

# Associations between Parent Physical Activity, Negative Parenting Behaviors, and Child ADHD Symptoms

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## Abstract

Attention-deficit/hyperactivity disorder (ADHD) is one of the most commonly diagnosed childhood disorders in the U.S., affecting 9.4% of the youth population. Parenting behaviors and practices displayed in the home can directly impact the child's expression of ADHD symptoms, specifically hyperactivity-impulsivity behaviors. Differences in parenting behaviors are associated with the amount of internal anxiety and stress experienced by the parent, which often can be reduced through implementing health daily behaviors, such as physical activity. This study sought to examine the relationship between parent physical activity levels and their child's ADHD hyperactivity-impulsivity in the home through the parenting behavior mediator of anxious intrusiveness. Ninety-five parents completed online questionnaires and a hypothetical mediated model was tested using regression and a path analysis framework. Results indicated that higher parent physical activity was associated with lower anxious intrusiveness, which was associated with lower hyperactivity-impulsivity behaviors by the child in the home. Clinical implications and future directions are discussed.

## Introduction

Attention-deficit/hyperactivity disorder (ADHD) is one of the most commonly diagnosed childhood disorders in the United States. With a prevalence rate of 9.4% among children, ADHD can be found in millions of households nationwide (Danielson et al., 2018). Currently, the most common form of treatment for ADHD in children and adolescents is pharmacotherapy, specifically using stimulants as a way to decrease the majority of symptoms associated with ADHD (Spencer et al., 1996). Although stimulant medication has been found to be an effective treatment of ADHD in children, it can have some adverse side effects such as severe sleep disturbances and appetite suppression (Noble et al., 2011; Spencer et al., 1996). Because of the potential negative

side effects of medication, parents may prefer to seek other forms of treatment that do not involve pharmaceuticals. Nearly all practitioner guidelines in the past decade regarding the management of ADHD recommend a multimodal treatment approach (CDC, 2020). This approach is largely due to the fact that one form of treatment, such as medication, does not demonstrate improvements in every single facet of a child's symptoms. Parents of children with ADHD may be able to aid in symptom reduction in ways that other treatments may not, specifically through altering their parenting practices and behaviors. Interestingly, differences in parenting styles are associated with different levels of physical activity by the parent (Jago et al., 2011; Sterrett et al., 2013). As such, the purpose of this study was to investigate the association between parents' physical activity levels and their child's ADHD symptom expression in the home.

## Literature Review

### ADHD Symptoms

From a neuropsychological perspective, it is theorized that the causes of ADHD symptoms are due to an irregularly low amount of dopamine, possibly due to the weak anticipatory cell firing in the prefrontal cortex (Volkow et al., 2011; Arnsten, 2000; Tripp & Wickens, 2008). Together, the dopaminergic system and the prefrontal cortex are responsible for a wide range of functions: motor control, reward, motivation, and affect (Cohen et al., 2002). Deficits in dopamine production, as seen with people with ADHD, can lead to different behavior patterns relating to these cognitive processes (Steinau, 2013). These behavior patterns are often categorized into an inattention category and a hyperactivity-impulsivity category. The inattention construct of ADHD combines behaviors such as being easily distracted, often losing items, or having difficulty holding attention. Hyperactivity-impulsivity encompasses excessive fidgeting, talking excessively, and being often

“on the go.” Because of dopamine deficiency, children with ADHD require more reinforcement for demonstrating desired behaviors and can be influenced more by their immediate environment than a neurotypical child (Tripp & Wickens, 2008). Educational programs and behavior management training programs for parents of children with ADHD often focus on addressing these behavior differences by having parents become more active in the reinforcing and rewarding of desired behaviors in order to increase anticipatory cell firing of these behaviors so that the child can regulate their behavior on their own. Children whose parents provide a more structured and purposeful approach to their parenting tend to show improvements in their executive functioning, processing of rewards, and even academic and social functioning (Tamm et al., 2014; Tarver et al., 2015).

### Parenting and Child ADHD Symptoms

Parents’ styles, behaviors, and everyday practices can directly influence their child’s ADHD symptoms in the home. The strength of the relationship between a parent’s behavior and a child’s behavior can be seen through the efficacy of widely used parenting behavior management trainings, such as Parent-Child Interaction Therapy (PCIT) and Triple P –Positive Parenting Program (Thomas & Zimmer-Gembeck, 2007). Specifically, research from these programs have demonstrated that parents who implement authoritative parenting tactics, such as creating consistent structures and establishing clear discipline expectations, report decreases in hyperactivity-impulsivity behaviors from their child in the home (Thomas & Zimmer-Gembeck, 2007; Wagner & McNeil, 2008). Conversely, parents who practice authoritarian or permissive parenting styles are more likely to experience a continuation of their child’s disruptive or inattentive behavioral patterns (Wagner & McNeil, 2008). In addition to parenting styles, higher parental stress and internal anxiety towards parenting can predict increases in hyperactivity-impulsivity behaviors by the child (Theule et al., 2013; Breen & Barkley, 1988). Another relevant factor, parenting anxious intrusiveness, is a term coined to describe a cluster of parenting behaviors that encompasses overprotection, domineering behavior, infantilizing, and an overgratification of the child’s wishes (Becker, 1964; Reid et al., 2015). These behaviors tend to be the opposite of what is suggested by research-backed programs, yet have not been linked with child ADHD symptoms and are im-

portant parenting behaviors relevant to child behavior. One method of lowering stress and internal anxiety in parents that shows promise is the monitoring of their own daily health behaviors, such as physical activity.

### Parent Physical Activity and Parenting Behaviors

Exercise has shown positive effects on parenting styles and behaviors. Parents who are more physically active tend to practice more positive or authoritative parenting behaviors, as opposed to the more maladaptive, authoritarian behaviors (Jago et al., 2011). Conversely, parents who engage in less physical activity tend to display more laissez-faire parenting behaviors or a permissive discipline parenting style (Sterrett et al., 2013). Theory suggests that this relationship exists because exercise increases overall self-efficacy and alleviates stress through released endorphins, which has positive impacts on mood and behaviors (Bandura, 1989; Rebar et al., 2015). Understanding these mechanisms is important because parents of children with ADHD tend to have lower self-efficacy towards their parenting abilities (Alizadeh et al., 2007). Additional stress brought about from the behavioral symptoms of ADHD in children and from a lack of dedicated self-care time are largely responsible for these lower self-efficacy levels in parents. While there is evidence for a link between child ADHD behavioral symptoms and increased parental stress, there is not a link for how changes in parental stress levels, through daily health practices, may be related to child ADHD symptoms. This gap exists largely because of the heavy focus on various and important parenting behaviors and hyperactivity-impulsivity behaviors in children with ADHD.

### The Present Study

This study aims to investigate the relationship between parents’ physical activity levels and their child’s ADHD symptom expression in the home through proposing a theoretical model involving specific parenting practices. While this study is correlational in nature and hopes to lay the groundwork for future causal research, understanding this relationship would provide parents with specific health behaviors that can impact their child’s ADHD-related behaviors. We hypothesize that higher levels of parent exercise will be associated with fewer ADHD behavioral symptoms in their child because exercise will lower anxious intrusiveness parenting.

## Procedures

Participants in this study were recruited online using a snowball convenience sampling procedure across the United States via Facebook™. Survey information was shared on personal and research lab Facebook™ pages, and some participants shared the post to their pages as well. Snowball sampling involves participants sharing the study with others who may be interested and qualify. Participants were sent a unique survey link from Qualtrics™ (Qualtrics, Provo, UT), gave their informed consent, and began the study. One hundred forty-one participants saw the survey, but only 106 participants met criteria for inclusion and provided consent. Inclusion criteria were having the ability to complete the form in English, being of legal adult age in Alabama (ages 19+), having a child between the ages of 2-19, and having a child that has had an official diagnosis of ADHD from a licensed professional for at least 6 months. Eleven participants chose to exit the survey at various points before completion, leaving a total of 95 completed surveys. The average length of time to complete the survey was 15.70 minutes. If they met criteria and participated in the survey, participants were offered a \$5 compensation for participating. This study was approved by the Auburn University Institutional Review Board, Protocol #20-419 EP 2010.

## Participants

The majority of parent respondents were responding about their child between the ages of two to 10 years of age, with almost 97% of these children having an official diagnosis of at least three or more months. The parent participants had an average age of 32.5 years (SD=7.68) with the largest racial group being white participants (N=71). Eighty-one of the participants had children who were on some form of medication for their ADHD. See Table 1 for further demographic information.

## Measures

### Parenting Behaviors

Anxious intrusiveness was measured using the Anxious Intrusiveness subscale from the Parenting Behaviors and Dimensions Questionnaire (PBDQ; Reid et al., 2015). The Anxious Intrusiveness subscale (five items) encompasses parent behaviors that tend to discourage autonomy or independence in the child, such as over-protective behaviors and attempts at shielding the child

from experiencing any form of distress. Examples include “I am more concerned with my child’s feelings than my own” and “I try to anticipate what my child desires and then provide them before he/she has to ask.” Responses were measured by a six-point Likert scale ranging from 1 (never) to 6 (always). Scores were averaged so that higher scores represent more anxious intrusiveness. The Cronbach alpha reliability coefficient for the present sample was 0.834.

### Child ADHD Hyperactivity-Impulsivity

In order to grasp the parents’ experience with their child with ADHD, regarding their behavior patterns, the ADHD Rating Scale-IV: At Home Version (DuPaul et al., 1998) was used. The ADHD Rating Scale-IV assesses hyperactivity-impulsivity behaviors in the child, and parents report on their child’s behavior at home on a 4-point Likert scale ranging from 0 (Never or Rarely) to 3 (Very Often). Items for each of the two subscales were added together, respectively, to get a total score for each subscale. This norm-referenced checklist refers to the child’s behavior over the past six months in the home, with questions based on information from the DSM-IV regarding ADHD and includes frequency items such as “has difficulty waiting turn” or “talks excessively.” The ADHD Rating Scale IV has adequate validity and reliability; the Cronbach alpha reliability coefficient for the present sample was 0.745.

### Parent Physical Activity

Lastly, there were questions regarding the parents’ physical activity habits and those relating to active play with the child. Specifically, the two items in this section inquired how much the parent engages in physical activity by themselves and how much they engage in physical activity with their child. All of the physical activity items were measured on half-hour increments per day, with the maximum amount for each category being five hours per day. The two items were then added together to get a total parent physical activity score.

### Control Variables

The variables controlled were the parent and child age, if the child had a formal diagnosis or not (dummy coded 0 = no diagnosis, 1 = diagnosis), the number of years since the diagnosis, medication usage (dummy coded 0 = no medication, 1 = prescribed ADHD medication), income, and parent education (in years).

### Analytic Plan

The collected data were analyzed using IBM® SPSS® Statistics version 22.0 and macro-program PROCESS 2.1—a freely available and downloadable add-on to SPSS® that allows for testing mediation using a regression and path analysis framework to provide indirect effects (Hayes, 2013). Parent physical activity was regressed onto anxious intrusiveness and hyperactivity. Parent anxious intrusiveness was regressed onto child hyperactivity impulsivity. The final model represented a fully mediated model, as hypothesized. The indirect paths were tested with bootstrapping procedures at the 95 percent confidence interval and 5,000 samples (Preacher & Hayes, 2008). Finally, parent and child gender and age, income, parent years of education, years since formal diagnosis, and if the child was on ADHD medication were also controlled for in the present study.

## Results

### Bivariate Correlations

Bivariate correlations and descriptive statistics were explored first to determine if the data met the requirements for structural equation modeling. More parent physical activity was associated with less anxious intrusiveness ( $p=.014$ ;  $p=.04$ ). Additionally, higher hyperactivity-impulsivity scores were associated with higher amounts of anxious intrusiveness ( $p<.001$ ). Interestingly, hyperactivity-impulsivity was not associated with parent physical activity. With these results proceeding generally as expected, the main analysis was continued.

### Final Model

The final model contained parent physical activity being negatively correlated with hyperactivity through anxious intrusiveness. The final parsimonious model fit the data well:  $p=.0016$ ,  $F=4.18$ . Additionally, parent physical activity accounted for 6.4% of the variance in anxious intrusiveness and parent anxious intrusiveness accounted for 14.6% of the variance in child's hyperactive impulsivity. More parent physical activity was negatively associated with anxious intrusiveness scores ( $\beta=-.13$ ;  $p=.015$ ). More parent anxious intrusiveness was associated with more hyperactivity-impulsivity ( $\beta=.70$ ;  $p=.002$ ).

### Indirect Effects

There was a statistically significant indirect effect from

parent physical activity to their child's hyperactivity-impulsivity: parent physical activity level  $\rightarrow$  parent anxious intrusiveness  $\rightarrow$  child hyperactivity-impulsivity ( $\beta = -.09$ , CI  $[-.221, -.010]$ ). This result can be interpreted as follows: A 1-standard deviation unit increase in parent physical activity is associated with a 0.09 standard-deviation unit decrease in child hyperactivity-impulsivity via the prior effect of parent physical activity on parent anxious intrusiveness.

## Discussion

This study sought to explore the associations between parental physical activity and ADHD symptom expression in the child at home. Results revealed an indirect association through parent anxious intrusiveness. These findings were robust as several important covariates in the literature were included. These findings highlight the role of parent exercise as a key target for intervention and prevention, which will be discussed further.

This study is amongst the first to explore the role of parent physical activity in child ADHD symptoms. Whereas previous research has emphasized the importance of child exercise in managing ADHD symptoms, no known research has linked lower ADHD symptom expression with parent exercise. Additionally, this association occurred through the parent's anxious intrusiveness. Anxious intrusiveness encompasses frequent worrying about the child's emotional well-being when the child is not present, meeting the child's desires before they ask for it, and attempting to shield the child from negative emotions. Our findings highlight that parent physical activity is associated with lower parent anxious intrusiveness and lends credence to the important role of exercising in managing behavior and mood states (Rebar et al., 2015).

The relationship between lower parental anxious intrusiveness and lower hyperactivity-impulsivity highlights the importance of parental stress and the secondary effects on the child's behavioral patterns. This finding is also supported by current treatment recommendations in parental training programs for ADHD. Specifically, when parents are more confident in their abilities, they are more likely to demonstrate research-supported parenting practices (CDC 2020; Eyberg & Robinson, 1982).

## Implications

The findings from this study have important implications for prevention and intervention programming. First, while many programs may incorporate and suggest child physical activity, our results suggest that including a parent may also have effects on the child's ADHD symptoms. As such, interventions including parents and family members may show lasting improvements. Second, parent anxious intrusiveness was the mechanism linking parent physical activity and child hyperactivity-impulsivity. As such, these findings support the importance of parental behavior management, specifically through internal anxiety management related to parenting. Although further research investigating these additions to programs are necessary, our findings nonetheless are promising.

Four additional parenting behavior clusters were examined in addition to anxious intrusiveness and they did not yield a significant relationship to the other investigated variables. This outcome may shed light on the relationship between parent physical activity, stress, and parenting behaviors. Three of the four additional parenting behavior clusters focused on different aspects of positive parenting or external parenting techniques encouraged by clinicians. It could be the case that lower parental stress primarily affects internal aspects of parenting or that it aids in lowering maladaptive parenting techniques and does not hold much influence on increasing positive behaviors. Anxious intrusiveness specifically encompasses behaviors that stem from internal fears and a lack of confidence in parenting. None of the other parenting clusters included in this study tap into parents' thoughts quite like this variable, which could be why physical activity was only associated with anxious intrusiveness. However, more information and research is needed to understand this relationship of health practices and parenting practices.

## Limitations and Directions for Future Research

This study, however, is not without its limitations. First, it is important to note that participants were recruited via snowball sampling techniques. This involved participants sharing this study to others who may be interested and qualified to participate. Other recruitment techniques may have yielded more representative sam-

ples. Additionally, participants were asked about various health habits of their family. It is possible that their health habit responses and behavioral patterns might have looked different outside of the COVID-19 pandemic. Future research can aim to replicate this study with more representative samples outside of the pandemic, as well as include additional health habits such as nutrition, sleep habits, and more that may be associated with the internal anxiousness of parents. Furthermore, the specific relationship between parental anxious intrusiveness and child hyperactivity-impulsivity behaviors necessitates a deeper understanding. Future research can investigate the psychological mechanisms of this relationship, possibly by looking at parental-child behavioral attentiveness when anxious intrusiveness is higher or at changes in other parenting behaviors when parents experience more internal anxiety towards their parenting. This study did not inquire on past or current ADHD treatment program involvement. Future research can also explore how the improvement of the daily health habits of parents may affect or elevate progress in behavioral treatment programs.

This study did combine the amount of time the parent participates in physical activity alone and with the child to give the overall total amount of time the parent engages in physical activity. Future research may isolate these two subcategories of physical activity, which may shed light on other possible relationships, such as the parent-child bonding from physical activity playing a significant role in reducing anxious intrusiveness. Future research should also use more established measures of physical activity, including reliable self-reported but also observational or actigraphy data. Our data were cross-sectional and future research should investigate the associations across time. Finally, all data were self-reported and are subject to bias. Future research should include more objective measures such as third party and observational reports on the variables of interest.

## Conclusion

This study sought to understand the possible relationship between parent physical activity and child ADHD symptom expression through the mechanisms of various parenting behaviors. Results indicated that higher amounts of parent physical activity are associated

with lower child hyperactivity-impulsivity through lower parent anxious intrusiveness. Exercise has been shown to decrease internal anxiety and increase parental self-efficacy while parental stress has been shown to predict hyperactivity-impulsivity behaviors in children with ADHD. Future research is warranted in order to further understand this relationship.

## Acknowledgments

This study was supported by the Auburn University Undergraduate Research Fellowship Program. We also thank the Relationships and Health Lab for their support and assistance throughout this study.

## IRB Approval

This study was approved by the Auburn University Institutional Review Board, Protocol #20-419 EP 2010.

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**Table 1.** Demographic Information for Parents  
(N=95)

Variable	<i>n</i>	<i>%</i>
Child Gender		
Male	24	25.3
Female	3	3.2
Child Age		
2-5 years old	41	43.2
6-10 years old	41	43.2
11-13 years old	7	7.4
14-19 years old	6	6.3
Time since child's diagnosis		
0-3 months	3	3.2
3-6 months	23	24.2
6-12 months	52	54.7
1+ years	17	17.9
Child on ADHD medication		
Yes	80	84.2
No	4	14.7
Prefer not to say	1	1.1
Racial Background		
American Indian/Alaskan Native	12	12.6
Asian American or Pacific Islander	3	3.2
African American (Black)	4	4.2
Latino/Hispanic	5	5.3
White	71	74.7
Bi-racial/Multi-Racial	0	
Highest Education completed		
Less than High School	0	
High school or GED	7	7.4
Some college, not graduated	7	7.4
Associate's degree	53	55.8
Bachelor's degree	26	27.4
Graduate or professional degree	2	2.1
Yearly Income		
None	0	
Under \$20,000	0	
\$20,000-\$39,000	18	18.9
\$40,000-\$59,999	36	37.9
\$60,000-\$79,999	21	32.6
\$80,000-\$99,999	6	6.3
\$100,000 and above	4	4.2

**Table 2.** Variable correlates and Descriptive Statistics (N=94).

<b>Variables</b>	<b>1</b>	<b>2</b>	<b>3</b>
1. Anxious Intrusiveness	--		
2. Parent Physical Activity	-.274**	--	
3. Hyperactive- Impulsivity	.355***	-.082	--
<i>M</i>	2.74	2.66	21.96
<i>S. D.</i>	.81	1.69	4.27

*Note:* \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .