Testing the Relation of ADHD and Hyperfocus with a Preliminary Self-report Hyperfocus Measure

Lyan Wellinkvoorde

S4004264

Department of Psychology, University of Groningen

PSB3E-BT15: Bachelor Thesis

Group number: 2A-14

Supervisor: Dr. Miguel Garcia Pimenta

Second evaluator: Dr. Anselm Fuermaier

In collaboration with: B. Leenders, E. Snoeren, S. Specht, and R. Vasilev.

June 26, 2022

Abstract

Attention-deficit/hyperactivity disorder (ADHD) has been linked to the phenomenon of hyperfocus (HF) in multiple instances. This phenomenon entails being completely absorbed in a task for an extended period of time, to the point of completely tuning out surroundings. Experiencing both ADHD symptoms and extended periods of focus sound paradoxical, but previous research found correlations. The aim of this study is to investigate the relation between risk of ADHD and HF frequency, HF duration, and a possible influence of the demographic sex on this relation in an adult population (n=322). Participants were gathered via SONA, PPP and social media. The online Qualtrics questionnaire consisted of Core HF for inspecting HF, the ASRS-S to indicate ADHD risk, and personal information questions (including the TAPS). By means of a Pearson correlation analysis we investigate correlations between scores on a ADHD screener and the HF total score, HF duration (Core HF and self-reported), and sex. Unlike results from previous research, ADHD risk did not significantly correlate with HF. It did have a small negative correlation with the core HF subset of prolonged concentration. No significant correlation was found when looking at the self-reported duration of HF. Sex did not significantly correlate with ADHD risk, HF, prolonged concentration, or HF duration. Focusing on duration of HF episodes and finding more support for the used questionnaire can be done in future research.

Keywords: Hyperfocus, Attention-Deficit/Hyperactivity Disorder, Adult ADHD

Testing the Relation of ADHD and Hyperfocus with a Preliminary Self-report Hyperfocus Measure

Being in a state of deep focus can be desirable if one wants to be as productive as possible. Having trouble with obtaining and maintaining attention and focus can be a big problem in daily life. People that have the neurodevelopmental disorder 'attention-deficit/hyperactivity disorder' (ADHD) might be strongly experiencing these troubles. A key feature of people with ADHD is a pattern of inattention and/or hyperactivity-impulsivity. Inattention, affecting more than 90% of adults with ADHD (Millstein et al., 1997), will manifest itself as for example having difficulty sustaining focus, and wandering off task. Hyperactivity refers to restlessness and excessive motor activity, for example excessive fidgeting or talkativeness. Impulsivity may reflect desires for instant rewards and not being able to delay gratification, and can result in hasty actions without forethought (American Psychiatric Association, 2013). Research shows that people with ADHD have impaired brain functions that are essential for self-management. Because of the impairment of these executive functions, things like motivation and prioritizing for tasks, sustaining effort, and focusing and shifting focus as needed are affected (Brown, 2018). These difficulties can severely affect the lives of people with ADHD. Surveys suggest that in most cultures, ADHD is prevalent in about 5% of children and 2,5% of adults (American Psychiatric Association, 2013), but many are also not yet diagnosed.

One phenomena experienced by people with this neurodevelopmental disorder is 'hyperfocus'(HF). It is described in literature as the complete absorption in a task, to the point where someone will 'tune out' their surroundings (Ashinoff & Abu-Akel, 2019). They are long periods of attentional focus. Patients with ADHD describe experiencing HF during activities they find interesting, and report not being aware of time passing (Ozel-Kizil et al., 2016). HF is observed in both neurotypical and neuroatypical populations. It is however

mostly mentioned in combination with conditions that cause trouble in regulating attention, such as autism, schizophrenia, and ADHD (Ashinoff & Abu-Akel, 2019). HF can greatly inconvenience people with ADHD and make it hard for them to function in daily life. Therefore, it is important to analyze the problem that HF can present.

Within HF research, there is a challenge in defining HF itself. Definitions describing possibly the same phenomenon seem to differ. The term 'HF' is mostly used in neurological and neuro-psychological papers (Groen et al., 2020; Ozel-Kizil et al., 2016), but the term 'flow' or 'being in the zone' used within the positive psychology movement (Csikszentmihalyi et al., 2014) and popular media (Raab, 2017) also seems prevalent. Ashinoff and Abu-Akel (2019) made an attempt to define and compare these terms, to determine if they were describing the same phenomenon. They concluded that HF must meet four criteria: the task must be engaging when experiencing HF; it is an intense state of sustained or selective attention; there is a diminished perception of non-task relevant stimuli; and task performance improves. On the basis of these criteria, they concluded that the term 'flow' is synonymous with HF, but that only 'HF' in the ADHD and autism literature fits their definition, and not the one in schizophrenia literature. Grotewiel et al. (2021) however found that most elements of HF were either negatively or not correlated with most aspects of 'flow', and therefore concluding they are not in fact the same phenomenon. They did agree that HF may be a type of 'deep flow', where there is a detachment from surroundings. More (replication) research might however still be warranted.

Ozel-Kizil et al., (2016) proposed HF to be a separate dimension of adult ADHD, since their research results reflected a higher HF level in adult ADHD compared to controls. In their research, the HF measure had three dimensions: hyperfocusing, impaired time management, and procrastination. HF had not yet been researched in this way, but these dimensions were based on literature about ADHD characteristics and executive deficits.

Hupfeld et al. (2019) tried to find an established measure of HF, and suggested that HF may be multidimensional. They developed the Adult Hyperfocus Questionnaire (AHQ), consisting of: Timelessness; Failure to attend to the world; Ignoring personal needs; Difficulty stopping and switching tasks; Feelings of total engrossment in the task; and Feeling 'stuck' on small details. Grotewiel et al. (2022) researched frequency of HF and flow experiences in people with and without ADHD symptoms, using the AHQ as well.

In this paper, HF will be treated like a multidimensional construct and studied using six subsets: Reduced awareness of the world, time and self; Narrow focus; Deep and intense focus; Stopping and initiating other things; Automatic focus; and Prolonged concentration.

Existing literature on HF has shown a correlation with ADHD (traits) on multiple occasions (Ozel-Kizil et al., 2016; Grotewiel et al., 2021). Ozel-Kizil et al. (2016) found a higher level of HF in adult ADHD cases as compared to a control group. Research by Grotewiel et al. (2021) on students found those with clinically significant levels of ADHD to have higher levels of HF. Research by Hupfeld et al. (2019) found evidence for this relationship for a more diverse sample of online-sourced respondents as well: those with higher ADHD levels experienced higher total and dispositional HF, and more frequent episodes in all researched settings. They emphasized the need for research on HF, as it may have clinical implications for adult ADHD. Within the literature there is however some contrasting evidence, as for example Groen et al. (2020) found no difference in occurrence, frequency, duration and pervasiveness of HF in ADHD patients and matched controls. However, when selecting a second matched comparison group, they found lower frequency of HF as compared to the ADHD patients.

Interestingly, besides lower frequency they also found a longer minimum duration of HF episodes. The fact that besides a difference in frequency, a difference in duration was found, gives great opportunities for future research on HF. HF frequency has more consistent

evidence than HF duration, but it might be an important aspect to research more thoroughly, as the duration could theoretically have a strong impact on the experience of HF for ADHD patients.

In line with this information about the duration of an HF episode and ADHD (symptoms), the literature, and anecdotal information, it is expected that higher ADHD risk (or a higher score on an ADHD screener) are correlated with a higher score on a 'total HF measure', and on 'prolonged concentration' subsets of HF. In this study a new HF self-report questionnaire will be introduced, with which the association between ADHD risk and (the duration of) HF episodes will be studied in an adult population.

There is some research supporting the possible relation between HF and ADHD, but adding to the existing body of information will expand our knowledge on ADHD and the phenomena of HF itself. With still many people that qualify, but not yet having the diagnosis of ADHD, it is important to keep expanding our knowledge and research possible relations between phenomena.

In this study we aim to gain more insight and contribute to existing knowledge of HF and ADHD. With previous research finding links between HF and ADHD, we intend to find if (a) there is a relationship between HF and ADHD risk; (b) there is a relationship between prolonged concentration and ADHD risk; (c) and if there is a relationship between the demographic factor sex with risk of ADHD, and/or frequency of HF, and/or prolonged concentration. Based on previous research and anecdotal information, we expect that (a) the higher the risk of ADHD, the higher the frequency of HF; (b) the higher the risk of ADHD, the higher the frequency of prolonged concentration, and the longer the periods of HF; (c) the demographic factor of sex correlates with risk of ADHD, and/or frequency of HF, and/or prolonged concentration, and or duration of HF.

Methods

Participants

Participants are obtained through convenience samples via the SONA first-year pool of the University of Groningen (n = 249), the paid participant pool (PPP; n = 84), and through social media (n = 35). This yields a total sample size of N = 368 before exclusion. Participants are excluded if they report insufficient language abilities (n = 1), if they report to not have answered the questions seriously (n = 5), if they fail one of the three validity control questions (n = 20), if they do not complete the questionnaire (n = 32) or if they do not consent to participation (n = 22). The final sample size is N = 322, with 240 female, 79 male and 3 participants who identified as 'other'. The age ranges from 18 to 54 with a mean of 21.44 (SD = 3.69). The level of education was coded by a bachelor thesis group and a master student separately via the International Standard Classification of Education System (ISCED; ISCED, 2011). The Cohen's kappa is .939, which is considered as excellent inter-rater reliability. Level of education ranges from the levels 3 ("upper secondary education") to 7 ("master or equivalent"), with mode education level being 5 ("short-cycle tertiary education"). 152 participants reported Dutch as their first language (47.2%), 68 reported German (21.1%), and 22 reported English (6.8%). Additionally, various reported other languages (e.g. Frisian, Romanian, Greek, Hebrew), which are categorized as "other" (24.8%). The participants also reported if they were ever diagnosed (n = 98), and/or currently have a diagnosis or received treatment for psychological, mental or brain disorders by a mental health professional (n = 46) and/or used prescribed medication (n = 29). Several diagnoses are reported that were then categorized, e.g. ADHD (n = 16), anxiety disorder (n = 39) and mood disorders (n = 38). Next to this, they reported on the use of various substances, namely alcohol (M = 2.81, SD = 1.24), nicotine (M = 2.19, SD = 1.51), drugs (M = 1.82, SD = 1.10), and abuse of prescription medication (M = 1.23, SD = 0.77).

Measures

Demographic information

Via open questions in English, participants are instructed to self-report demographic data such as age, nationality, first language, highest level of education attained and in which country they attained this education. Furthermore, participants are asked to categorize their sex as either “female”, “male” or “other”. Lastly, they are instructed to categorize their current occupational status based on nine answer options, including an “other” option, where they could fill it in themselves if theirs is different from the options provided.

Core Hyperfocus questionnaire

For assessing the various dimensions of hyperfocus among participants, an experimental version of the Core Hyperfocus questionnaire is applied. Participants are instructed to indicate the frequency of specific hyperfocus experiences in the past six months, on a 6-point Likert scale (1 = never, 6 = very frequently/always). This questionnaire incorporates eight dimensions of hyperfocus: ‘reduced awareness of the world’ (6 items, α = .85), ‘reduced awareness of time’ (6 items, α = .82), ‘reduced awareness of the self’ (6 items, α = .76), ‘narrow focus’ (6 items, α = .78), ‘deep and intense focus’ (4 items, α = .75), ‘stopping and initiating other things’ (6 items, α = .34), ‘automatic focus’ (6 items, α = .86) and ‘prolonged concentration’ (6 items, α = .72), with a total of 46 items (α = .95). Examples of items are; “I can be so focused on something that I do not notice the world around me’’ (world awareness) and “There are times when I feel trapped or locked in a state of deep concentration’’ (stopping and initiating other things). Two validity control questions are included, which instruct participants to choose the answers “rarely” and “sometimes” in order to indicate attentive responding. Item order is randomized to reduce the probability of order and fatigue effects. To summarize the scores for these hyperfocus dimensions, the scores of each question are summed up, and divided by the amount of questions per dimension.

Adult ADHD self-report scale screener (ASRS-S)

To measure the risk for ADHD of the participants we use The World Health Organization ASRS-S (Kessler et al., 2005). This is a shortened version consisting of six items from the full ASRS, which contains 18 items. The ASRS assesses the prevalence of common symptoms of ADHD and therefore the potential risk for an ADHD diagnosis. The items are based on the criteria for ADHD as described in the DSM-IV (American Psychiatric Association, 1994) and input from clinical experts. The items are measured on a 6-point Likert scale (1 = never, 6 = very often). Participants are asked to self-report these symptoms over the last six months. Examples of items included are: “How often do you have difficulty getting things in order when you have to do a task that requires organization?” and “How often do you feel overly active and compelled to do things, like you were driven by a motor?”. A validity control question was included which instructed participants to choose the answer “often” to indicate that their responses were attentive. The ASRS-S summary score consists of the sum of these six individual item scores. Validity research by Kessler et al. (2007) showed Cronbach's alpha ranged from 0.63 to 0.72. This research identifies a Cronbach's alpha of 0.66.

Personal information questionnaire

The questionnaire includes items regarding personal information. Participants are instructed to self-report whether they have ever been diagnosed or received treatment for a psychological, mental or brain disorder, and whether this diagnosis was obtained in the last six months. If the response is yes, they are asked to specify which disorder(s). In addition to that, an inquiry is done regarding the use of prescribed medication, and the specific type of medication which was prescribed. Considering the sensitive nature of these questions, participants are given the option to skip any questions they did not feel comfortable answering.

The Tobacco, Alcohol, Prescription medication, and other Substance use (TAPS) tool

Furthermore, four questions of the TAPS screening tool (Adam et al, 2019) are used to examine the frequency of substance use, including tobacco/other forms of nicotine, alcohol, drugs or the abuse of prescribed medication in the last six months. An example of an item is "In the past 6 months, how often have you used tobacco or any other nicotine delivery product (i.e., e-cigarette, vaping or chewing tobacco)?" These are assessed by a 5-point Likert scale (1 = never, 5 = daily or almost daily). Considering the sensitive nature of these questions, participants were able to leave any of these questions open if they did not feel comfortable answering.

Procedure

The full survey is administered online, and takes approximately fifteen minutes to complete. Participants gain access to the online Qualtrics (https://www.qualtrics.com) questionnaire through a link and complete it unsupervised. Participants gaining access through SONA receive mandatory study credits as compensation. Participants gaining access through the PPP received €2.00 as compensation. Lastly, other participants are approached via social media (e.g. Facebook, Whatsapp), but not compensated. All relevant aspects of the study were approved by the Ethics Committee of the Faculty of Behavioral and Social Sciences of the University of Groningen.

The questionnaire starts with information of the study, after which participants give informed consent to participation and to collection of personal data (e.g. IP address). First, participants answer questions regarding demographic information. Then, the core hyperfocus questionnaire is presented. In addition to the core hyperfocus questionnaire, participants are instructed to estimate the average duration of a single hyperfocus experience in hours and minutes. Then the ASRS-S is administered, followed by additional personal information questions and the TAPS screening tool. In addition to the validity control questions, two final

quality control questions are included at the end of the questionnaire to control for attentive responding. Participants are instructed to report whether they responded seriously and if their English language skills were sufficient to reliably fill in the questionnaire. The final phase is a debriefing in which participants are informed about the research's purpose.

Data Analysis

Statistical analyses were conducted via the IBM SPSS Statistics for Windows, Version 26. We investigate if (a) HF is correlated with ADHD risk; (b) if prolonged concentration is correlated with ADHD risk; and (c) if the demographic factor sex is correlated with ADHD risk, and/or frequency of HF, and/or prolonged concentration. Additionally to the subset of prolonged concentration, which focuses on frequency of HF, we will also do an analysis for HF duration, which is based on self-reported data.

The assumptions for a correlational analysis were checked: level of measurement, linear relationship, normality, outliers, and related pairs. The ASRS screener scores, HF experience scores, and prolonged concentration scores are normally distributed based on review of their respective histograms and Q-Q plots. SPSS flagged four outliers for the ASRS screener scores and one for HF total score. They were found by observing boxplots, extreme score tables and by following the 1.5*interquartile rule of outliers, where anything below 1.5*IQR of Q1 and anything above 1.5*IQR of Q3 is considered an outlier. Filtering out scores outside this [Q1-1.5*(Q3-Q1); Q3+1.5*(Q3-Q1)] interval used by SPSS had little effect on correlation values and results, and were therefore kept in.

Responses on the (self-reported) duration of HF were transformed to a ‘total minutes score’ for easier comparison. The duration of these experiences ranged from 25 to 1440 minutes. Duration of HF in minutes was non-normally distributed and strongly skewed to the right, with skewness of 3.321 (*SE* = .136) and kurtosis of 18.194 (*SE* = .71). After correction with a log transformation, the variable is approximately normally distributed, ranging from

1.40 to 3.16 (*M* = 2.26, *SD* = 0.26). Before transforming the data, a total of twelve participants were flagged as outliers, and afterwards four were flagged. Excluding these participants had little effect on the correlation, and were therefore kept in.

All hypotheses in this research were tested by means of a Pearson correlation analysis. Since this study does not assume a direction of the possible correlation, an alpha-value of 0.05 was used. To find a small to moderate correlation (r=0.20), we needed n=150 for a power of 0.80.

Results

Descriptive Statistics

Table 1 shows the descriptive statistics of the ASRS-S and HF focus measures.

Table 1

Descriptive Statistics of the ASRS screener and all HF focus measures

	ASRS Screener	HF total	Prolonged concentration	HF time in min (Log)
Mean	2.1097	3.4182	3.6579	2.2625
Std. Deviation	.65226	.60390	.69240	.26158

Inferential Statistics

To test the hypothesis (a) 'the higher the risk of ADHD, the higher the frequency of HF', we calculated correlation coefficients. As seen in Table 2, the correlation between the ASRS-S score and total HF score was not significant. So, our hypothesis is not supported by the data.

Secondly, we hypothesized that (b) 'the higher the risk of ADHD, the higher the frequency of prolonged focus, and the longer the periods of focus'. There is a small significant negative correlation between the ASRS-S score and prolonged concentration score (Table 2 and Figure 3). This means that the first part of our hypothesis is not supported, since

we found a negative instead of positive correlation. However, for the 'self-reported duration in minutes' no significant correlation was found. This result is not in line with the hypothesis.

Table 2

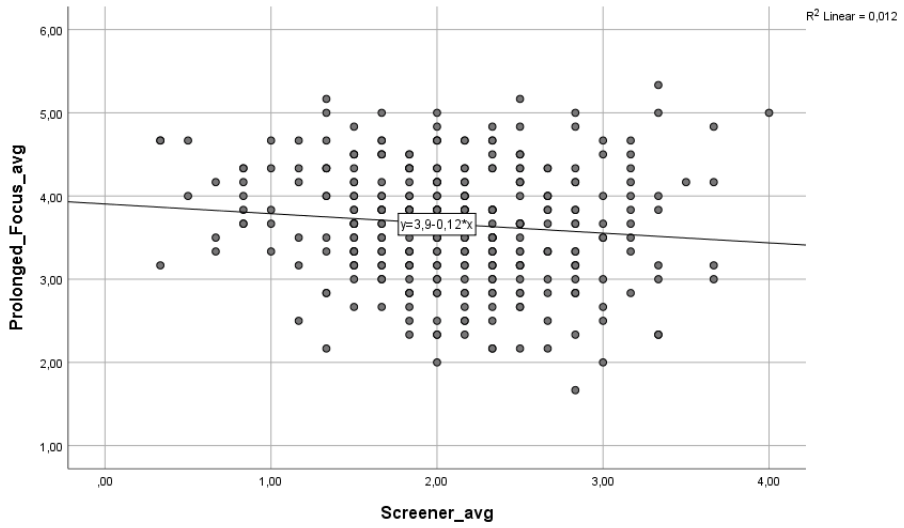
Correlation matrix of the ASRS screener with all HF focus points and the factor sex.

	ASRS Screener	HF total	Prolonged concentration	HF time in min (Log)	Sex of participant
ASRS Screener					
HF total	-.034				
Prolonged concentration	-.110*	.844**			
HF time in min (Log)	-.048	.312**	.346**		
Sex of participant	-.045	.052	-.014	-.007	

Note. N=322. *p < .05. **p < .01. (2-tailed)

Figure 3

Scatterplot showing the distribution and direction of correlation between prolonged concentration and ASRS-screener score



Note. Retrieved from SPSS.

Lastly we wanted to see if (c) 'the demographic factor of sex correlates with risk of ADHD, and/or frequency of HF, and/or prolonged concentration'. As shown in the correlation matrix of Table 2, the sex of participant is not correlated with the ASRS-screener score, the HF-total score, the prolonged concentration score, or the self-reported time in minutes. This result is not in line with our hypothesis. The absence of significant correlations indicates that sex might not be relevant when looking at ADHD or HF focus points in this research.

Discussion

The goal of this study was to gain more insight and contribute to existing knowledge of (a) the relationship between HF and ADHD risk; (b) the relationship between prolonged concentration and ADHD risk; (c) and the relationship between the demographic factor sex with risk of ADHD, HF, frequency of prolonged focus, and HF duration.

We hypothesized that the higher the risk of ADHD, the higher the frequency of HF. No significant correlation was found, and therefore our findings did not support our hypothesis. This is not in line with findings of previous research (Ozel-Kizil et al., 2016; Grotewiel et al., 2021; Hupfeld et al. 2019). We also predicted that the higher the risk of ADHD, the higher the frequency of prolonged concentration would be. We found a small negative correlation between these variables, which is not in line with our hypothesis. We hypothesized that the higher the risk of ADHD, the longer the periods of HF would be. In line with previous research (Groen et al., 2020), we did not find a significant result.

Finding a small significant negative correlation between ADHD risk and prolonged concentration went against our expectations. Instead of participants with higher risk of ADHD experiencing prolonged concentration more frequently, we found that they seemed to experience it less frequently. A possible explanation is a methodological limitation; the way HF is measured. The questions in this questionnaire were, although mostly about intensity and quality of focus, asking about 'how often' they have these experiences. Having an ADHD

diagnosis or having a high risk for ADHD might change one's perspective on what a ‘normal’ and ‘deviating from normal’ period of focus means. We did not specifically ask participants about ‘hyperfocus’, but about their experiences while concentrating or focusing on something in the last 6 months. This could include work or school related activities, but also leisure or social activities. We know from the literature that even though ADHD patients might have trouble reaching a state of focus, they can actually perform very well on tasks that are extremely urgent (Glickman & Dodd, 1998), and that they usually experience HF during activities they find interesting (Ozel-Kizil et al., 2016). Groen et al. (2020) added ‘HF pervasiveness’ as a separate variable to assess the different HF situation, and found differences between ADHD patients and matched controls in HF frequency for educational and social situations, and other activities. Therefore, not having asked about qualitative experiences, or distinguishing between the settings and contexts of the period of focus, could have hindered us from finding possible existing significant results, between both ADHD risk and HF, and ADHD risk and prolonged concentration. It could be an explanation for why high ADHD risk individuals were found to ‘experience prolonged concentration less frequently’.

Unlike what we had hypothesized, we found no significant relationship concerning the duration of HF. However, unlike results from Groen et al. (2020) where HF duration ranged from minimally 8-12 to maximally 48-69 minutes, we found data with a greater, less realistic range. It is possible that we received more extreme answers to this question because the formulation of the question was not clear enough, even though it is very similar to how Groen et al. (2020) quantified this measure. This should be investigated further in the pilot study of future research with similar questions.

In this research we used a preliminary questionnaire. Although the included HF dimensions are based on previous research on HF, some of our included dimensions were not yet tested. We also used the ASRS-S for determining ADHD risk, but this screener only

consists of six questions that were considered the most predictive of ADHD symptoms. Although validated, it is a very rudimentary way of assessing ADHD risk.

The repetitivity of the questionnaire might also have had an influence on results. While we did control for 'mindless answering' with attention checks, randomizing the core HF questions, and giving an option to admit to not having answered questions properly at the end, we do believe it could still have influenced results. While most participants did not answer mindlessly, many might have rushed through similar questions without carefully reading and thinking of the most accurate answer. Most feedback we got in the pilot-stage of our research was about the repetitivity of the questionnaire. With having to measure all HF dimensions, it is unavoidable for the questionnaire to be somewhat repetitive, but it would be dishonest to ignore all the comments we received regarding how this influenced their experience.

In this research, we had three ways of gathering participants, which left us with three samples that should all have slightly different demographics. However, through our means of sampling we gained access to mostly younger people pursuing higher education. This is especially problematic since previous research (Groen et al., 2020) found age and educational level to be significantly correlated to HF occurrence, duration, and pervasiveness. Hupfeld et al. (2019), who found evidence for higher ADHD symptomology being linked to (more frequent) HF, described their sample to be comparable in age, sex, and race distribution to large representative national surveys. It is possible that in having observed mostly highly educated young people, we have looked at a different demographic group, which has given us a different view on HF and ADHD, and therefore different (non-significant) results on all focus points in this research. This means that our external validity is compromised when talking about the relationship between HF and ADHD risk in the general population.

In future studies, more research can be done to look at the different dimensions of HF. More knowledge about the make-up of HF and which parts are most impactful will have a positive impact on future research on HF in relation to other fields (such as neurodevelopmental disorders). Finding more support for the core HF questionnaire as a way of assessing HF might be needed. It is also important for future research to have a sample size that is more representative to the general population, since it is important to not only focus on one specific demographic, but to expand knowledge for all demographic groups.

Conclusion

In a non-clinical sample, we found no support for our hypotheses that there would be a relationship between ADHD risk and HF, and that sex would be related to ADHD risk, frequency or HF prolonged concentration. The frequency of prolonged focus did have a small negative correlation with ADHD risk. No support was found for ADHD risk and HF duration. These findings contrast with some previous studies on HF. Thus, opportunities exist for future researchers to study the qualitative side of HF, the relation between HF and how patients with ADHD experience long periods of focus, work on validating this specific questionnaire and its subsets, and do it on a more representative scale.

References

Adam, A., Schwartz, R. P., Wu, L. T., Subramaniam, G., Laska, E., Sharma, G., Mili, S., & McNeely, J. (2019). Electronic self-administered screening for substance use in adult primary care patients: feasibility and acceptability of the tobacco, alcohol, prescription medication, and other substance use (myTAPS) screening tool. Addiction Science & Clinical Practice, 14(1). https://doi.org/10.1186/s13722-019-0167-z

American Psychiatric Association. (1994). *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.).

American Psychiatric Association. (2013). Neurodevelopmental Disorders. *In Diagnostic and statistical manual of mental disorders* (5th ed.). https://doi.org/10.1176/appi.books.9780890425596

Ashinoff, B. K., & Abu-Akel, A. (2019). Hyperfocus: the forgotten frontier of attention. Psychological Research, 85(1), 1–19. https://doi.org/10.1007/s00426-019-01245-8

Brown, , T. E. (2018). Adhd: beyond dsm-5. Psychiatric News, 53(5). https://doi.org/10.1176/appi.pn.2018.3a20

Csikszentmihalyi M., Abuhamdeh S., Nakamura J. (2014) Flow. In: Flow and the Foundations of Positive Psychology. Springer, Dordrecht. https://doi.org/10.1007/978-94-017-9088-8_15

Glickman, M. M., & Dodd, D. K. (1998). Guti: A Measure of Urgent Task Involvement among Adults with Attention-Deficit Hyperactivity Disorder. *Psychological Reports,* 82(2), 592–594. https://doi.org/10.2466/pr0.1998.82.2.592

Groen, Y., Priegnitz, U., Fuermaier, A. B., Tucha, L., Tucha, O., Aschenbrenner, S., Weisbrod, M., & Garcia Pimenta, M. (2020). Testing the relation between ADHD and hyperfocus experiences. *Research in Developmental Disabilities*, 107, 1–11. https://doi.org/10.1016/j.ridd.2020.103789

Grotewiel, M. M., Crenshaw, M. E., Dorsey, A., & Street, E. (2022). Experiences of hyperfocus and flow in college students with and without attention deficit hyperactivity disorder (adhd). Current Psychology: A Journal for Diverse Perspectives on Diverse Psychological Issues. https://doi-org.proxy-ub.rug.nl/10.1007/s12144-021-02539-0

Hupfeld, K. E., Abagis, T. R., & Shah, P. (2019). Living "in the zone": hyperfocus in adult ADHD. *ADHD Attention Deficit and Hyperactivity Disorders*, 11(2), 191–208. https://doi.org/10.1007/s12402-018-0272-y

Kessler, R. C., Adler, L., Ames, M., Demler, O., Faraone, S., Hiripi, E., Howes, M. J., Jin, R., Secnik, K., Spencer, T., Ustun, T. B., & Walters, E. E. (2005). The world health organization adult adhd self-report scale (asrs): a short screening scale for use in the general population. *Psychological Medicine*, 35(2), 245–56. https://rug.on.worldcat.org/oclc/111755766

Kessler, R. C., Adler, L. A., Gruber, M. J., Sarawate, C. A., Spencer, T., & VanBrunt, D. L. (2007). Validity of the World Health Organization Adult ADHD self report scale (ASRS) screener in a representative sample of health plan members. International Journal of Methods in Psychiatric Research, 16(2), 52–65. https://doi.org/10.1002/mpr.208

Marty, J., & Daniel, D. (2019). Deep , effortless concentration : re-examining the flow concept and exploring relations with inattention , absorption , and personality. Psychological Research, 83(8), 1760–1777. https://doi.org/10.1007/s00426-018-1031-6

Millstein, R. B., Wilens, T. E., Biederman, J., & Spencer, T. J. (1997). Presenting ADHD symptoms and subtypes in clinically referred adults with ADHD. *Journal of Attention Disorders,* 2(3), 159–166. https://doi.org/10.4088/JCP.08m04785pur

Ozel-Kizil, E. T., Kokurcan, A., Aksoy, U. M., Kanat, B. B., Sakarya, D., Bastug, G., Colak, B., Altunoz, U., Kirici, S., Demirbas, H., & Oncu, B. (2016). Hyperfocusing as a dimension of adult attention deficit hyperactivity disorder. Research in Developmental Disabilities, 59, 351–358. https://doi.org/10.1016/j.ridd.2016.09.016

Raab, D. (2017). How to Be in the Flow: Being in the flow of your life might be all about mind-set. www.psychologytoday.com. Retrieved on 20 march 2022, from https://www.psychologytoday.com/us/blog/the-empowerment-diary/201703/how-be-in-the-flow