speculative but points to a need for increased study of sex and gender influences on child resilience.

Positive parent mental health and child working memory abilities ranked next in relative importance for predicting resilience in ADHD. Consistent with prior evidence, positive parent mental health was beneficial for children irrespective of ADHD status (Masten, 2014), though the benefits were descriptively greater for children with ADHD. This potential protective effect may be conferred by the adaptive parenting styles (Chronis-Tuscano et al., 2008) and improved treatment engagement/outcomes (Sonuga-Barke et al., 2002) associated with greater parental mental health. These findings underscore the promise of ADHD interventions that foster both child and parent well-being, particularly given parents of children with ADHD are at risk for increased mental health concerns (Piscitello et al., 2022).

The benefits of better-developed working memory (WM) are also well-established in the ADHD literature, with studies demonstrating better WM abilities buffer against ADHD-related impairments (Singh et al., 2022), predict enhanced response to evidence-based behavioral therapy (Fosco et al., 2018), and are malleable with targeted intervention (Kofler et al., 2020). Intriguingly, however, the benefits of WM were found only among the ADHD group, which stands in contrast to prior evidence for the promotive effects of better cognitive abilities (Masten, 2014). Together, these findings position WM as a potentially important intervention target, particularly given emerging evidence next-generation neurocognitive training protocols may demonstrate more robust improvements in WM and downstream behavioral outcomes than first-generation programs (Kofler et al., 2020).

Unexpectedly, *lower* levels of parental involvement were associated with higher levels of parent/teacher reported resilience for children with ADHD, while the converse was true for the non-ADHD group. These findings, while surprising, corroborate recent research indicating greater parental involvement does not buffer against academic difficulties for children with elevated ADHD symptoms (Condo et al., 2022; Shelleby & Ogg, 2020), despite the well-established academic benefits of parental involvement within the developmental literature (Wilder, 2014). Collectively, these results are aligned with emerging literature indicating assets identified as beneficial for children without ADHD may not operate the same way for children with ADHD (Chan et al., 2022a). Notably, this pattern was also found for other assets examined herein (i.e., parent-child attachment and communication; positive self-esteem; emotion regulation; SES), which, while promotive for children without ADHD, did not confer positive benefits for the ADHD group. Further

research is thus needed on how to enable children with ADHD to gain the advantages children without ADHD experience from these assets.

Next, we identified several demographic factors associated with resilience. Aligned with prior work establishing benefits of psychological wellbeing to adaptive functioning (e.g., Frazier et al., 2007), children with fewer co-occurring diagnoses and less severe inattentive symptoms were perceived as more resilient by parents/teachers. A parsimonious explanation may be children with fewer mental health challenges bounce back quicker from setbacks due to fewer interfering factors to overcome. However, this conclusion does not appear viable given we also found *more* hyperactivity/impulsivity symptoms to be protective for children with ADHD. While this latter finding may appear initially surprising, it is aligned with evidence indicating increased gross motor movement may mitigate executive function impairments children with ADHD often experience during cognitively demanding tasks (Sarver et al., 2015). Finally, we found older age to be promotive, which is aligned with evidence indicating competencies associated with positive outcomes increase with age (Paris et al., 2019).

## Limitations

The following study limitations warrant consideration. First, while all-subsets regression identifies the subset of variables that explains the most variance in resilience while balancing parsimony, retaining all predictors could explain more variance in resilience. In addition, though the use of multiple informants across the home and school settings was a strength, subjective parent/teacher reports can introduce potential measurement error. Future research may benefit from replicating our findings with more objective, task-based measures of resilience. Furthermore, including children with comorbid conditions in the ADHD group was important for external validity given comorbidity is the norm rather than exception (Wilens et al., 2002). We thus recruited for clinical conditions for our Non-ADHD group to ensure any ADHD/Non-ADHD between-group differences can be attributed to ADHD specifically rather than comorbid conditions. Nonetheless, including these children in the Non-ADHD sample may limit generalizability to neurotypical children more broadly. We view this tradeoff as acceptable given it allowed us to better address our primary research aim regarding ADHD specifically, and to examine the impact of clinical conditions on resilience for children with and without ADHD. Future research may benefit from examining assets that promote resilience for children with ADHD only as well as within other specific clinical conditions. Lastly, as research on resilience in ADHD expands, it will be important to continue this work with longitudinal studies.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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## Highlights

- Largest and broadest study to date of candidate assets promoting resilience in ADHD
- Multi-informant/method strength-based study with carefully evaluated children
- All-subsets/dominance analyses identified promotive/protective/conditional assets
- Assets were identified across individual/family/community domains for ADHD group
- Overlapping and unique predictors of resilience found for ADHD and non-ADHD samples

### Clinical Implications

The present study identified a preliminary ‘shortlist’ of promotive/protective factors that together account for over 40% of the variance in parent and teacher reported resilience for children with ADHD. Consistent with the ‘shortlist’ of promotive/protective factors identified in the developmental literature more broadly, assets associated with resilience in ADHD were found across all three domains. This pattern of results highlights the importance of applying an ecological systems perspective to the study and treatment of ADHD, such that optimal outcomes are likely to be realized when we take a strengths-based, ‘whole child’ approach to intervene not only on malleable child-level factors, but also their family, peer, and broader community linkages and assets. Future research is needed to replicate the preliminary shortlist identified herein, expand this line of work to identify factors that account for the ~60% of children’s resilience that was not related to any of the important predictors identified herein, and identify ‘predictors of the predictors’ toward a more complete picture of the individual, family, and social-community assets likely to produce optimal outcomes for children with ADHD.

### What this paper adds?

This original, multi-informant, multi-method study provides the largest and broadest investigation to date of candidate individual, family, and social-community assets that may promote resilience in children with ADHD, using relatively large, well-characterized, and carefully evaluated ADHD and non-ADHD samples. The study contributes to a critical but predominantly deficit-focused literature on ADHD with its strength-based theoretical model in our provision of an initial roadmap of key, potentially malleable assets that may promote resilience among school-aged children with ADHD. Our study results also contribute to an emerging literature indicating assets that may predict resilience for children *without* ADHD are not the same for children *with* ADHD. As such, it is critical to investigate assets that may uniquely predict resilience within pediatric ADHD. Collectively, our results provide implications for ecological systems or 'whole child' approaches to the study and treatment of ADHD, in that optimal outcomes are likely to be realized with intervention not only on a child's individual but also their family, peer, and broader community linkages and assets.

**Table 1.**

Sample and Demographic Variables

| Variable | ADHD (N=108) | | Non-ADHD (N=98) | | Cohen's *d* | *p* |
|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | | |
| Sex (Boys/Girls) | 73/34 | | 51/47 | | -- | .003 |
| Ethnicity (B/A/W/H/M) | 17/0/77/8/5 | | 10/7/59/12/10 | | -- | .01 |
| Oppositional Defiant Disorder (Y/N) | 32/76 | | 1/97 | | -- | <.001 |
| Anxiety (Y/N) | 23/85 | | 19/79 | | -- | .73 |
| Depression (Y/N) | 5/103 | | 4/94 | | -- | .85 |
| Autism (Y/N) | 11/97 | | 8/90 | | -- | .62 |
| Specific Learning Disability-Reading (Y/N) | 13/95 | | 3/95 | | -- | .005 |
| Specific Learning Disability-Math (Y/N) | 19/89 | | 3/95 | | -- | .04 |
| Age | 10.13 | 1.44 | 10.53 | 1.36 | 0.29 | .03 |
| SES | 47.91 | 11.45 | 48.57 | 11.87 | 0.06 | .72 |
| FSIQ (Standard Scores) | 102.4 | 15.38 | 107.32 | 11.73 | 0.35 | .01 |
| Resilience (T-scores)<br>BASC-3 Resiliency subscale | | | | | | |
| Parent | 42.19 | 8.68 | 47.56 | 9.25 | 0.60 | <.001 |
| Teacher[1] | 41.94 | 9.15 | 46.72 | 10.76 | 0.48 | .002 |
| ADHD Symptoms (Raw scores)<br>ADHD-RS-4/5 Inattention | | | | | | |
| Parent | 19.44 | 5.65 | 11.07 | 8.11 | 1.20 | <.001 |
| Teacher[1] | 17.18 | 5.75 | 10.43 | 7.53 | 1.01 | <.001 |
| ADHD-RS-4/5 Hyperactivity/Impulsivity | | | | | | |
| Parent | 14.82 | 7.21 | 6.51 | 6.33 | 1.22 | <.001 |
| Teacher[1] | 12.35 | 8.47 | 6.26 | 7.05 | 0.78 | <.001 |
| BASC-3 Attention Problems (T-scores) | | | | | | |
| Parent | 67.62 | 7.18 | 56.05 | 11.24 | 1.23 | <.001 |
| Teacher[1] | 65.29 | 7.55 | 56.01 | 11.02 | 0.98 | <.001 |
| BASC-3 Hyperactivity | | | | | | |
| Parent | 68.53 | 12.93 | 55.37 | 11.34 | 1.08 | <.001 |
| Teacher[1] | 63.89 | 14.89 | 53.29 | 11.21 | 0.80 | <.001 |

Note

[1]Teacher BASC data was missing for 29 of the neurotypical children who completed the abbreviated assessment ($n$=65 Non-ADHD cases for these comparisons). BASC = Behavior Assessment System for Children. Ethnicity: B = Black or African American, A = Asian, W = White Non-Hispanic, H = Hispanic or Latino, M = Multiracial. FSIQ Full Scale Intelligence (WISC-V Short Form), SES = Hollingshead socioeconomic status.

**Table 2.**

Individual, Family, and Social-Community Predictors of Resilience in ADHD.

| Domain | Definition | Indicator(s) | Informant(s) | Psychometric Support | Scoring | Item Count |
|---|---|---|---|---|---|---|
| Resilience | A pattern of positive adaptation in context of high-risk for negative outcomes (Lerner, 2009). | BASC-2/3 Resiliency subscale | Parent & Teacher (4-point Likert scale) | Internal consistency: Current sample parent (α=.73-.88) and teacher (α=.86-.89) National sample parent (α=.85-.93) and teacher (α=.91-.96) 1-10 week test-retest: parent (r=.87.90), teacher (r=.84-.88) (Reynolds & Kamphaus, 2015) | Age and sex normed T-scores (national standardization, N=1700–1800; ages 2:0–21:11).<br><br>Higher scores indicate greater resilience. | 13 items |
| ***Individual Assets*** | | | | | | |
| Academic Competence | Attitudes, skills, and behaviors that contribute to school achievement (DuPaul & Langberg, 2015). | Academic Performance Rating Scale (APRS) | Teacher (4-point Likert scale) | Internal consistency: Current sample α=.91; National sample α=.95<br>2-week test retest=.95; (DuPaul et al., 1991) | Age and sex normed T-scores (national standardization, N = 487, ages 6–12).<br><br>Higher raw scores indicate higher academic competence. | 19 items |
| Emotion Regulation | Skill at modulating the escalation/de-escalation, and intensity, of one's physiological, experiential, and behavioral expression of emotions (Graziano & Garcia, 2016). | Emotion Regulation Checklist (ERC) | Parent (4point Likert scale) | Internal consistency: Current sample α=.87 National sample α=.98 (Shields & Cicchetti, 1997) | Higher raw scores indicate better emotion regulation. | 24 items |
| Intellectual Functioning | Global capacity to act purposefully, think rationally, and deal effectively with one's environment (Wechsler, 2014). | WISC-V FRI | Child Test Performance | Internal consistency: National sample α=.92.93<br>1–11 week test-retest: r=.75-.94 (Wechsler, 2014) | Age normed standard scores (residualized; Kofler et al., 2016).<br><br>Higher scores indicate better developed intellectual functioning. | FRI: 2 subtests |
| Inhibitory Control | A set of interrelated cognitive processes that underlie the ability to restrain/ cancel an ongoing response (Alderson et al., 2007). | Stop-Signal Reaction Time (Verbruggen et al., 2013 integrated method)<br><br>(reverse scored) | Child Test Performance | Internal consistency: Current sample α = .66 National sample α=.72;<br>3-week test retest: r=.72 (Soreni et al., 2009) | Component score (z-score) from 4 task blocks based on current sample (factor loadings = .62–.78).<br><br>Higher scores indicate better inhibitory control. | 128 trials |
| Self-Esteem | An individual's sense of worth (Blascovich & Tomaka, 1991). | CDI-2 Negative Self-Esteem subscale<br><br>(reverse scored) | Child SelfReport | Internal consistency: Current sample α=.63 National sample α=.75.80<br>2–4 week testretest: r=.89 (Kovacs, 2010) | Age and sex normed T-scores (national standardization, N = 1,100; ages 717).<br><br>Higher reverse raw scores indicate higher self-esteem. | 6 items |
| Social Skills | Learned behaviors that enable competent social functioning | SSIS Social Skills subscale | Parent (4point Likert scale) | Internal consistency: Current sample α=.95 National sample α=.95.96; | Age and sex normed T-scores (national standardization, N = 4,700, ages 318). | 46 items |

| Domain | Definition | Indicator(s) | Informant(s) | Psychometric Support | Scoring | Item Count |
|---|---|---|---|---|---|---|
| | (Gresham & Elliott, 2008). | | | 10–15 week test-retest: r=.86 (Gresham & Elliott, 2008) | Higher raw scores indicate better social skills. | |
| Working Memory | Active, top-down manipulation of information stored in short-term memory (Repovs & Baddeley, 2006). | Central executive component score from Rapport WM tasks | Child Test Performance | Internal consistency: Current sample α=.73.83 National sample α=.82.97 1–3 week test-retest: r=.76.90 (Kofler et al., 2017; Sarver et al., 2015) | Bartlett component score based on the current sample (51.41% of variance explained; loadings = .55– .78).<br><br>Higher scores indicate better developed central executive (CE) working memory. | 24 trials per task (48 total trials) |
| ***Family Assets*** | | | | | | |
| Parent-Child Attachment | Attachment style characterized by parental responsiveness to child's needs and child's secure parental attachment (Masten, 2014a). | PRQ Attachment subscale | Parent | Internal consistency: Current sample α=.82.87 National sample α=.82.87 5 week testretest: r=.76 (Kamphaus & Reynolds, 2006) | Age and sex normed T-scores (national standardization, N = 4130, ages 2–18).<br><br>Higher raw scores indicate higher levels of parentchild closeness. | 11 items |
| Positive Parenting | Parenting style characterized by high engagement responsiveness, structure, and expectations of responsible child behavior (Masten, 2014a). | PRQ Communication, Discipline Practices, & Involvement subscales | Parent | Internal consistency: Current sample α=.80.89 National sample α=.82.89 5 week testretest: r=.72.84 (Kamphaus & Reynolds, 2006) | Age and sex normed T-scores (national standardization, N = 4130, ages 2–18).<br><br>Higher raw scores indicate better parent-child communication, more structured disciplinary practices, and greater parent involvement. | 26 items |
| Positive Parental Mental Health | Psychological/ emotional well-being (Beck et al., 2016). | BDI-II<br><br>(reverse scored) | Parent Selfreport | Internal consistency: Current sample α= .90 National sample α= .90 2 week testretest: r=.73.96 (Wang & Gorenstein, 2013) | Higher raw scores indicate better parental mental health (lower parent self-reported depressive symptoms). | 21 items |
| Socioeconomic Status | A social/behavioral construct often operationalized as parental income level, education, and/or occupational prestige (Cirino et al., 2002) | Hollingshead 4-Factor Index | Parent | Inter-rater reliability: r=.86-.95 (Cirino et al., 2002). | Weighted average of parent(s) education and occupation.<br><br>Higher scores indicate higher SES. | 4 items |
| ***SocialCommunity Assets*** | | | | | | |
| Peer Acceptance | Degree to which a child is liked by peers (Hoza, 2007). | K-SADS | Parent (4-point Likert scale) | Current sample interrater agreement: r=.93-1.00 1–5 week testretest: r=.631.00 (Kaufman et al., 1997) | 0–3<br><br>Higher scores indicate higher levels of peer acceptance. | 1 item |
| School/ community involvement | Participation in school/community activities | K-SADS | Parent | Current sample interrater agreement: r=.93–1.00 1–5 week testretest: | Total number of organized sports and social organizations in which the child currently participates | 2 items |

| Domain | Definition | Indicator(s) | Informant(s) | Psychometric Support | Scoring | Item Count |
|---|---|---|---|---|---|---|
| | | | | r=.631.00 (Kaufman et al., 1997) | | |