

The Role of Distinct ADHD Symptoms For Pre-Entry Entrepreneurial Behavior: When Intentions Do Not Translate Into Action.

Jarno Stappers and Petra Andries
Ghent University

ABSTRACT

Recent academic work and popular press advocate that individuals with symptoms of Attention Deficit Hyperactivity Disorder (ADHD) may be particularly well equipped to conduct entrepreneurial activities. This study investigates the link between the two main symptoms of ADHD – namely attention deficit and hyperactivity/impulsivity symptoms – and pre-entry entrepreneurial behavior. Building on the person-environment fit literature and analysing a unique dataset of Flemish individuals, it demonstrates a positive link between hyperactivity/impulsivity symptoms and attention deficit symptoms on the one hand, and entrepreneurial intentions on the other hand. However, it also shows that, unlike hyperactivity/impulsivity symptoms, symptoms of inattentiveness hinder the transition of these intentions into actual pre-entry entrepreneurial behavior. These results imply that previous entrepreneurship research on ADHD as one single symptom is likely to be overly optimistic.

Keywords: Attention Deficit; Hyperactivity/impulsivity; ADHD; Entrepreneurial Intentions; Pre-Entry Entrepreneurial Behavior

1. INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) is worldwide known as the most common childhood behavioral disorder, and is characterized by symptoms of inattentiveness, impulsivity and/or hyperactivity (American Psychiatric Association (APA), 2013). In adulthood, these symptoms form a barrier to professional success (Fletcher, 2014), being associated with lower job-performance, substandard jobs, higher risk of injury and a higher chance of becoming unemployed (Kessler et al., 2009; Verheul et al., 2015).

However, recent research has started to uncover the brighter side of ADHD symptoms in an entrepreneurial context. Rather than viewing ADHD symptoms as a deficit, this stream of research empirically shows that there is a positive association between ADHD symptoms and several aspects of entrepreneurship. In particular, academic research has started to link ADHD symptoms to a higher need for achievement and a higher ability to come up with creative ideas or solutions (Acar and Runco, 2012; White, 2018). In addition, qualitative and quantitative evidence shows that entrepreneurs with elevated ADHD symptoms have higher energy levels, and are more novelty seeking, creative, and risk-taking than entrepreneurs without these symptoms (White and Shah, 2011; Wiklund et al., 2016; Wismans et al., 2020). Overall, most research observes a positive link between ADHD symptoms and the intentions of an individual to found his/her own firm (Verheul et al., 2015; Wiklund et al., 2017; see Canits et al., 2018 for an exception).

However, there are still questions regarding the effects of ADHD symptoms in an entrepreneurial context that warrant investigation (Antshel, 2018). Although some evidence suggests that ADHD symptoms do not only trigger entrepreneurial intentions but also self-employment (Lerner, Hatak and Rauch, 2018a; Lerner, Hunt and Verheul, 2018b; Lerner, Verheul and Thurik, 2019; Patel et al., 2019), we have limited insight into how they affect the actual transition from entrepreneurial intentions to self-employment. In particular, it remains

unclear how ADHD symptoms affect entrepreneurial activities during the pre-entry period, i.e. the period in which entrepreneurs prepare the actual foundation of their firm. As noted by Bennett and Chatterji (2019) and Chen et al. (2018), entrepreneurs' activities in this pre-entry period may be crucial drivers of firm entry and of post-entry performance and persistence. Aspiring entrepreneurs have prior beliefs of varying quality about the likely profitability of their idea and they undertake a series of activities to update these beliefs as they contemplate entry. Recent work (Dillon and Stanton, 2017; Fjeld, 2018; Manso, 2011) highlights the important role of performing those pre-entry activities regarding the business idea iteratively before fully launching a business.

Meta-analyses show that the relationship between entrepreneurial intentions and behavior fluctuates widely (Armitage and Conner, 2001; Schlaegel and Koenig, 2014; Fayolle and Linan, 2014) and several researchers have suggested that personality traits may be important moderators in this respect (Allen et al., 2005; Lippke et al., 2009; Schutz et al., 2011; Neheh, 2019). Therefore the current study intends to improve our understanding of the importance of ADHD symptoms during the pre-entry period by investigating how the two core symptoms of ADHD, namely attention deficit and hyperactivity/impulsivity symptoms, affect entrepreneurial intentions as well as the extent to which these intentions translate into pre-entry entrepreneurial behaviour, i.e. the number of activities aspiring entrepreneurs undertake to update their beliefs about the viability of their idea as they contemplate entry.

We conducted a telephone survey of a representative sample of 1,052 individuals in Flanders, the northern and Dutch-speaking part of Belgium, where ADHD affects approximately 4.1 per cent of adulthood population (De Ridder et al., 2008). Mediated moderation analyses identify a positive indirect effect, as expected, between hyperactivity/impulsivity symptoms and pre-entry entrepreneurial behavior, as well as between attention deficit symptoms and pre-entry entrepreneurial behavior, both through entrepreneurial intentions. However, the analyses also

show that attention deficit symptoms hinder the translation of entrepreneurial intentions into pre-entry entrepreneurial behavior. These findings have important implications for individuals with ADHD and their career choices. They also advance the literature on entrepreneurial intentions and behavior.

2. THEORETICAL BACKGROUND AND HYPOTHESES

2.1. Person-Environment Fit

Person-environment fit theory defines the person-environment as the extent to which individual's characteristics and that of his/her environment match (Kristof, 1996). The basic principle of this theoretical approach is that neither personal nor environmental factors can provide an independent explanation of human behaviour, but that it is the interaction between an individual and his/her environmental context that matters (Edwards and Cooper, 1990; Edwards et al., 2006). The theory was successfully extended to the work/occupational context, where the fit between an individual and the organization he or she works for was shown to affect his/her organizational commitment, job performance, job involvement, and turnover (Kristof-brown et al., 2005).

In an entrepreneurial environment, person-environment fit theory implies that individuals prefer an entrepreneurial career over wage employment when there is a better fit between their individual characteristics and the requirements of being an entrepreneur as compared to being employed in a regular job environment (Markman and Baron, 2003; Verheul et al., 2015). Several authors build on this theoretical insight to argue that individuals with ADHD symptoms will be particularly attracted to an entrepreneurial career, give that their personal characteristics “fit” with the demands of entrepreneurship (Verheul et al., 2015; Wiklund et al., 2016).

However, although these studies show that individuals with ADHD symptoms have higher entrepreneurial intentions, the question remains how these symptoms affect their actual pre-

entry behaviour. In order to understand these relationships, we will distinguish between the two main components of ADHD, namely attention deficit symptoms and hyperactivity/impulsivity symptoms (Barkley, 1997). While we expect both attention deficit symptoms and hyperactivity/impulsivity symptoms to have an indirect positive effect on pre-entry entrepreneurial behaviour via elevated entrepreneurial intentions, we will argue that they differentially moderate the degree to which these higher entrepreneurial intentions translate into actual pre-entry entrepreneurial behavior.

2.2. The Indirect Effect of Hyperactivity/Impulsivity and Attention Deficit Symptoms on Entrepreneurial Intentions and Pre-Entry Entrepreneurial Behavior

Pre-entry entrepreneurial behavior involves multiple types of activities such as “market research, soliciting feedback on business plans, seeking out and evaluating potential suppliers, and visiting competitors” (Chen et al. 2018, p.994). Executing these pre-entry activities plays an important role in the creation of new business ventures as they are necessary to learn about the viability of the entrepreneur’s initial idea (Chen et al., 2018; Bennett and Chatterji, 2019), and to develop unique capabilities, overcome liabilities of newness and gain the thrust of constituents, thereby permitting the new venture to be perceived as legitimate (Aldrich, 1999; Delmar and Shane, 2004). As such, they form the seed for later firm performance and persistence (Chen et al., 2018; Bennett and Chatterji, 2019).

We know from entrepreneurship literature that an individual’s characteristics matter in explaining his/her entrepreneurial intentions and behavior (Schumpeter; 1934; Stevenson and Jarillo, 1990). Existing theories (e.g. theory of planned behavior) and numerous empirical studies show that intentions form a strong predictor of individual behavior. For example, van Gelderen, Kautonen and Fink (2015) observe that entrepreneurial intentions are highly relevant for predicting actual entrepreneurial behavior. Moreover, a wide range of studies demonstrates

that these entrepreneurial intentions in turn depend on individual characteristics. Several previous studies show that *creativity* has a direct positive effect on entrepreneurial intentions (Smith et al., 2016; Zampetakis et al., 2011). It leads to original and new business ideas (Ko and Butler, 2006), which in turn form a common motive for having entrepreneurial preferences and pursuing an entrepreneurial career (Nicolaou and Shane, 2010) and distinguish entrepreneurs from non-entrepreneurs (Markman and Baron, 2003). Furthermore, empirical evidence shows that *passion* is an important prerequisite to develop entrepreneurial intentions (Cardon et al., 2009; De Clercq et al., 2013) and that people with more positive attitudes towards *independence and risk* have stronger intentions to be self-employed (Douglas and Shepherd, 2002).

One can argue that individuals with hyperactivity/impulsivity symptoms are more likely than others to display the creativity, passion, and attitudes towards independence and risk that drive entrepreneurial intentions and therefore also pre-entry entrepreneurial behaviour. Studies demonstrate that they are more adventurous (Kelly and Ramundo, 1996), exploratory in their behavior (Weiss, 2001), passionate (Weiss, 2001; Wiklund et al, 2016), intuitive (Weiss, 2001) and spontaneous (Kelly and Ramundo, 1996) than individuals without hyperactivity/impulsivity symptoms. They are also more proactive and risk-taking in their behavior (Wismans et al., 2020). As such, from a person-environment perspective, the characteristics and preferences of individuals with hyperactivity/impulsivity symptoms fit very well with the entrepreneurial environment, implying that individuals with more hyperactivity/impulsivity symptoms may have higher entrepreneurial intentions than individuals with less hyperactivity/impulsivity symptoms. And as it is generally accepted that higher entrepreneurial intentions lead to more entrepreneurial behaviour (see above), we can therefore hypothesize that:

Hypothesis 1. Hyperactivity/impulsivity symptoms have a positive relationship with pre-entry entrepreneurial behavior through entrepreneurial intentions.

Moreover, one can argue that also attention deficit symptoms will positively relate to entrepreneurial intentions (and thereby also to pre-entry entrepreneurial behavior). We know from psychology research that people with attention deficit symptoms can exhibit intensive concentration and become completely absorbed by tasks and activities they find interesting or pleasurable; a phenomenon called ‘hyperfocus’ (Schecklmann et al., 2008). Corman and Hallowell (2006) find that people with attention deficit symptoms are capable to show sustained, rare levels of intensity and focus on activities and projects that catch their interest. Over time, inattentiveness can help to achieve goals (Webb et al., 2005) as it can lead to the development of expertise in those specific non-routinized tasks that individuals with attention deficit symptoms do find interesting (Wiklund et al., 2016). This suggest that people with attention deficit symptoms may able to perform well when it comes to creativity and innovation, and potentially even outperform other individuals. Attention deficit symptoms may lower the barrier for individuals to discover and develop new activities (White and Shah, 2011), and may put individuals at an advantage when it comes to non-routinized activities like concept and product testing, prototyping and market testing, which are core activities to pre-entry entrepreneurial behavior (Block and MacMillan, 1985; Chen et al., 2018; Bennett and Chatterji, 2019). Although empirical evidence is limited, it suggests that entrepreneurs with attention deficit symptoms can indeed concentrate intensively on activities and tasks that are exciting and interesting (Wiklund et al., 2016). As such, from a person-environment perspective, the characteristics and preferences of individuals with attention deficit symptoms fit well with the entrepreneurial environment, implying that individuals with more attention deficit symptoms may have higher entrepreneurial intentions than individuals with less attention deficit

symptoms. As higher entrepreneurial intentions are known to lead to more entrepreneurial behaviour (see above), we therefore propose that:

Hypothesis 2. Attention deficit symptoms have a positive relationship with entrepreneurial behavior through entrepreneurial intentions.

2.3. The Moderating Effect of Hyperactivity/Impulsivity Symptoms and Attention Deficit Symptoms on the Transition from Entrepreneurial Intentions to Pre-Entry Entrepreneurial Behaviour

Although intentions generally are a sound predictor of behaviour, research has observed an intention-behavior gap in the sense that many individuals fail to translate their positive intentions into action (Sheeran, 2002). We propose that this gap will be larger or smaller depending on the degree to which an individual has attention deficit symptoms and hyperactivity/impulsivity symptoms. In particular, while both attention deficit symptoms and hyperactivity/impulsivity symptoms can be presumed to have an indirect positive effect on entrepreneurial intentions (and thereby hence also on pre-entry entrepreneurial behaviour), we expect that they will differentially moderate the degree to which these higher entrepreneurial intentions translate into pre-entry entrepreneurial behavior.

On the one hand, we expect that people with elevated hyperactivity/impulsivity symptoms may be more likely to act upon their entrepreneurial intentions. Individuals with hyperactivity/impulsivity symptoms have the capacity to make quick decisions with little or no forethought, reflection, or consideration of the consequences (VandenBos, 2007). Research associates hyperactivity and impulsivity with behavioral differences related to uncertainty. In uncertain situations, most individuals react with a sense of doubt and anxiety (Tellegen, 1985), which leads to continued evaluation of alternatives as well as procrastination (McMullen and Sheperd, 2006). Individuals with elevated hyperactivity/impulsivity symptoms, however, tend

to charge ahead in such situations (Leland et al., 2006), unable to delay gratification (Mischel and Metzner, 1962). Therefore, we propose that symptoms of hyperactivity/impulsivity may positively moderate the relationship between entrepreneurial intentions and pre-entry entrepreneurial behavior:

Hypothesis 3. Hyperactivity/impulsivity symptoms positively moderate the relation between entrepreneurial intentions and pre-entry behavior.

On the other hand, we expect that people with elevated attention deficit symptoms may be less likely to act upon their entrepreneurial intentions. Attention deficit symptoms are typically associated with lower levels of conscientiousness (Knouse et al., 2013), lower levels of task persistence in employment settings (Halbesleben et al., 2013) and lower levels of drive and determination (Dimic and Orlov, 2014). As a result, when it comes to starting a venture and performing associated start-up activities requiring sustained attention to details, individuals with attention deficit symptoms may quickly lose their focus on activities and task that are not challenging enough or are distracted by more stimulating or challenging activities. Furthermore, as individuals with attention deficit symptoms are known to be less proactive (Wismans et al., 2020) and to have difficulties with planning, performing tasks ‘by the book’ and fulfilling commitments (Halbesleben et al., 2013; Wiklund et al., 2016), they may experience difficulties translating their entrepreneurial intentions into pre-entry entrepreneurial behavior. The limited empirical evidence appears to support this. For example, none of the entrepreneurs in the study by Wiklund et al., (2016) felt comfortable with routine activities or tasks like accounting and bookkeeping. Overall, these insights suggest that for people with elevated attention deficit symptoms, entrepreneurial intentions may translate in lower degrees of pre-entry entrepreneurial behaviour (than for individuals without attention deficit symptoms). As such, we hypothesize that:

Hypothesis 4. Attention deficit symptoms negatively moderate the relation between entrepreneurial intentions and pre-entry behavior.

An overview of our hypotheses is shown in Figure 1.

Insert Figure 1 about here

3. DATA AND METHODS

3.1. Data Collection

A telephone survey was conducted between October and December 2016 with a representative sample of 1,052 working-age individuals (18-64 years old) in Flanders, the Dutch-speaking region of Belgium. The sample was stratified according to age, sex, and level of education. Random-digit dialling was used to select individuals, who were guaranteed confidentiality. Trained telephone operators interviewed the participants using a structured questionnaire. Interviews lasted approximately 14 minutes. Additional respondents were contacted until the different strata were saturated. When conducting the analyses, 131 participants were excluded because they were already owner of a company and hence less suitable for studying pre-entry entrepreneurial behavior. An additional 195 participants were excluded because of missing data, resulting in a final sample of 726 individuals. About 49% of our final respondents were 45 years or older (cfr. 48% of the population), 51% were female (cfr. 50% of the population), and 40% had obtained a bachelor, master or doctoral degree (cfr. 31% of the population). The composition of the final sample hence approximates that of the total working-age population of Flanders. The study was reviewed and approved beforehand by the Ethical Affairs Committee

of the Faculty of Economics and Business Administration to which the authors of this study belong.

3.2. Variables

3.2.1. Pre-Entry Entrepreneurial Behavior

As mentioned before, pre-entry entrepreneurial behavior refers to multiple types of activities which aspiring entrepreneurs undertake to update their beliefs about the viability of their idea as they contemplate entry (Chen et al., 2018; Bennett and Chatterji, 2019). Therefore, the dependent variable in our study measures the number of different start-up activities an individual has undertaken to try and test his/her business idea. Based on the approaches used in previous research (e.g., see van Gelderen et al., 2015; Shirokova et al., 2015; Bennett and Chatterji, 2019), we asked respondents to indicate for each item on a list of nine pre-entry activities whether they had engaged in this activity, with a value of zero representing a negative, and a value of one representing a positive answer (see Appendix for the specific items). In line with previous work (Farmer et al., 2011; van Gelderen et al., 2015 ; Bennett and Chatterji, 2019), the scores for the nine items were added to construct a count variable representing *Pre-Entry Entrepreneurial Behavior*, with values ranging between zero – for individuals that had not undertaken any activities to start up their own company - and nine (Mean = 0.40; SD = 1.43). The low mean, which is in line with previous research (e.g. Shirokova et al., 2016), suggest that most observations are grouped along low values. This is a predictable result for a large representative sample of Flemish individuals, of whom only a minority is likely to be an aspiring entrepreneur. Finally, it is important to note that the above-mentioned measurement is formative as the items represent independent activities that together form *Pre-Entry Entrepreneurial Behavior*. Therefore, test such as inter-item reliability (e.g. Cronbach's alpha) and dimensionality (e.g. factor analysis) are not relevant (Diamantopoulos and Siguaw, 2006).

3.2.2. Entrepreneurial Intentions

Based on Kolvereid (1996), *Entrepreneurial Intentions* were measured by asking the respondents to score two items on a 7-point scale (1 = very unlikely, 7 very likely) (see Appendix for the specific items). An index of entrepreneurial intentions was created by averaging the scores on these two items ($\alpha = 0.947$). The Pearson correlation between both items is 0.904, which is confirmed by the factor loadings of both items (both 0.928). In this index, a higher score indicates higher intentions towards pursuing an entrepreneurial career.

3.2.3. Attention Deficit and Hyperactivity/Impulsivity Symptoms

We based our assessment of ADHD symptoms on the six-items Adult ADHD Self-Report Scale (ASRS-v1.1), which includes two sub-dimensions – attention deficit and hyperactivity/impulsivity – (Barkley, 1997) and which was proven the most predictive in screening ADHD for adults (Halbesleben et al., 2013; Kessler et al., 2005). The aim of this study was not to clinically screen individuals for ADHD symptoms but rather to examine the relationship between the number of ADHD symptoms an individual experiences on the one hand and his/her entrepreneurial intentions and pre-entry behavior on the other hand.

Each of the six items of ASRS-v1.1 represents specific ADHD symptoms, and asks the respondent about the frequency with which he or she experiences these particular symptoms. Whereas previous entrepreneurship studies that build on the six-items ASRS-v1.1 (Halbesleben et al., 2013; Kessler et al., 2005) asked respondents to score the frequency of each item on a scale from one to five (with one representing never and five representing very often) and then averaged these scores, we use a slightly modified version of the six-items which is more consistent with the instructions of the ASRS-v1.1 (see Appendix). For each item/symptom, the individual received a score of one if he/she experiences that particular symptom with a

frequency the ASRS-v1.1 considers consistent with ADHD symptoms in adults, and zero otherwise. The individual scores of the four items representing attention deficit symptoms were then added to construct the variable *Attention Deficit* symptoms with values ranging between zero and four ($Mean = 0.93$; $SD = 1.03$). The individual scores of the two items representing hyperactivity/impulsivity symptoms were added to obtain the variable *Hyperactivity/impulsivity disorder* symptoms, with values varying between zero and two ($Mean = 0.76$; $SD = 0.74$). The above measurements are also formative, such that tests for inter-item reliability (e.g. Cronbach's alpha) and dimensionality (e.g. factor analysis) are again not relevant (Diamantopoulos and Siguaw, 2006).

3.2.4. Control Variables

We include various control variables, which are potentially correlated with entrepreneurial intentions and/or pre-entry behavior. First, as knowing other entrepreneurs has a positive influence on entrepreneurial intentions (Minniti and Nardone, 2007), respondents were asked whether they know someone personally who started a firm in the past two years (*Know Entrepreneur*). Approximately 50% of our participants know someone who recently started a firm. Second, we asked respondents whether one of their *Parents* was self-employed, as this typically influences an individual's entrepreneurial intentions (Hoffmann et al., 2015). 31% of our respondents has/had self-employed parents, thereby receiving the value one for this dummy variable. Third, as social perceptions can form individual decisions to start an entrepreneurial activity (Reynolds et al., 2005), individuals were asked if they agreed with the statement that in their country, most people consider starting a business as a *Desirable Career Choice*. In our sample, 58% agreed with this statement. Finally, given that high *Self-efficacy* has a positive influence on the decision to create new business (Zhao et al., 2005), respondents were asked

whether they believed that they had the required knowledge and skills to start a business. In our sample, 41% responded affirmatively.

3.3. Data analysis

We used Structural Equation Modeling (SEM), and in particular the maximum likelihood method with bootstrap confidence intervals, to test our hypotheses. SEM is a multivariate technique used in moderated-mediation analysis (Preacher et al., 2007), which allows us to simultaneously depict multiple relationships between the observable variables. More specifically, it enables us to verify whether a mediation effect, stemming from entrepreneurial intention, exists between the two core symptoms of ADHD and pre-entry entrepreneurial behavior while at the same time determining if this mediation effect is weakened or enhanced by the core symptoms of ADHD. Additionally, the bootstrapping approach is a nonparametric procedure of which the use has been recommended for moderated-mediation analysis (Preacher et al., 2007). Because the indirect effect of each core symptom via entrepreneurial intentions is the product of two parameters, the resulting distribution is often not normal. A nonparametric procedure is able to deal with the non-normal distribution of these interaction terms, and of those of other non-normally distributed variables in the analyses (including our dependent variable *Pre-Entry Entrepreneurial Behavior*). Further, in accordance with the recommendations of Aiken and West (1991), we mean-centered the ADHD-symptoms and entrepreneurial intentions variables to avoid multicollinearity with their product terms. All variance-inflation factors in our regressions were below 2, suggesting that multicollinearity is not an issue in our analyses (Hair et al., 2010).

Since we relied on self-report measures from the same individuals for obtaining all constructs, the study results could potentially be distorted by common method bias (Podsakoff, MacKenzie and Podsakoff, 2012). Although we took several measures to mitigate this problem (e.g., by

introducing psychological and proximal separations between variables, and by avoiding complex formulations and unclear terminology, as advised by Podsakoff et al., 2012), we statistically tested for this bias nevertheless. According to the Harman's single factor test, the largest factor accounted for only 13,74% of the variance. Similarly, in CFA (Becker and Cote, 1994) linking each variable to a single construct rather than separate ones resulted in a major drop in the model's fit. Finally, we also followed Lindle and Withney (2001) and used a marker variable. More specifically, we used a survey item assessing whether or not the respondent agreed that media channels were paying much attention to stories about successful entrepreneurs. This variable was uncorrelated with the predictor variables, as well as with the mediator and the dependent variable. All initially significant correlations remained significant after adjusting for this marker variable. Given the results of these various statistical tests, we conclude that common method bias is unlikely to present a problem in our study.

4. RESULTS

4.1. Main results

Table 1 presents the descriptive statistics and Pearson correlations. The data meet the expected distribution of the population.

Insert Table 1 about here

Table 2 presents the results of the regression analyses. According to the recommendations of Hair et al. (2006) our SEM fit statistics and indices show a good model fit according our sample size and number of observed variables: the Root Mean Square Error of Approximation (RMSEA) = 0.035 (which is below the 0.07 rule of thumb), the Comparative fit index (CFI) = 0.985 (which is above the 0.92 rule of thumb), the Tucker-Lewis Index (TLI)=0.960 (which is

above the 0.92 rule of thumb), and the Chi-square statistics together with the degrees of freedom: $\chi^2(df=23)=474.94$, $p \leq 0.1$. All these fit statistics indicate that the distributions of the variables in the model do not pose a problem for the interpretation of the results.

The results in Table 2 allow us to investigate, as a first step, the effects of hyperactivity/impulsivity symptoms and attention deficit symptoms via entrepreneurial intentions on pre-entry entrepreneurial behaviour (i.e. the mediation effects). As the results in the upper part of Table 2 indicate, individuals with more hyperactivity/impulsivity symptoms show significantly higher entrepreneurial intentions ($\beta = 0.29$; $p < 0.001$). Further, as can be seen in the middle part of Table 2, these entrepreneurial intentions have a strong significant positive effect on pre-entry entrepreneurial behavior ($\beta = 0.35$; $p < 0.001$). Consequently, the indirect effect of hyperactivity/impulsivity symptoms is 0.10 (i.e. $0.29 * 0.35$). To assess the significance of this indirect effect, a bootstrap estimation approach with 5,000 resamples was used. Its results, which can be found in the lower part of Table 2, indicate that the 95% confidence interval of this indirect effect [0.04; 0.17] does not include zero, meaning that it is significant. These results are in line with our Hypothesis 1. Interestingly, the lower part of Table 2 also indicates that, notwithstanding this significant indirect effect, the total effect of hyperactivity/impulsivity symptoms on pre-entry entrepreneurial behaviour is not significant. Similarly, we observe in the upper part of Table 2 that attention deficit symptoms are also positively and significantly related to entrepreneurial intentions ($\beta = 0.19$; $p < 0.001$). As these entrepreneurial intentions have a strong significant positive effect on pre-entry entrepreneurial behaviour (as discussed above and shown in the middle part of Table 2), the total indirect effect of attention deficit symptoms is a 0.07 (namely $0.19 * 0.35$) increase in pre-entry entrepreneurial behavior. The results of our bootstrap estimation approach confirm that this positive indirect effect of attention deficit symptoms is significant. As can be seen in the lower part of Table 2, the 95% bootstrap confidence interval of this indirect effect [0.02; 0.11] does

not include zero, indicating that it is significant. Therefore, we can conclude that attention deficit symptoms positively and significantly affect pre-entry entrepreneurial behavior through entrepreneurial intentions, which confirms our Hypothesis 2. Again, the lower part of Table 2 also indicates that notwithstanding this significant indirect effect, the total effect of attention deficit symptoms on entrepreneurial behaviour is statistically significant.

Insert Table 2 about here

We now turn to the moderation effects under investigation. As can be seen in the middle part of Table 2, the analysis does not show any moderating effect of hyperactivity/impulsivity symptoms on the relationship between entrepreneurial intentions and entrepreneurial behavior. Thus, the results do not support hypothesis 3. The middle part of Table 2 does show evidence for Hypothesis 4 however. We predicted that attention deficit symptoms would negatively affect the relation between entrepreneurial intentions and pre-entry entrepreneurial behavior. Consistent with our hypothesis, our result shows a negative moderation effect of attention deficit symptoms that is significant at a 10% significance level ($\beta = -0.05$; $p < 0.1$).

In view of this latter result, we also tested whether the indirect effects of hyperactivity/impulsivity symptoms and of attention deficit symptoms on pre-entry entrepreneurial behaviour are moderated by attention deficit symptoms. As shown in Table 3, the indirect path from hyperactivity/impulsivity symptoms to pre-entry entrepreneurial behavior varies significantly for individuals with more versus fewer attention deficit symptoms. When more attention deficit symptoms are present, hyperactivity/impulsivity has a weaker indirect effect on pre-entry entrepreneurial behavior ($\beta = 0.08$, boot SE = 0.03, and the 95% bias-corrected confidence interval around the bootstrapped indirect effect does not include zero). When attention deficit symptoms are fewer, hyperactivity/impulsivity symptoms have a

stronger indirect on pre-entry entrepreneurial behavior ($\beta = 0.10$, boot SE = 0.03, and the 95% bias-corrected confidence interval does not include zero). Similar results are obtained for the indirect path from attention deficit symptoms to pre-entry entrepreneurial behavior. When more attention deficit symptoms are present, the moderating effect of attention deficit weakens the positive indirect effect on entrepreneurial behavior ($\beta = 0.05$, boot SE = 0.02, and the 95% bias-corrected confidence interval around the bootstrapped indirect effect does not include zero). When attention deficit symptoms are fewer, the indirect of attention deficit on pre-entry entrepreneurial behavior remains stable ($\beta = 0.07$, boot SE = 0.02, and the 95% bias-corrected confidence interval does not include zero). In other words, the results indicate that people with more attention deficit symptoms have problems translating their entrepreneurial intentions into pre-entry behavior.

Insert Table 3 about here

4.2. Robustness checks

To test the robustness of our main analyses we performed several robustness checks. First, we performed a sensitivity analysis, which allows examining the robustness of our empirical findings to the possible existence of an unmeasured confounder (Imai, Keele and Yamamoto, 2010). It is based on an estimation of a sensitivity parameter p – a correlation between the error term of the mediation model (entrepreneurial intentions) and the outcome model (pre-entry entrepreneurial behavior). The results indicate that our conclusions regarding average mediation effects are robust, and can be causally interpreted. That is, the original results would hold unless $p > 39\%$ at the 95% confidence level.

In a second robustness check, we took into account the possible threat of reverse causality, and in particular the possibility of the independent variable (Entrepreneurial Intentions) being also

caused by the dependent variable (Pre-entry Entrepreneurial Behavior). We verified this by running a two-stage least squares (2SLS). A 2SLS regression minimizes the possibility of reverse causality as it exploits the exogenous variation generated by an instrumental variable. Based on the literature, we selected the variables ‘know entrepreneur’, ‘parents’ and ‘desirable career choice’ as our instrumental variables. The logic is that each of these variables could influence an individual’s entrepreneurial intention, but not the other way around. For example, it is unlikely that an individual’s entrepreneurial intentions will affect whether his/her parents are an entrepreneur. Our results show that these three variables form strong instruments. To test for potential threats of endogeneity, we estimated a Wu-Hausman test (Hausman, 1978) to compare the 2SLS estimates with the SEM estimates. The Wu-Hausman test statistics ($F(1,722) = 1.83, p > .05$) imply that the SEM estimates and the estimates with 2SLS are consistent, which indicates that there is no issue of reverse causality. The results of these robustness tests are available from the authors upon request.

5. DISCUSSION

The aim of this paper was to improve our understanding of the importance of ADHD-symptoms for pre-entry entrepreneurial behavior, by investigating how two core symptoms of ADHD, namely attention deficit and hyperactivity/impulsivity symptoms, affect entrepreneurial intentions as well as the extent to which these intentions translate into pre-entry entrepreneurial behavior. Our results have important implications for the emerging research stream on ADHD and entrepreneurship, for studies on the gap between entrepreneurial intentions and behavior, and for practice.

5.1. Contributions on ADHD and entrepreneurship

Our results confirm existing research indicating that people with more hyperactivity/impulsivity and attention deficit symptoms display higher entrepreneurial intentions (Verheul et al., 2015; Wiklund et al., 2017). However, they shed serious doubt on the common belief that these symptoms will also lead to higher degrees of entrepreneurial behavior. First, this study empirically verifies the claim of Wiklund and his colleagues that especially impulsivity may be “a major driver of entrepreneurial action” (Wiklund et al., 2016, p. 14). We provide large-scale quantitative evidence that individuals with hyperactivity/impulsivity symptoms have higher entrepreneurial intentions than individuals without such symptoms, and that these symptoms do not hinder them in translating these intentions into actual pre-entry entrepreneurial behavior. At first sight, our findings hence confirm the idea that impulsivity reflects a decision-making logic well suited to entrepreneurial action.

The results for individuals with attention deficit symptoms are less optimistic however. We demonstrate that inattentiveness, which characterizes about 60% of impulsive/hyperactive individuals (Skounti et al., 2007), significantly hinders the translation of entrepreneurial intentions into pre-entry entrepreneurial behavior. The hyperfocus that typically comes with attention deficit symptoms hence does not seem to help the entrepreneur in executing the broad range of activities necessary to update his/her beliefs about the business idea’s viability. Instead, inattentiveness distracts entrepreneurs from taking action. This focus on fewer activities may enable the entrepreneur to move quicker through the different start-up phases and reach specified milestones, which some academics and investors use as an indicator of start-up performance (Van Gelderen et al., 2005). However, as we know that the number of activities an entrepreneur performs before start-up has a positive effect on later venture performance and persistence (Gruber et al., 2008; Bennet and Chatterji, 2019), it is more likely that inattentiveness and hyperfocus have a negative influence as they cause the entrepreneur to miss out on a number of necessary and important entrepreneurial activities.

Finally, our work shows that although both hyperactivity/impulsivity symptoms and attention deficit symptoms have an indirect effect on pre-entry entrepreneurial behavior via entrepreneurial intentions, and that attention deficit symptoms also influence the degree to which an individual's intentions translate into pre-entry entrepreneurial behavior, their overall effect on pre-entry entrepreneurial behavior is not significant.

In sum, although this study partly confirms the emerging idea that ADHD symptoms may render an individual particularly apt for entrepreneurship in general, and for decision-making under uncertainty in particular, it also demonstrates that any theoretical development that regards ADHD as one single symptom, having a positive influence on entrepreneurial intentions and decision-making, is likely to be overly simplistic. Future work should carefully distinguish between hyperactivity/impulsivity and attention deficit symptoms when studying effects on decision-making and outcomes at the individual and firm level.

5.2. Contributions on the Transition from Entrepreneurial Intentions to Pre-Entry Entrepreneurial Behavior

Our results show that the relationship between entrepreneurial intentions and pre-entry entrepreneurial behavior is weaker for individuals with elevated attention deficit symptoms than for individuals that do not have such symptoms. This finding points to the limitations of the theory of planned behavior, which assumes that individuals who express intentions to act will make every reasonable effort to follow through on those intentions. Sheeran (2002) already noted that there is often an intention-behavior gap such that individuals fail to translate their positive intentions into action. Self-monitoring, conscientiousness, self-efficacy, and risk-aversion were found to moderate the relationship between individuals' intentions and their actual behavior in a variety of contexts (Allen et al., 2005; Lippke et al., 2009; Schutz et al., 2011). While we know that individuals with ADHD exhibit significantly lower levels of self-

esteem, self-efficacy and confidence than individuals without ADHD (Newark et al., 2016), our study shows that it are particularly attention deficit symptoms – as opposed to hyperactivity/impulsivity symptoms – that create a gap between entrepreneurial intentions and actions.

With these insights, the current study also adds to a recent body of literature that is trying to improve our understanding of the pre-entry period, based on the argument that pre-entry activities form the seed for later firm performance and persistence (Chen et al., 2018; Bennet and Chatterji, 2019). Recent empirical work by Bennet and Chatterji (2019) shows that there is significant variation in how much information prospective entrants acquire during the pre-entry period. In particular, the authors find that the degree of engagement in pre-entry activities and the amount of information obtained from these activities depends on aspiring entrepreneurs' opportunity costs, prior experience, and confidence levels. Our study adds to these insights by demonstrating that also the presence/absence of attention deficit symptoms shapes the pre-entry period, as it affects the number of activities prospective entrants undertake to verify the viability of their idea.

5.3. Practical Implications

Finally, our study has important practical implications for individuals with ADHD who have to decide on a career. ADHD is generally seen as something 'negative' in the labour market (Kessler et al., 2009; Nadeau, 2005). However, in line with the person-environment fit, the present study suggests that entrepreneurship could be a valid career choice for individuals with impulsivity/hyperactivity symptoms. It is important to note here that hyperactivity/impulsivity and attention deficit symptoms do not necessarily co-occur, and that adults can display either one or the other, or both. While our study indicates that individuals with hyperactivity/impulsivity symptoms have higher entrepreneurial intentions, which in turn

translate into the undertaking of more pre-entry activities, it also shows that people with attention deficit symptoms should be careful not to jump to next phase too quickly without performing all necessary pre-entry activities (cfr. Lerner et al., 2018b). Even though the total effect of attention deficit symptoms on entrepreneurial behavior is not significant, we see that inattentive people are less able to translate their entrepreneurial intentions into actual pre-entry entrepreneurial behavior. This has practical implications, for example with respect to coaching nascent entrepreneurs with attention deficit symptoms. An explicit and extensive mapping of start-up activities and teaming up with co-founders or top management team members that take care of less exiting, routine tasks may be useful to overcome this problem.

5.4. Limitations and Future Research

Our study has some limitations that provide opportunities for further research. First, we measured an individual's ADHD symptoms using a modified, dichotomous six-item ASRSv1.1 screener. Not only may six items be limited to capture the whole range of ADHD symptoms, it is also important to note that the six-item ASRSv1.1 screener captures more the pathological aspects of inattentiveness than those of hyperactivity/impulsivity. Three of the four items measuring attention deficit symptoms explicitly include the words "trouble", "difficulty", and "problems", while no negatively loaded words are included in the hyperactivity/impulsivity items, and this may affect our results. An 18-item version of the same scale could provide more accurate measurements of hyperactivity/impulsivity and attention deficit symptoms. Further, the dichotomization of the measurement items reduces the variance in our data, making it more difficult to observe statistically significant relationships. Future research could also try to move beyond self-report scales and use more refined diagnostics, allowing also to establish ADHD as a clinical condition. This type of more detailed data collection should preferably also take the use of medication and behavioral therapy into account.

Second, it is important to note that, in line with Joensuu-Salo et al. (2015) and Shirokova et al. (2015), we used a cross-sectional approach. We do not see this as a problem, however. ADHD symptoms are known to be relatively stable (APA, 2013). And whereas many studies on entrepreneurial intentions and behaviour measure these concepts at different points in time, we are convinced that for the specific purpose of our study, we do not need a time lag between the measurement of intentions and that of behavior, and this because of two reasons. First, we are focussing on pre-entry behaviour, and we do not expect that it takes a lot of time for individuals to translate their entrepreneurial intentions into such pre-entry behaviour. If one has the intention to start a company, one can immediately start checking the idea, developing a prototype, thinking about ways to produce. Second, a cross-sectional design allows us to capture the effect of impulsivity symptoms, which we expect to materialize almost immediately. Nevertheless, there is a possibility that the effect of increased intentions would only fully play out after one or two years, which implies that we would be underestimating it in our current model. Future research may therefore verify our results using longitudinal data. Such longitudinal studies would also allow to further rule out potential endogeneity problems. Although our robustness tests suggest that these are not substantial, there is still the possibility that pre-entry entrepreneurial behaviour could result in lower beliefs about viability and therefore in lower entrepreneurial intentions.

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Figure 1. Theoretical Framework

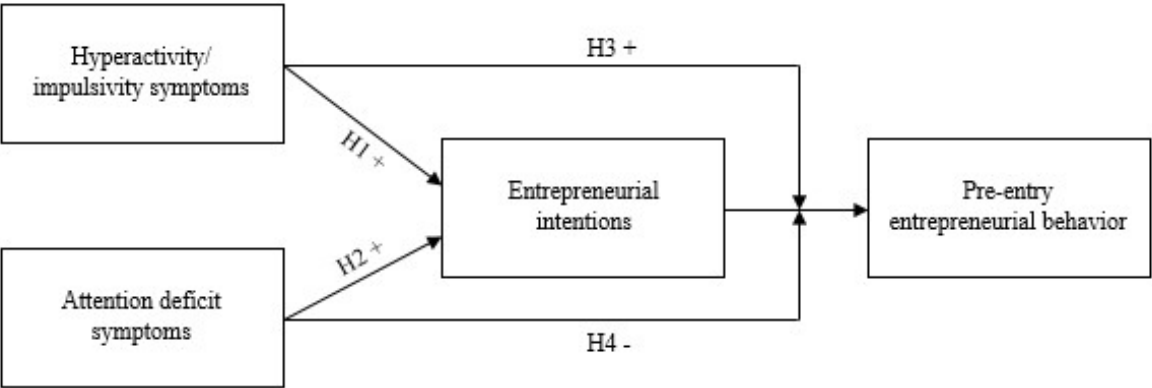


Table 1*Descriptive Statistics*

Name	Mean	St. dev.	1	2	3	4	5	6	7	8
1. Pre-Entry Entrepreneurial behavior	0.40	1.43								
2. Entrepreneurial Intentions	2.30	1.75	0.45*							
3. Attention Deficit Symptoms	0.93	1.03	0.00	0.11*						
4. Hyperactivity/Impulsivity Symptoms	0.76	0.74	0.05	0.16*	0.11*					
5. Parent	0.31	0.46	0.11*	0.12*	0.06	-.01				
6. Desirable Career Choice	0.58	0.49	0.01	0.12*	0.02	0.01	0.02			
7. Know Entrepreneur	0.50	0.50	0.16*	0.21*	0.03	0.13*	0.07	0.03		
8. Self-efficacy	0.41	0.49	0.19*	0.31*	-0.11*	0.04	0.09	0.01	0.18*	

Note: n = 726; * = p<0.05

Table 2
Regression Results for Testing Mediation Moderation

Abb.	Effect	β	B	SE	<i>p</i>	Bootstrap 95 % CI
Mediator Variable Model (Entrepreneurial Intentions)						
	<i>Intercept</i>	0.95	0.54	0.14	0.000	[0.71; 1.18]
X ₁	<i>Hyperactivity/impulsivity symptoms</i>	0.29	0.12	0.08	0.000	[0.12; 0.46]
X ₂	<i>Attention deficit symptoms</i>	0.19	0.11	0.06	0.001	[0.08; 0.31]
	<i>Parent</i>	0.31	0.08	0.13	0.017	[0.04; 0.57]
	<i>Desirable career choice</i>	0.37	0.10	0.12	0.002	[0.14; 0.61]
	<i>Know entrepreneur</i>	0.45	0.13	0.12	0.000	[0.22; 0.69]
	<i>Self-efficacy</i>	1.02	0.29	0.12	0.000	[0.76; 1.28]
Dependent Variable Model (Pre-Entry Entrepreneurial Behavior)						
	<i>Intercept</i>	-0.42	-0.29	0.11	0.000	[-0.61; -0.23]
M	<i>Entrepreneurial Intentions (EI)</i>	0.36	0.44	0.03	0.000	[0.26; 0.45]
	<i>Hyperactivity/impulsivity symptoms</i>	-0.09	-0.05	0.09	0.279	[-0.22; 0.03]
	<i>Hyperactivity/impulsivity symptoms x EI</i>	0.04	0.06	0.03	0.221	[-0.07; 0.15]
	<i>Attention deficit symptoms</i>	0.03	0.02	0.07	0.607	[-0.05; 0.12]
	<i>Attention deficit symptoms x EI</i>	-0.05	-0.09	0.03	0.066	[-0.13; 0.03]
	<i>Self-efficacy</i>	0.14	0.05	0.10	0.171	[-0.05; 0.33]
(Un)standardized direct and indirect effects (5,000 bootstrap samples; level of confidence: 95%)						
	Direct effect: X ₁ → M	0.29	0.12	0.08	0.000	[0.12; 0.46]
	Direct effect: X ₂ → M	0.19	0.11	0.06	0.001	[0.08; 0.31]
	Indirect effect: X ₁ → EI → Y	0.10	0.05	0.03	0.001	[0.04; 0.17]
	Indirect effect: X ₂ → EI → Y	0.07	0.05	0.02	0.001	[0.02; 0.11]
	Total effect X ₁	0.01	0.003	0.09	0.935	[-0.12; 0.13]
	Total effect X ₂	0.10	0.07	0.07	0.138	[0.01; 0.20]

N = 726

β = unstandardized coefficients; B = standardized coefficients

SE = standard errors

p = p-value

Abb. = Abbreviation; We use abbreviations for our main variables for the (un)standardized direct and indirect effects.

Y = Pre-Entry Entrepreneurial Behavior

Table 3

Conditional indirect effect(s) of hyperactivity/impulsivity symptoms on pre-entry entrepreneurial behavior at values of attention deficit symptoms

	Conditional indirect effects	Boot SE	Boot LLCI	Boot ULCI
Weak symptoms of Attention Deficit	0.10	0.03	0.04	0.17
Strong symptoms of Attention Deficit	0.08	0.03	0.02	0.14

Conditional indirect effect(s) of attention deficit symptoms on pre-entry entrepreneurial behavior at values of attention deficit symptoms

Weak symptoms of Attention Deficit	0.07	0.02	0.02	0.11
Strong symptoms of Attention Deficit	0.05	0.02	0.01	0.10

95% bias-correlated CI; Weak = mean – 1 SD; Strong = mean + 1 SD

APPENDIX: Measurement Scales

A. ATTENTION DEFICIT AND HYPERACTIVITY/IMPULSIVITY SYMPTOMS

In order to measure Attention Deficit and Hyperactivity/Impulsivity Symptoms, we modified the ARSR-v1.1 in line with the instructions of the original Adult ADHD Self-Report Scale (ASRS-v1.1). The ASRS-v1.1 was developed by Ronald C Kessler et al. (2005) in conjunction with the World Health organization. Each question of the original ASRS-v1.1 is measured on a 5-point scale (0 = never; 4 = very often), where only marks in the dark shaded boxes can be seen as a positive signal of attention deficit or hyperactivity/impulsivity symptom (see Table A.1 below). If four or more marks appear in the darkly shaded boxes then the patient has symptoms highly consistent with ADHD in adults.

Please answer the questions below, rating yourself on each of the criteria shown using the scale on the right side of the page. As you answer each question, place an X in the box that describes how you have felt and conducted yourself over the past 6 months.	Never	Rarely	Sometimes	Often	Very often
1. How often do you have trouble wrapping up the final details of the project, once the challenging parts have been done?					
2. How often do you have difficulty getting things in order when you have to do a task that requires organization?					
3. How often do you have problems remembering appointments or obligations?					
4. When you have a task that requires a lot of thought, how often do you avoid or delay getting started?					
5. How often do you fidget or squirm with your hands or feet when you have to sit down for a long time?					
6. How often do you feel overly active and compelled to do things, like you were driven by a motor?					

Table A.1 The Adult ADHD Self-Report Scale (ASRS-v1.1)

We modified these questions to a dichotomously coded screener shown in Table A.2. A positive answer to a question in our dichotomously screener corresponds to a mark in the dark shaded box in the original ASRS-v1.1 screener.

Please answer the questions below, rating yourself on each of the criteria shown using the scale on the right side of the page. As you answer each question, place an X in the box that describes how you have felt and conducted yourself over the past 6 months.	Yes	No
1. Do you sometimes have trouble wrapping up the final details of the project, once the challenging parts have been done?		
2. Do you sometimes have difficulty getting things in order when you have to do a task that requires organization?		
3. Do you sometimes have problems remembering appointments or obligations?		
4. When you have a task that requires a lot of thought, do you often avoid or delay getting started?		
5. Do you often fidget or squirm with your hands or feet when you have to sit down for a long time?		
6. Do you often feel overly active and compelled to do things, like you were driven by a motor?		

Table A.2 The modified ASRS-v1.1

We modified the questions to dichotomously coded items, as these are easier for respondents to answer on the phone. We do not expect this modification to cause any problems, as Verheul et al. (2016) applied a sensitivity analyses with the same dichotomous coding and their findings remained stable for both attention deficit and hyperactivity symptoms.

B. PRE-ENTRY ENTREPRENEURIAL BEHAVIOR

We measured pre-entry entrepreneurial behaviour by asking respondents to indicate for each of the nine activities in Table B.1. below whether or not they had engaged in this activity. Although we initially expected items 1 through 5 to be more likely in the pre-entry period than items 6 through 9, we decided to include the latter in our measurement scale nevertheless, because it is possible to conduct these activities already in the pre-entry period. In fact, our data shows that several aspiring entrepreneurs used the pre-entry period to verify whether they were able to develop an actual company structure, marketing strategy or production process, and/or to attract financing for these commercialization activities (cfr. the second column of Table B.1).

Items	Number of positive responses (out of 726 respondents)
(1) Exploring the interest of potential customers and partners in the concept or idea	54
(2) Developing a prototype	20
(3) Testing how the product will be produced or how the service will be provided	39
(4) Testing if potential customers are willing to buy the product or service	41
(5) Attracting funding to test the concept	23
(6) Developing an efficient company structure and employment policy	24
(7) Developing an efficient marketing strategy to sell your product or service on a commercial scale	38
(8) Setting up processes to produce your products or to provide your services on a commercial scale	34
(9) Attracting financing to commercialize your product or service	21

Table B.1 Frequency of pre-entry activities

C. ENTREPRENEURIAL INTENTIONS

In line with Kolvereid (1996), we measured entrepreneurial intentions by asking the respondents to score the following two items on a 7-point scale (1 = very unlikely, 7 very likely):

- (1) “How likely is it that, in the foreseeable future, you will pursue a career as entrepreneur?”;
- (2) “How likely is it that, in the foreseeable future, you will start your own business?”