

ORIGINAL ARTICLE

Exploring the association between attention-deficit/hyperactivity disorder and entrepreneurship

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Objective: To investigate the association between attention-deficit/hyperactivity disorder (ADHD) symptoms and entrepreneurial profiles and the effects of entrepreneurial characteristics in individuals who screen positive for ADHD and self-identify as entrepreneurs.

Methods: We sent 4,341 questionnaires by e-mail to applicants for a career development course for entrepreneurs. We used the propensity score covariate adjustment to balance differences between included and excluded individuals. ADHD symptoms were evaluated with the Adult ADHD Self-Report Scale. The Individual Entrepreneurial Orientation scale was used to assess the entrepreneurial profile of the participants. Impairment from ADHD symptoms was assessed with the Barkley Functional Impairment Scale.

Results: Those who screened positive for ADHD had higher risk-taking scores (p -value = 0.016) and lower proactivity (p -value = 0.001) than those who screened negative. Higher inattention scores were related to lower proactivity (p -value < 0.001), while higher hyperactive symptom scores were related to a more generalized entrepreneurial profile (p -value = 0.033). Among ADHD-positive participants, entrepreneurial profile scores were not significantly associated with company profits or impairment.

Conclusion: Inattention symptoms were related to less proactivity, whereas hyperactive symptoms were positively associated with a general entrepreneurial orientation. ADHD-positive individuals had a higher risk-taking profile, and these characteristics did not negatively impact their lives.

Keywords: ADHD; attention-deficit/hyperactivity disorder; entrepreneurship

Introduction

Attention-deficit hyperactivity disorder (ADHD) is one of the most common neurodevelopmental disorders diagnosed during childhood, with a worldwide prevalence of 5.3%.¹ Its prevalence is 3-5.8% among Brazilian children and adolescents.² About 60% of children diagnosed with ADHD will present symptoms of the disorder during adult life,³ resulting in an adult ADHD prevalence of 2.5-3%.⁴ In Brazil, Matte et al.⁵ found a DSM-IV ADHD prevalence of 2.8% among adults. In adulthood, ADHD symptoms are related to a higher rate of job dismissal and greater difficulty in achieving prestigious positions.⁶ Adults with ADHD are also more likely to be absent from work, make more mistakes, and often cannot meet workload demands.^{6,7} Moreover, they represent a higher annual burden for employers due to more expensive health benefits and more health-related absences (mainly due to psychiatric comorbidities).⁸ These individuals also have lower job performance and greater job instability.⁹

Although studies have found a negative association between ADHD symptoms and work performance, most of the evidence is derived from samples of employees, rather than self-employed.¹⁰ Individuals with ADHD actually prefer to work independently,¹¹ and the characteristics of the disorder could be positively related to an entrepreneurial profile.¹² Some aspects of entrepreneurship, such as the active nature of the work and the involvement of risk, may provide a good person-environment fit for adults with ADHD.¹³ Some studies have suggested that individuals with ADHD are more open to new experiences and have more creative personalities.¹⁴⁻¹⁶ One could speculate that mind wandering (associated with inattention) is related to imagination and discovery, while hyperactivity is related to multitasking and innovation. Moreover, an impulsive character could be the trigger for risk-taking.¹²

In fact, studies have been conducted on the relation between ADHD symptoms and entrepreneurial profiles. A cross-sectional study with a large sample of university

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students showed that individuals with ADHD have greater entrepreneurial intentions and are more likely to start business ventures.¹⁷ In another study, university students that had a greater number of ADHD characteristics were more likely to pursue an entrepreneurial career than be employees.¹² Additionally, a study on small business owners in France found a positive association between general ADHD symptoms and entrepreneurial orientation.¹⁸ When assessed dichotomously, individuals with ADHD have higher entrepreneurial intent and action.¹⁷ However, findings in the literature are controversial. A study on academic researchers from France, Italy, and Spain found a negative association between inattentive symptoms and entrepreneurial characteristics, with no significant association between hyperactive symptoms and entrepreneurship.¹⁹ On the other hand, another investigation found a positive association between hyperactive and general ADHD symptoms and self-employment, as well as a significant negative association between self-employment and inattentive symptoms.²⁰ Thus, despite some recent research on the association between ADHD symptoms and an entrepreneurial profile, divergent results have been found and data is still lacking.

The question of how potential entrepreneurial characteristics impact the lives of individuals with ADHD is also open to investigation. No study has yet assessed the impact of entrepreneurial characteristics on areas frequently impaired by ADHD. In addition, we could find no data about how entrepreneurial orientation influences the job success of individuals with ADHD.

Thus, the present study aimed to: 1) verify the association between ADHD symptoms and entrepreneurial characteristics; 2) identify whether inattentive and hyperactive domains are related to different entrepreneur profiles; 3) assess the interaction between ADHD symptoms and entrepreneurial characteristics on job success; and 4) evaluate the interaction between ADHD symptoms and entrepreneurial profiles vs. impairment in different areas of personal life.

Methods

This project is the result of a partnership between the Programa de Transtornos de Déficit de Atenção/Hiperatividade, Hospital de Clínicas de Porto Alegre (HCPA), state of Rio Grande do Sul, Brazil, and TriadPS, a consulting firm focused on business and productivity (www.triadps.com). TriadPS provides consultation for individuals and companies in Brazil and enterprises worldwide.

Data collection and sample

TriadPS developed an entrepreneur career development course called Second Career (www.segundacarreira.com.br) in partnership with Revista Você S/A. A total of 4,341 people registered for the course and provided full sociodemographic data. All prospective participants were aged 18 years or older, had a company in their name and self-identified as an entrepreneur.

A letter of invitation describing the project was sent by e-mail to each person who registered for the course.

The letter included a link to a self-completed questionnaire. The invitation was sent three times between the end of 2017 and the beginning of 2018, with a week between each message. After filling out an instrument that collected sociodemographic data, the participants responded to specific instruments assessing ADHD symptoms, impairment due to the symptoms, entrepreneurial performance, and the Individual Entrepreneurial Orientation (IEO) scale.

Measures

Adult ADHD Self-Report Scale (ASRS) version 1.1

To assess ADHD symptoms, we used the ASRS, which was developed by the World Health Organization workgroup on adult ADHD.²¹ This standardized, well-validated self-report instrument assesses current ADHD symptoms in individuals aged 18 years and older. It consists of 18 questions in two sections (part A and part B), each related to DSM-IV ADHD symptoms.²² The symptom checklist uses a five-point Likert-type scale to rate ADHD symptoms (0 = never, 1 = rarely, 2 = sometimes, 3 = often, 4 = very often). The instrument was included in the online questionnaire. As in previous studies by our group, the score for each symptom was dichotomized as 0 (negative) or 1 (positive) as follows: 0, 1, and 2 = 0; 3 and 4 = 1.^{5,23} Participants were categorized into two groups: 1) ADHD-positive and 2) ADHD-negative, according to DSM-5 ADHD criteria A (threshold = 5 symptoms of inattention and/or hyperactive/impulsivity).²⁴ Individuals also had to describe impairment due to symptoms in at least two areas in the Barkley Functional Impairment Scale (see below) to be considered ADHD-positive. ADHD symptoms were also assessed as continuous variables according to the sum of the nine symptoms in each dimension (inattention and hyperactivity/impulsivity).

Structured interview for impairment

To evaluate the level that ADHD symptoms impaired important daily activities, we used Barkley's Current and Childhood Symptom Scales (self-report forms that address current and past ADHD symptoms according to DSM-4 diagnostic criteria).²⁵ The self-report questionnaire was e-mailed to all participants. In this study, we used a subset of the scale in which respondents report how often symptoms interfere in 10 areas of daily life: family, work, social life, community, studies, relationships/marriage, finance, driving, leisure, and daily responsibilities. The score for each question ranged from 0 to 3 (rarely to frequently). The impairment score for each domain was dichotomized as follows: 0 and 1 = 0 (negative), 2 and 3 = 1 (positive). Participants with a positive score in at least two domains were classified as impaired according to DSM-5 criteria. We assessed the number of sites with severe impairment, calling this variable as "impairment." The impairment score was also assessed as a continuous variable according to the sum of each domain score (from 0 to 30). We called this variable "total impairment." Individuals were considered ADHD-positive if they fulfilled the above-described ASRS criteria and were impaired in at least two domains.

Entrepreneurial performance

We evaluated entrepreneurial success by measuring annual profits of the participants' companies. Five profit categories were determined: 1) up to Brazilian *reais* (BRL) 90,000; 2) BRL 90,000-900,000; 3) BRL 900,000-4 million; 4) BRL 4-22.5 million; 5) over BRL 22.5 million.

Individual entrepreneurial orientation (IEO)

The IEO was used to evaluate the participants' entrepreneurial characteristics.²⁶ This well-validated scale assesses entrepreneurial intent, covering important information about the respondent's entrepreneurial profile and performance.^{18,26} The questionnaire consists of 10 questions subdivided into three dimensions: risk-taking, innovativeness, and proactivity.

The risk-taking profile can be defined as the willingness to take risks and the capacity to venture into the unknown. The questions assessing this dimension were: 1) I like to take bold action by venturing into the unknown; 2) I am willing to invest a lot of time and/or money in something that might yield a high return; 3) I tend to act "boldly" in situations where risk is involved.

Innovativeness is the predisposition for creativity and experimentation in ideas, products, and services. The questions assessing to this dimension were: 4) I often like to try new and unusual activities that are not necessarily risky; 5) In general, I prefer a strong emphasis on projects with unique, one-of-a-kind approaches rather than revisiting tried and true approaches; 6) I prefer to learn new things my own way rather than the way everyone else does; 7) I favor experimentation and original approaches to problem solving rather than the methods others generally use.

The individual's proactivity can be characterized by the pursuit of opportunities, acting in advance against future demand. The questions assessing this dimension were: 8) I usually act in anticipation of future problems, needs or changes; 9) I tend to plan ahead on projects; 10) I prefer to "step-up" and get things going on projects rather than sit and wait for someone else to do it.

Responses for each item ranged from 1 to 5 (strongly disagree to strongly agree). Mean overall scores and scores for each dimension were calculated. Thus, individuals had an overall score from 1 to 5, as well as another score from 1 to 5 for each dimension (proactivity, innovativeness, and risk-taking). The scale's back-translation process followed similar procedures used in other studies.^{27,28}

Statistical analysis

Categorical variables (gender, home region, marital status, and family income) were compared between responders and non-responders using the chi-square test. The only continuous variable (age) was compared between groups with the Mann-Whitney *U* test, since it was non-normally distributed.

Since our response rate was low (see below), as in most Internet surveys,²⁹ we compared sociodemographic data from participants and non-responders. We found a

significant difference in sociodemographic data (gender, family income, home region, marital status) between the groups, so we adjusted our findings using propensity score covariate adjustment.³⁰ The propensity score aims to balance two non-equivalent groups to obtain a non-biased estimate.^{31,32} The weight generated with this method was used in all subsequent analyses.

We used a generalized linear model to test the association between dichotomously and dimensionally defined ADHD and the overall and dimensional IEO scores. We also used a generalized linear model to determine associations between general entrepreneurial profile scores, dimensional scores, total company profits, and impairment in different areas among those with ADHD. The chi-square test and a generalized linear model were used to compare the annual profits between individuals with and without ADHD.

Ethics statement

This study was developed in accordance with Declaration of Helsinki guidelines and the protocol was accepted by the HCPA ethics committee. Study participants provided consent in the e-mail invitation. Participant anonymity and the privacy of personal data were ensured.

Results

Descriptive analysis

Of the 4,166 individuals invited to participate (in three separate emails), 449 responded (response rate = 10.8%). Those who did and did not respond differed significantly in gender, home region, marital status, and family income (Table 1).

Of the total population of 4,166 individuals, 355 reported being entrepreneurs, of whom 259 (6%) completely filled out the questionnaire and were included in the data analysis. Of those included, 64.9% were male and the mean age was 39.55 years (standard deviation [SD] = 9.08 years). A total of 57.1% were from the southeast region and only 2.7% were from the north region. Most (69.5%) reported being in a stable relationship and the monthly family income of the majority was between BRL 470 and 2,500 (57.1%). As expected, we found a high prevalence of ADHD^{5,23}: 71 (27.4%) of the participants fulfilled the ADHD diagnostic criteria. Of the participants with ADHD, 66.2% were male, 62% were married, and their mean age was 36.52 (SD = 8.02 years). This group was predominantly from the southeast region (42.3%), and 60.6% had a monthly family income between BRL 470-2,500.

The relationship between ADHD, IEO, and outcomes

Figure 1 presents the results of the association between ADHD and overall and dimensional IEO scores after covariate adjustment for propensity scores. Table 2 shows the association between hyperactive and inattentive dimensional symptoms with IEO dimension scale scores without regard to ADHD diagnosis. We found that ADHD was

Table 1 Sociodemographic characteristics of responders and non-responders

Variable	Responders	Non-responders	p-value	p-value*
Total	449 (100)	3,717 (100)		
Gender			< 0.001	0.294
Female	161 (35.9)	1,715 (46.1)		
Male	288 (64.1)	2,002 (53.9)		
Home region			0.028	0.412
North	12 (2.7)	128 (3.4)		
Northeast	46 (10.2)	450 (12.1)		
Midwest	43 (9.6)	395 (10.6)		
Southeast	252 (56.1)	2,164 (58.2)		
South	96 (21.4)	580 (15.6)		
Marital status			0.008	0.663
Not married	115 (25.6)	744 (20)		
Married	302 (67.3)	2,572 (69.3)		
Divorced	31 (6.9)	366 (9.9)		
Widower	1 (0.2)	31 (0.8)		
Family income (BRL)			< 0.001	0.010
< 470	43 (9.6)	576 (15.5)		
470-2.500	253 (56.7)	2,496 (67.2)		
> 2.500	150 (33.6)	645 (17.4)		
Age, mean (SD)	39.01 (9.03)	39.20 (10.42)	0.72	0.162

Data presented as n (%), unless otherwise specified.

* After covariate adjustment using propensity score.

BRL = Brazilian *reais*; SD = standard deviation.

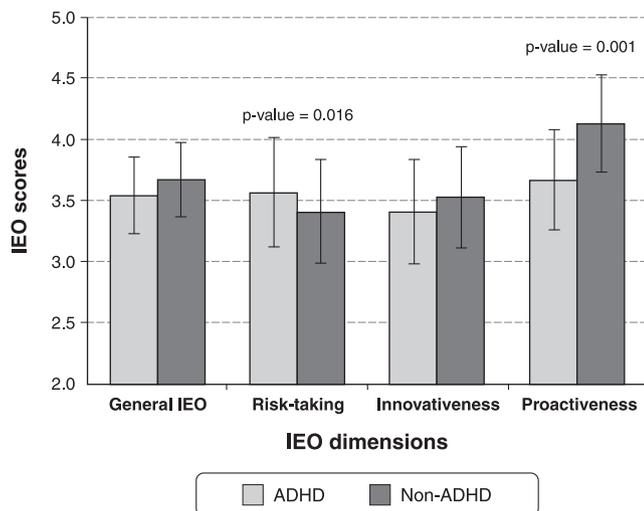


Figure 1 Screening for attention-deficit/hyperactivity disorder (ADHD) and its relation with individual entrepreneurial orientation (IEO). ADHD = screened positive for ADHD; Non-ADHD = screened negative for ADHD.

significantly associated with higher risk-taking scores (odds ratio [OR] = 1.59; $p = 0.016$) and lower proactiveness scores (OR = 0.55; $p = 0.001$). Independently of ADHD diagnosis, a profile with more inattentive symptoms was significantly associated with a lower proactiveness score (OR = 0.92; $p < 0.001$), whereas a profile with more hyperactive

symptoms was significantly associated with higher overall IEO scores (OR = 1.06; $p = 0.033$). Considering the entire sample, inattention symptoms were not associated with risk-taking scores (OR = 1.01; $p = 0.733$) or innovativeness (OR 1.02; $p = 0.333$). A marginally significant association was found between inattention and overall IEO score (OR = 0.95; $p = 0.050$). Hyperactivity symptoms were also not associated with risk-taking (OR = 1.02; $p = 0.267$) or innovativeness (OR = 1.03; $p = 0.189$) and proactiveness (OR = 1.00; $p = 0.952$).

Table 3 shows the impact of entrepreneurial profile scores on annual profits, the number of sites with impairment (“impairment”) and total impairment scores (“total impairment”) among participants with ADHD. Higher risk-taking in individuals with ADHD was not significantly associated with profit (OR = 1.05; $p = 0.359$), impairment (OR = 0.98; $p = 0.200$), or total impairment (OR = 0.99; $p = 0.167$). Proactiveness scores were not significantly associated with profit (OR = 1.02; $p = 0.651$), impairment (OR = 0.99; $p = 0.744$), or total impairment (OR = 0.99; $p = 0.327$). Innovativeness scores were not significantly associated with profit (OR = 1.02; $p = 0.732$), impairment (OR = 1.02; $p = 0.195$), or total impairment (OR = 1.01; $p = 0.241$). There was no significant association between ADHD and higher or lower profit levels (Table 4).

Discussion

We observed that participants with ADHD not only had higher risk-taking scores, but lower scores in the proactiveness dimension. When the influence of symptoms was assessed, we observed that higher levels of hyperactivity were positively associated with the overall IEO score. On the other hand, inattention symptoms were negatively related to the proactiveness dimension. To evaluate the effects of higher risk-taking behavior and lower proactiveness among participants with ADHD, we analyzed the impact of these characteristics on entrepreneurial success (i.e., annual profits) and on impairment in daily activities. We demonstrated that risk-taking was neither positively nor negatively associated with economic success. Furthermore, higher risk-taking scores were not associated with greater impairment in daily activities.

Contrary to our expectations, we found no association between hyperactive symptoms and risk-taking. Among participants who screened positive for ADHD, we found no association between IEO dimensions, profit, and impairment. The lack of associations might be related to our small sample size.

A previous study found that individuals with ADHD have greater intentions to become entrepreneurs and higher entrepreneurial action.¹⁷ Canits et al.¹⁹ evaluated the association between ADHD dimensions and entrepreneurial academic preference (entrepreneurial commercialization and patent registration) among academic researchers in France, Italy, and Spain. They found a negative relationship between inattention symptoms and entrepreneurial characteristics but no association with hyperactivity symptoms.¹⁹ Another investigation demonstrated that small business owners in France with a

Table 2 Association between dimensional symptoms of attention-deficit/hyperactivity disorder and individual entrepreneurial orientation (IEO) adjusted by propensity score

	Overall IEO		Risk-taking		Innovativeness		Proactivity	
I score*	0.95 (0.90-1.00)	0.050	1.01 (0.97-1.05)	0.733	1.02 (0.98-1.07)	0.333	0.92 (0.88-0.96)	< 0.001
H score [†]	1.06 (1.01-1.12)	0.033	1.02 (0.98-1.07)	0.267	1.03 (0.99-1.08)	0.189	1.00 (0.96-1.04)	0.952

Data presented as odds ratio (97.5% confidence interval) and p-values.

Generalized linear model were used and the results are adjusted by propensity score.

* Related to the sum of all nine inattentive symptoms.

[†] Related to the sum of all hyperactive symptoms.

Table 3 Impact of entrepreneurial profiles over company profit and impairment among individuals screening positive for attention-deficit/hyperactivity disorder

IEO	Annual company profit		Impairment*		Total impairment [†]	
Risk-taking	1.05 (0.94-1.17)	0.359	0.98 (0.95-1.01)	0.200	0.99 (0.97-1.00)	0.167
Proactivity	1.02 (0.92-1.13)	0.651	0.99 (0.96-1.03)	0.744	0.99 (0.98-1.01)	0.327
Innovativeness	1.02 (0.91-1.13)	0.732	1.02 (0.99-1.05)	0.195	1.01 (0.99-1.02)	0.241
Overall IEO	1.03 (0.95-1.11)	0.440	1.00 (0.98-1.02)	0.996	1.00 (0.99-1.01)	0.704

Data presented as odds ratio (OR) (97.5% confidence interval) and p-value.

The results of the generalized linear model (Poisson regression) are adjusted by propensity score.

IEO = individual entrepreneurial orientation.

* Number of sites with severe impairment.

[†] Sum of all impairment scores.

Table 4 Annual company profit and ADHD status

Variables	ADHD* (n=71)	Non-ADHD [†] (n=188)	p-value
Company profit (BRL)			0.995
< 90,000	48 (69.0)	140 (74.5)	
90,000-900,000	19 (26.8)	35 (18.6)	
900,000-4 million	2 (2.8)	9 (4.8)	
4-22.5 million	1 (1.4)	2 (1.1)	
> 22.5 million	0 (0.0)	2 (1.1)	

Data presented as n (%), unless otherwise specified.

ADHD = attention-deficit/hyperactivity disorder; BRL = Brazilian reais.

The table shows the distribution of company profits between participants with and without ADHD (chi-square test). The p-value is the result after covariate adjustment using the propensity score.

* ADHD = screened positive for ADHD.

[†] Non-ADHD = screened negative for ADHD.

greater number of ADHD symptoms had a higher entrepreneurial orientation.¹⁸ It was found that students with ADHD-like behaviors prefer pursuing a career as an entrepreneur rather than working as an employee.¹² A different group of investigators found a positive association between ADHD, hyperactivity symptoms and self-employment, as well as a negative relationship between self-employment and inattention symptoms.²⁰ Likewise, another study found a positive relation between hyperactive symptoms and entrepreneurial characteristics and a negative association between inattentive symptoms and entrepreneurship.³³ These results corroborate the findings of the present study.

Impairment from ADHD increases with the number of symptoms. On the ADHD symptom spectrum, impulsivity causes the greatest impairment in daily activities.³⁴ Thus, it would be reasonable to infer that entrepreneurs with ADHD and a higher risk-taking profile would also have

greater functional impairment. For this reason, we analyzed the relationship between risk-taking scores, the number of impaired domains, and the total impairment scores, although we found no significant relationship between risk-taking behavior and impairment in daily life. This shows that the risk-taking profile, a positive factor in entrepreneurship,^{26,35-37} has not brought greater impairment to entrepreneurs with ADHD. On this point, we could find no other studies for comparison.

Nevertheless, our study has some limitations. Because it is an observational study and the data were collected by a self-report web-based survey, caution should be used when generalizing our findings.³⁸ The response rate was low, although this is normal with web-based surveys.²⁹ We found sociodemographic differences between responders and non-responders, but these differences were corrected through covariate adjustment using the propensity score.³¹ The weight generated by the method was used in the subsequent analyses, reducing the effect of the differences between the groups. Although controversial, this is a widely used approach in medical research.³⁰⁻³² Finally, a high percentage of participants met the criteria for ADHD. Previous studies on ADHD prevalence in adults that used online self-report questionnaires also found a high prevalence of ADHD.^{5,39} In addition, since our survey explained that the topic under investigation was ADHD symptoms, we might have attracted the attention of individuals who self-identify with some or several of these symptoms, a frequent selection bias in this type of study.

Our findings can enrich current understanding of ADHD. The results indicate that individuals with ADHD and those with a greater number of hyperactivity symptoms have a greater entrepreneurial profile. Although it is not yet clear how beneficial this may be, we found no negative outcomes from certain characteristics associated with this profile,

such as risk-taking. These results are also important for educators, who can help adolescents and young adults with ADHD select future careers based on where their characteristics can be advantageous. Moreover, in the workplace, managers should not be only aware of the challenges that accompany ADHD symptoms, but should also understand their possible advantages. However, we must not forget the huge negative impact that ADHD has on an individual's life.^{3,10} We demonstrated that inattention symptoms were negatively associated with a proactiveness among entrepreneurs, which indicates that caution is important when interpreting our findings. Since few studies have been conducted on this issue, further investigation into the positive attributes of ADHD is clearly needed.

Disclosure

LAR has been a member of the speakers' bureau/advisory board and/or acted as a consultant for Eli-Lilly, Janssen-Cilag, Medice, Novartis and Shire in the last three years; receives authorship royalties from Oxford Press and ArtMed; has received travel awards from Shire for his participation in the 2018 APA meeting and from Novartis to take part of the 2016 AACAP meeting. The ADHD and Juvenile Bipolar Disorder Outpatient Programs he chaired received unrestricted educational and research support from the following pharmaceutical companies in the last three years: Janssen-Cilag, Novartis, and Shire. The other authors report no conflicts of interest.

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