

# Adult ADHD and Emerging Models of Maladaptive Personality: A Meta-Analytic Review

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## Research Article

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## Abstract

**Background:** ADHD is a highly consequential disorder that is estimated to affect 2.5% of the adult population. Emerging models of psychopathology posit that disorders like ADHD can be usefully situated within general models of individual differences in personality, such as those recently implemented in the DSM and ICD for the diagnosis of personality disorder. Previous research and systematic reviews have linked adult ADHD to the personality traits Conscientious Inhibition and Negative Emotionality. However, there have been some inconsistencies in the literature and research embedding ADHD-personality connections in the DSM-5 and ICD-11 personality disorder models has been limited. The goal of this paper was to systematically review associations between adult ADHD and personality traits, organized within a maladaptive five factor framework.

**Methods:** A comprehensive literature search yielded 13 papers whose effects were meta-analyzed.

**Results:** Results supported associations between ADHD and low Conscientious Inhibition and high Negative Emotionality. However, interesting patterns of variability were observed, potentially related to issues such as instrumentation and facet variation.

**Conclusion:** Results support the clinical application of personality assessment for suggesting risk for ADHD symptoms, and point to important directions for further research.

## Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a prevalent psychiatric disorder (1-3). Although it is commonly conceptualized as a neurodevelopmental condition, it also includes features that resemble basic personality traits, such as neuroticism and impulsivity (4,5). Similar to broad personality traits, ADHD tends to co-occur with a wide range of other disorders, including mood disorders, anxiety disorders, personality disorders and substance disorders (6-9). Moreover, deficits in personality traits such as emotion-regulation, distractibility, irresponsibility, risk-taking and impulsivity are thought to be at the core of ADHD symptoms (10,11).

Most research on personality and psychopathology organizes individual differences in the form of the Five Factor Model (4), which includes the traits Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness. Notably, there are several variants of this model, including the Research Domain Criteria (RDoC) (12); the Hierarchical Taxonomy of Psychopathology (HiTOP) (13); the Alternative Model of Personality Disorder (AMPD) (14); and the ICD-11 proposal for personality disorder (15). All of them have in common the proposal that a few broad traits underlie functioning in a wide range of areas, including dysfunction related to inattention and hyperactivity. Associations between personality and psychopathology are particularly strong when maladaptive trait measures, or instruments that focus on personality-related problems, are used (16).

Several previous reviews have documented associations between FFM personality traits and ADHD (17-20). These reviews indicate that ADHD as a unified construct is most consistently related to low Conscientiousness, low Agreeableness, and high Neuroticism. This research also suggests that the sub-presentations of inattention and hyperactivity/impulsivity correlate differentially with personality traits which deviates from single construct ADHD (21,22). Specifically, Inattention is positively correlated to Neuroticism and negatively to Conscientiousness; and Hyperactivity/Impulsivity relates negatively to Agreeableness and positively to Extraversion (23). However, these results have not been summarized quantitatively. The goal of the present study was to use meta-analysis to summarize associations between adult ADHD and maladaptive personality traits.

### The Five-Factor Model of Personality

The five-factor model of personality (FFM) consists of the following five factors: *Neuroticism* which refers to the extent of negative emotions, i.e. sadness, fear, hostility, and emotional lability that the individual experiences (24). Individuals high in this domain may be at risk for many different psychiatric and physical disorders, high comorbidity, lower quality of life, shorter lifespan and more extensive use of health care (25). *Extraversion* concerns how outgoing or talkative the individual is in most situations. Core traits are sociability, assertiveness, positive affect, and activity level (24). Low Extraversion, or introversion, may include social withdrawal, social detachment, intimacy avoidance, restricted affectivity and anhedonia (26-28) and extremely high Extraversion may represent personality pathology in sexual promiscuity, emotional intrusiveness, excessive self-disclosure and thrill-seeking behavior (29). *Openness to experience* describes the depth and breadth of an individual's intellectual, artistic, and experiential life, with key facets such as aesthetic sensitivity, intellectual interests, and imagination (24). Although open individuals generally tend to have greater psychological well-being, maladaptive Openness can be found in distinguishing between major depression and bipolar disorder as well as different variants of schizotypy (30). *Agreeableness* concerns the extent of the individual's motivation for prosocial behavior and pleasant interpersonal relationships. Important traits are compassion, trust, and politeness (24). Individuals low in Agreeableness tend to be critical, skeptical, try to push limits, express hostility and being condescending (30). Agreeableness is also inversely linked to psychopathy and aggressive behavior (31,32). Maladaptive variants of extreme Agreeableness can result in gullibility, submissiveness, clinging, subservience, servility etc. (30). *Conscientiousness* refers to the individual's level of organization, ability to complete tasks, and persistence in achieving long-term goals. Key concepts are orderliness, self-discipline, and reliability (24). However, both high and low Conscientiousness is associated with decreased functioning. Low Conscientiousness is characterized by disinhibition, irresponsibility, negligence, and rashness (33,34); and inflexible high Conscientiousness can result in perfectionism, fastidiousness, punctiliousness, workaholism and other facets of compulsivity (35-37).

### The Integrated Five-Factor Model

Research has shown that multiple models of both normal-range and maladaptive personality traits can be integrated into the structure of the FFM (38-40). For instance, the trait Neuroticism is empirically and conceptually similar to the trait Negative Affectivity in the AMPD and ICD-11, Emotion Dysregulation in Livesley's Dimensional Assessment of Personality Pathology (DAPP; (41), and the traits Harm Avoidance and (low) Self-Transcendence in Cloninger's Temperament and Character Inventory (TCI; (42). Similarly, FFM Conscientiousness is similar to Disinhibition in the AMPD/ICD-11, Compulsivity on the DAPP-

BQ, and low Novelty Seeking and Persistence on the TCI. For the purposes of this paper, labels that integrate normal-range and maladaptive aspects of the FFM (Markon et al., 2005; (39): Negative Emotionality, Positive Emotionality, Openness, Conscientious Inhibition, and Agreeable Inhibition (see table 1), were used.

### Conceptualizing ADHD within an Integrative Individual Differences Framework

Conceptualizing ADHD as a dimension or set of dimensions that can be placed within a general, evidence-based model of maladaptive personality traits has a number of potential clinical advantages (43-46). For instance, this model may help provide a principled and efficient means for conceptualizing heterogeneity in the presentation of individuals with ADHD diagnosis. Specifically, previous research suggests that Negative Emotionality and low Conscientious Inhibition are most strongly related to inattention, whereas Agreeable inhibition and Positive emotionality maybe more strongly related to hyperactivity and impulsivity (17,18,47,48). However, these relationships seem to be more complex with indications that hyperactivity is associated with higher levels of Positive emotionality and impulsivity with low Agreeableness. Evidence-based models of individual differences also help explain comorbidity, insofar as many disorders share underlying propensities for high Negative emotionality and low Conscientious and Agreeable Inhibition (49) these disorders should be expected to co-occur with inattentive and hyperactive symptoms. Identifying the underlying dimensions that support ADHD and its associated dysfunctions may also pave the way for more targeted treatments and research. As such, individual differences models such as the IFFM have the potential to improve the efficiency, validity, and utility of ADHD diagnoses.

However, there are certain challenges associated with placing adult ADHD in evidence-based personality models. First, a variety of measures of both ADHD and personality traits have been used in the past and there is no consensus in which measures to use and variation in measurement could impact patterns of association. In particular, stronger effects can be expected with maladaptive as opposed to normal range personality measures (16). There is also variability in the sense that both ADHD and the FFM traits can be conceptualized using lower order units – inattentive and hyperactive/impulsive subtypes in the case of ADHD and facets in the case of personality. The goal of this study was to provide a summary of the current evidence about how adult ADHD is related to IFFM personality traits. Given the existing body of research in adult populations, we focused on traits from the FFM, DAPP, HEXACO (50), and TCI. Given that relatively few studies have distinguished between ADHD subtypes, we also focused on ADHD as single construct.

In summary, the aim of this study was to quantify associations between ADHD and the traits of an Integrated FFM as represented by the FFM, DAPP, and TCI measurement systems, to better understand how ADHD fits into evidence-based models of personality and psychopathology, and ultimately enable improved clinical practice and research.

## Methods

Literature searches were conducted in November 2019 via Cochrane, PubMed, PsychInfo and SCOPUS using the following keywords: (ADHD OR ADD OR ADDH OR Attention Deficit Disorder with Hyperactivity) AND (personality traits OR personality dimensions OR NEO OR five-factor model OR FFM OR BFI OR Temperament and Character Inventory OR TCI). The reference sections of each article retrieved was searched manually for any potentially relevant studies. Included studies were a) written in English; b) published after January 1, 2000; c) containing adult cases with a diagnosis of ADHD according to DSM-IV or DSM-5; d) using valid measures for adult ADHD; e) using established dimensional personality measures; and f) presenting results according to the Five-Factor Model of Personality (FFM) or in a format that had an established model for conversion to the FFM. See figure 1 for search process.

The first author initially screened titles and abstracts and excluded papers that did not meet inclusion criteria. The remaining articles were assessed, discussed, and consented upon by the first author and two of the coauthors (TN and BS). This process resulted in 14 papers that examined adult patients with ADHD (47,48,51-62). Six used an explicit FFM measure (23,48,52,53,55,57), one used the HEXACO (61), six used the Temperament and Character Inventory (TCI; (51,54,56,58-60), and Jacob et al. (62) included both FFM and TCI measures. The study by Koerting et al (55) used measures from the personality pathological instrument Dimensional Assessment of Personality Pathology (DAPP-BQ) in addition to FFM.

All formal ADHD diagnoses were based on the DSM criteria, although different instruments were used to assess current and historical symptoms and impairments. All data included in this analysis examined group differences as they relate to personality traits. Control groups included community samples, non-clinical parents of children with ADHD, blood donors, clinical groups without ADHD, and population norms extracted from manuals (table 2). In five of the papers (23,48,58,62,63) correlations with the ADHD symptom clusters: Combined (C), Inattentive (I), Hyperactive/Impulsive (HI), were described. Only the Jacob (62) 2016 study presented individual data according to specific subtype of ADHD. Thus, results on individual ADHD type or presentation could not be aggregated and analyzed separately. However, indicative heuristic patterns are presented and discussed.

Meta-analysis was used to aggregate associations of personality traits and ADHD in Meta-Essentials (64,65). Group differences were converted to the Cohen's  $d$  metric, weighted by sample size, and analyzed separately for each personality dimension. Effect sizes, 95% confidence intervals and prediction intervals were calculated and illustrated in forest plots. Heterogeneity of effects was also calculated to estimate the robustness of results (66). Indices of  $I^2$  were used to evaluate the heterogeneity of mean effect sizes. An  $I^2$  value above 50% can be interpreted as meaningful heterogeneity around the mean effect size (67).

### Quality assessment of papers

The 14 papers were ranked for scientific quality according to an adaptation of QUADAS (68). QUADAS was developed as a tool to systematically assess scientific papers that concern diagnostic tests. The following QUADAS items: a) Design, b) Population size, c) Relevant population, d) Assessment method, e) Relevant assessment instrument, f) Sources of recruited cases, g) Blinding, h) Conflict of interest, and i) Drop-out, were assessed by the first author (PJ) and two co-authors (TN and BS). The papers were first assessed independently and then discussed to reach consensus. Each aspect was scored from 0 - 2:

unsatisfactory=0; fair=1; good=2. The scores for the aspects were summarized for each paper to generate total scores between 0 and 18. The 14 papers ranged from 5 to 13. The paper with lowest score (5) was removed after quality assessment and subsequent preliminary analyses due to deviating both in quality assessment and being identified as an outlier in subsequent analyses, thus resulting in 13 papers that were included in the final analysis. The excluded paper did not meet the quality criteria (unsatisfactory=0) for five of the nine assessed criteria: population size, number of sources from which participants were recruited, no blinding, no description of conflict of interest, no description of drop-out. High drop-out rate or not specifying drop-out and insufficient blinding were the most common quality deficits in the reviewed papers. Assessment methods and relevant populations were general qualitative strengths. The range of the included papers was 7 to 13 (median 10).

## Results

Thirteen original articles consisting of 1142 unique adult subjects diagnosed with ADHD were included in this meta-analysis. Mean age ranged from 21.6 to 42.8 years; 54 % of the included population identified as male. Most of the clinical cases of ADHD were recruited through psychiatric clinics, either general or specialized centers (see table 2). A few clinical cases were recruited through advertisements.

The meta-analytic analyses used in this review indicate a range of combined effect sizes from  $d=0.15$  (negligible) for Openness to  $d=1.11$  (large) for Negative Emotionality (69,70). The effect size for Conscientious Inhibition was large ( $d=-0.89$ ). Effect sizes for Agreeable Inhibition and Positive Emotionality were more modest,  $d=-0.39$  and  $-0.43$ , respectively. All associations with the exception of Openness were significant. *Negative Emotionality* and *Conscientious Inhibition* are thus the personality dimensions that were consistently elevated in the ADHD samples in this review.

Even though the combined effect sizes for Negative Emotionality and Conscientious Inhibition are large, there is significant variability in the ADHD populations within these personality domains. Negative Emotionality includes effect sizes, between the studies in the current review, spanning from  $d=0.50$  (medium to large) to  $d=2.06$  (very large). Conscientious Inhibition exhibits even larger differences between studies and instruments:  $d=0$  (negligible) indicated for the Cloninger TCI facet Persistence to  $d=-2.51$  (very large) for the Five-Factor domain Conscientiousness. Combined confidence intervals (CI) and prediction intervals (PI) were largest for Conscientious Inhibition (CI=-1.15 to -0.63; PI= -2.09 to 0.30) and smallest for Positive Emotionality (CI=-0.57 to -0.28; PI= -1.23 to 0.38).

The  $I^2$  is a measure for the proportion of observed variance that reflects real differences in effect size. It is expressed as a percentage with a range from 0 to 100 percent (71). All effect sizes for the various personality domains in the ADHD samples range from 85 - 97 %. Heterogeneity decreases when FFM measures are extracted and the  $I^2$  for FFM Negative Emotionality is 47 % and  $I^2$  for FFM Agreeable inhibition 64%.

## Discussion

The results of this systematic, quantitative review of the adult ADHD literature suggest a robust connection with the IFFM personality domains *Negative Emotionality* and *low Conscientious Inhibition*. *Positive Emotionality* and *Agreeable Inhibition* have somewhat smaller, although significant, associations with adult ADHD. These results are consistent with the review from Gomez et al (18) with the exception of Agreeable inhibition that in the Gomez paper reached a larger effect size:  $d=-0.39$  in the current review compared to  $d=-0.64$  in the Gomez analysis.

These findings support the emerging view that personality, personality disorders, and neurodevelopmental disorders can be conceptualized within an integrated and evidence-based dimensional trait system. It also supports the clinical application of personality disorder assessment models according to the DSM and ICD diagnostic systems to broaden the clinical description of adult ADHD, as well as research on the shared etiological factors between personality variables and ADHD. Also important is the future research on the influence of these personality variables for the long-term outcome of ADHD.

*Low Conscientious Inhibition* consists of core features that are also implicated in the core symptoms of ADHD. These features are conceptualized in ADHD as difficulties in executive functions or self-regulatory processes (72,73). Barkley (74) proposed that *behavioral inhibition*, consisting of: a) inhibition of pre-potent responses, b) stopping ongoing responses, and c) interference control, can be seen as a superordinate factor that affects several cognitive and behavioral modalities, eventually manifesting themselves in specific symptoms commonly found in ADHD. Common descriptors of ADHD as well as personality facets intersect as seen in concepts of disinhibition, irresponsibility, and disorganization. Thus the finding of *low Conscientious Inhibition* (14,49) is expected, and could even be regarded as an ADHD proxy; particularly the subordinate trait Distractibility was implicated in the Smith and Samuel study. (75).

Key features in *Negative Emotionality* are not represented in the ADHD criteria, but emotional dysregulation has been extensively discussed in later editions of the DSM nosologies as a possible criterion (76). *Negative Emotionality* is elevated across most psychiatric disorders and is highly predictive of psychological and physical comorbidity as well as general quality of life (25,49). There is evidence that high Negative Emotionality also predicts worse outcomes in individuals with ADHD (77-79)

Significant variability was observed in effect sizes between and within samples in the current review, as well as between instruments. For example, the high percentage in the  $I^2$  measure, described above, indicates that there is a high degree of heterogeneity between studied populations within the different personality domains in the meta-analysis. Ideally, subgroup or moderator analyses should be performed to explain the variance. However, the number of studies possible to include in the current meta-analysis are at this point too few to generate reliable subgroup analyses. Despite the lack of sufficient studies to expose moderators, heuristic patterns are indicated. For example, when specific measures of FFM are extracted for separate analysis, heterogeneity decreases. This suggests that populations are more homogenous within specific personality domains measured with five-factor instruments. Thus, more studies, using FFM related measures in the adult ADHD population, are needed to further explore this venue.

One important source of variability seems not only to involve the use of different personality instruments, but also differing facet models across those instruments. Facet variability is complicated by the interstitial nature of some traits, which leads different models to place similar facets on different domains. For instance, we conceptualized TCI self-transcendence as an aspect of Negative Emotionality, although it also shares some features with Conscientious Inhibition.

Variability might also relate to ADHD presentation, given that traits may differentially relate to inattentive and hyperactive features (17,18,47,58,62). Unfortunately, our relatively small sample size precluded moderator analyses of personality instruments, and there were not enough studies reporting associations with ADHD subtypes to examine this issue. Future studies with larger samples, a diversity of IFFM instruments, and symptom or subtype-level representations of ADHD are needed to further explore the heterogeneity of effects we observed here.

### *Clinical implications*

Psychiatric diagnoses are fraught with high comorbidity, complicating the clinical picture and reducing treatment specificity. Dimensional models provide an opportunity to integrate comorbidity into a more comprehensive and individualized clinical description, which makes treatment planning more in line with current clinical praxis. The current review strongly suggests that the features of ADHD can be economically situated within evidence-based models of personality and psychopathology. As such, the clinical use of personality trait measures and the emerging dimensional personality models included in the AMPD and the ICD-11 proposal provide opportunities to implement a more individualized approach for patients with problems related to hyperactivity and inattention. Specifically, multidimensional trait profiles may help clinicians estimate long-term risk for psychosocial consequences of ADHD, as well as the likelihood of other comorbid conditions. They also help provide explanations for heterogeneous clinical presentations and point to appropriate pathways for intervention (43-45,80).

In clinical practice it is useful to rely on heuristics to make efficient clinical decisions (81). So how could these robust findings guide us in the clinic? Using standard deviations or percentiles are some of the heuristics that can be used to explore significant clinical thresholds. For example, these findings indicate that results on personality measures when differing with more than one standard deviation positively on Negative Emotionality (NE) constructs or negatively on Conscientious Inhibition (CI) constructs, in relation to non-clinical populations could be clinically informative about risk for ADHD. Another possible, more conservative criterion would be results within the 10th percentile on CI and 90th percentile on NE. These heuristics can be helpful in screening, or in standard triangulation assessment methods to improve diagnostic reliability, or in guiding treatment.

### **Limitations**

The literature on associations between adult ADHD and personality traits is scarce, thus limiting the degree to which the current results can provide robust information about these links. This also limited our ability to test moderators such as ADHD subtype, personality measure, or various sample features, and it necessitated inclusion of measures with varying connection to the FFM or DSM/ICD personality disorder proposals. Some of our conclusions were based on assumptions about how to organize facets into maladaptive five factor domain(18,39) that have not been fully tested empirically. All personality measures were self-report. This is particularly important because some aspects of personality (developmental, variability, neurocognitive, reflective functioning) may be better assessed using other methods (e.g. informant reports, repeated reporting, implicit tests, neuropsychological testing). Finally, the samples used in this study were WEIRD (i.e. *White Educated Industrialized Rich and Democratic*) Greater diversity in samples is needed to add confidence to these findings.

## **Conclusion**

Psychiatric nosology is in a transition from legacy diagnostic categories to evidence-based models of individual differences that closely resemble personality traits (14,82). Research on how ADHD fits into these models is relatively nascent, particularly in adult samples. This study shows that existing research on personality associations with ADHD suggests that ADHD is strongly related to Negative Emotionality and low Conscientious Inhibition, and moderately related to low Positive Emotionality and low Agreeable Inhibition. These results support the clinical assessment of personality traits in ADHD diagnosis, clinical care, and research, while also pointing to the need for further research to more specifically delineate how ADHD can be fit into the personality/psychopathology hierarchy.

## **Declarations**

**Ethics approval and consent to participate:** Approved by the Ethics Review Board in Lund, Sweden, Dnr: 2018/53.

**Consent for publication:** Not applicable.

**Availability of data and materials:** The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

**Competing interests:** All authors declare that they have no competing interests.

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**Authors' contributions:** PJ, CH, BS and TN conceptualized and designed the study, PJ performed all the analyses and drafted the manuscript. All authors reviewed and consented to the final version of the manuscript.

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## Tables

TABLE 1

IFFM factors <sup>a</sup>	Five-Factor Model	DAPP-BQ	Cloninger TCI	AMPD/ICD-11 <sup>b</sup>
<b>Negative Emotionality</b>	Neuroticism	Emotional dysregulation	Harm avoidance; Self-directedness (-)	Negative affectivity
<b>Positive Emotionality</b>	Extraversion	Inhibitedness (-)	Harm avoidance (-); Reward dependence	Detachment
<b>Openness</b>	Openness to experience		Self-transcendence	Psychoticism (AMPD only)
<b>Conscientious Inhibition</b>	Conscientiousness	Compulsivity	Novelty seeking (-); Persistence	Disinhibition (AMPD); Anankastia (ICD-11)(-)
<b>Agreeable Inhibition</b>	Agreeableness	Dissocial behavior (-)	Cooperativeness	Antagonism (AMPD); Dissociality (ICD-11)

<sup>a</sup>Adapted from Markon et al (2005) and Gomez & Corr (2014). Note: Negative sign indicates that the scale loaded negatively.

<sup>b</sup>Emerging personality models AMPD and ICD-11 factors are not represented in included studies of the current review

**TABLE 2**

Author	ADHD N	Male (%)	Age M (SD)	Clinical recruitment	Control N	Male (%)	Age M (SD)	Control Group	Personality scale	AI M (S)	
He & Antschel (2019)	184	51	36.3 (10.8)	Psychiatric clinics	118	46	29.8 (8.7)	Community	TCI Harm Avoidance	60 (1)	
									TCI Self-directedness	61 (1)	
									TCI Reward Dependence	67 (1)	
									TCI Self-transcendence	52 (1)	
									TCI Novelty seeking	64 (9)	
									TCI Persistence	63 (1)	
Wallace (2016)	217	56	23.6 (4.7)	Psychiatric clinics and advertisements	114	50	22.2 (4.7)	Community	NEO-FFI Neuroticism	28 (7)	
									NEO-FFI Extraversion	28 (7)	
									NEO-FFI Openness to experience	33 (7)	
									NEO-FFI Conscientiousness	16 (4)	
									NEO-FFI Agreeableness	31 (6)	
Di Nicola (2014)	16	No information	No information	Affective disorders unit	102	38 <sup>a</sup>	47.4 (13.2)	BD	NEO-PI-R Neuroticism	14 (2)	
									8	No information	No information
										NEO-PI-R Extraversion	93 (2)
											82 (2)
										NEO-PI-R Openness	10 (2)
											10 (2)
										NEO-PI-R Conscientiousness	88 (1)
											94 (2)
										NEO-PI-R Agreeableness	11 (1)
											12 (1)
Faraone et al (2009)	127	53	36.1 (10.8)	Psychiatric clinics and advertisements	123	46	29.9 (9.0)	Community	TCI Harm Avoidance	59 (1)	
									TCI Self-directedness	61 (1)	
									TCI Reward Dependence	67 (1)	
									TCI Self-transcendence	52 (1)	
									TCI Novelty seeking	64 (1)	

									TCI Persistence	63 (1)
									TCI Cooperativeness	75 (1)
Jacob et al (2016)	Male 441	50	34.5 (10.2)	Psychiatric clinic	80	No information	No information	Reference values male	TPQ Harm Avoidance	18 (7)
	Female 440	50	34.5 (10.2)	Psychiatric clinic	80	No information	No information	Reference values female		20 (6)
									TPQ Reward Dependence	16 (4)
										18 (4)
									TPQ Novelty seeking	19 (5)
										19 (5)
	Male 426		34.5 (10.2) Total	Psychiatric clinic	4219	No information	No information	Reference values male	NEO-PI-R Neuroticism	10 (2)
	Female 432		34.5 (10.2) Total	Psychiatric clinic	7505	No information	No information	Reference values female		12 (2)
									NEO-PI-R Extraversion	10 (2)
										10 (2)
									NEO-PI-R Openness	10 (1)
										11 (2)
									NEO-PI-R Conscientiousness	92 (2)
										89 (2)
									NEO-PI-R Agreeableness	10 (1)
										11 (1)
Koerting (2016)	30	43	33.5 (8.8)	Psychiatric clinic	30	43	28.2 (7.0)	Community	NEO-PI-R Neuroticism;	2, (0)
									NEO-PI-R Extraversion	2, (0)
									NEO-PI-R Openness	2, (0)
									NEO-PI-R Conscientiousness	1, (0)
									NEO-PI-R Agreeableness	2, (0)
									DAPP-BQ Emotional Dysregulation	2, (0)
									DAPP-BQ Inhibitedness	2, (0)
									DAPP-BQ Compulsivity	2, (0)
									DAPP-BQ Dissocial Behavior	2, (0)
Nigg et al. (2002)	88	38	21.6 (3.9)	University disability office	26	No information	No information	Community	NEO-FFI Neuroticism	26 (8)

and advertisements

									NEO-FFI Extraversion	32 (7)
									NEO-FFI Openness to experience	31 (5)
									NEO-FFI Conscientiousness	22 (7)
									NEO-FFI Agreeableness	29 (6)
Knouse (2013)	117	50	42.8 (11.0)	Hospital	1539	No information	No information	Reference values	NEO FFI Neuroticism	26 (8)
									NEO-PI-R Extraversion	28 (6)
									NEO-PI-R Openness	31 (6)
									NEO-PI-R Conscientiousness	19 (6)
									NEO-PI-R Agreeableness	31 (6)
Sizoo et al (2009)	53	68	31.4 (9.9)	Center developmental disorders	657	No information	No information	Expected population norms (T-score)	VTCl Harm Avoidance	55 (1)
									VTCl Self-directedness	34 (1)
									VTCl Reward Dependence	50 (1)
									VTCl Self-transcendence	53 (1)
									VTCl Novelty seeking	61 (9)
									VTCl Persistence	50 (1)
									VTCl Cooperativeness	46 (1)
Steinhausen et al (2013)	30	No information	No information	Parents with ADHD of children with ADHD	34	50	44.7 (5.4)	Parents of children with ADHD	NEO-FFI Neuroticism	21 (0)
									NEO-FFI Extraversion	21 (0)
									NEO-FFI Openness to experience	21 (0)
									NEO-FFI Conscientiousness	21 (0)
									NEO-FFI Agreeableness	21 (0)
Perroud (2016)	119	69	37.3 (11.0)	ADHD center	403	63	45.5 (12.7)	Blood donors	TCI Harm Avoidance	18 (8)
									TCI Self-directedness	21 (8)
									TCI Reward Dependence	14 (4)
									TCI Self-transcendence	15 (6)
									TCI Novelty seeking	23 (5)
									TCI Persistence	41 (2)
									TCI	30

									Cooperativeness	(7
Sizoo et al (2015)	53	66	32.1 (11.4)	Center developmental disorders	399	No information	No information	Expected population norms (T-scores)	VTCl Harm Avoidance	55 (1
									VTCl Self-directedness	34 (1
									VTCl Reward Dependence	50 (1
									VTCl Self-transcendence	55 (1
									VTCl Novelty seeking	60 (9
									VTCl Persistence	50 (1
									VTCl Cooperativeness	45 (1
Anckarsater et al. (2006)	100	No information	No information		1300	No information	No information	Expected population norms (T-scores)	TCI Harm Avoidance	65 (1
									TCI Self-directedness	25 (1
									TCI Reward Dependence	46 (1
									TCI Self-transcendence	55 (1
									TCI Novelty seeking	55 (1
									TCI Persistence	50 (1
									TCI Cooperativeness	35 (1

Note: TCI=Temperament and Character Inventory; NEO FFI=NEO Five Factor Inventory NEO-PI-R= The Revised NEO Personality Inventory; TPQ= Tridimensional Personality Questionnaire; DAPP-BQ= Dimensional Assessment of Personality Pathology, Brief Questionnaire; VTCl= The brief Dutch version of the Temperament and Character Inventory; BD=Bipolar Disorder; MDD=Major Depressive Disorder.

<sup>a</sup>Total number including ADHD.

## Figures



## PRISMA 2009 Flow Diagram

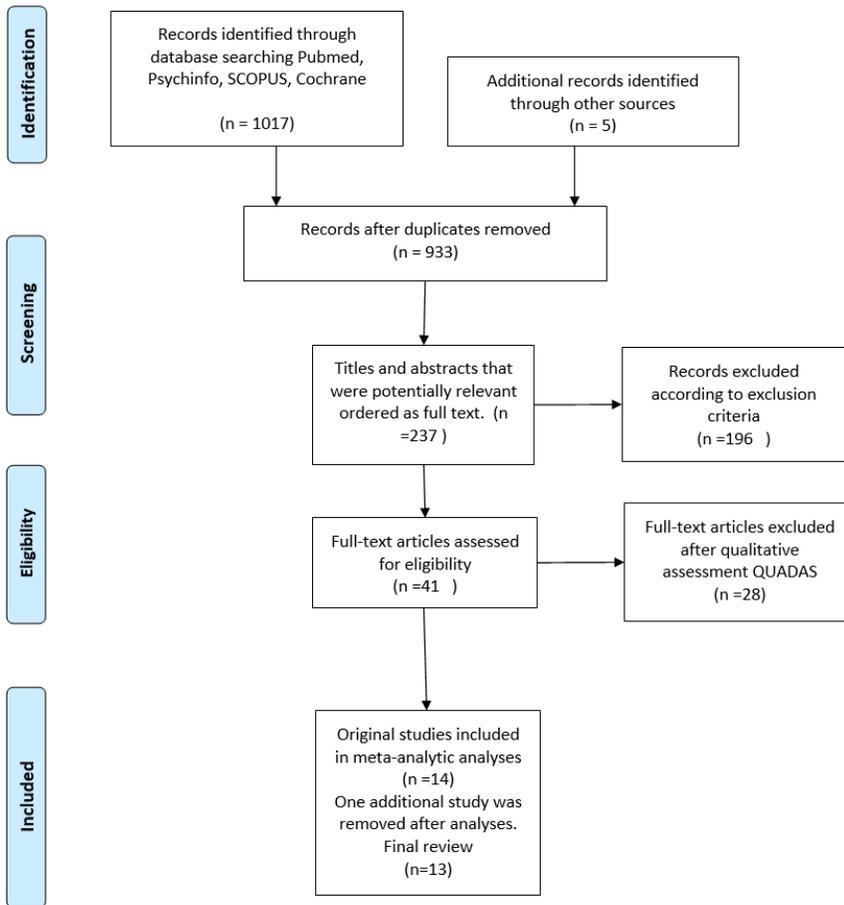
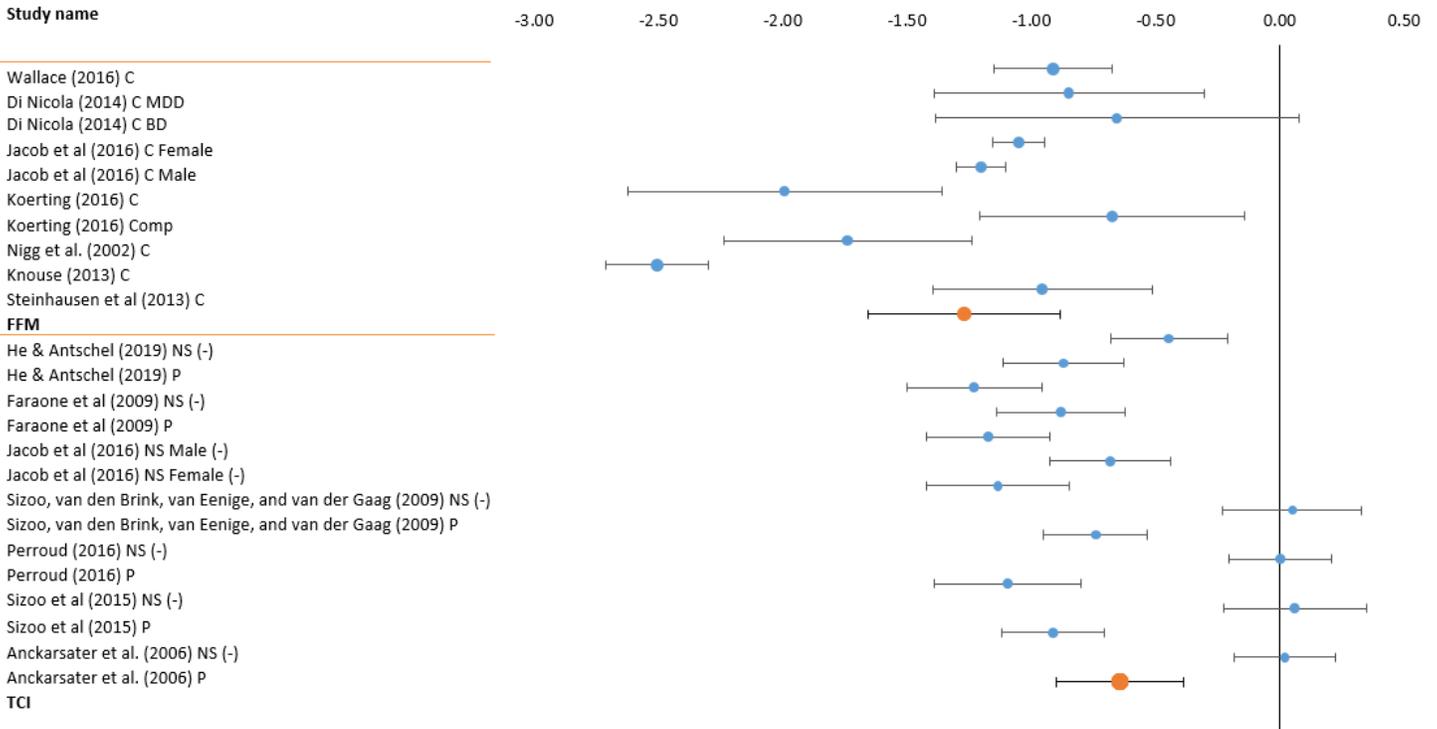


Figure 1

Literature searches were conducted in November 2019 via Cochrane, PubMed, PsychInfo and SCOPUS using the following keywords: (ADHD OR ADD OR ADDH OR Attention Deficit Disorder with Hyperactivity) AND (personality traits OR personality dimensions OR NEO OR five-factor model OR FFM OR BFI OR Temperament and Character Inventory OR TCI). The reference sections of each article retrieved was searched manually for any potentially relevant studies. Included studies were a) written in English; b) published after January 1, 2000; c) containing adult cases with a diagnosis of ADHD according to DSM-IV or DSM-5; d) using valid measures for adult ADHD; e) using established dimensional personality measures; and f) presenting results according to the Five-Factor Model of Personality (FFM) or in a format that had an established model for conversion to the FFM. See figure 1 for search process.

## ADHD – IFFM Conscientious Inhibition

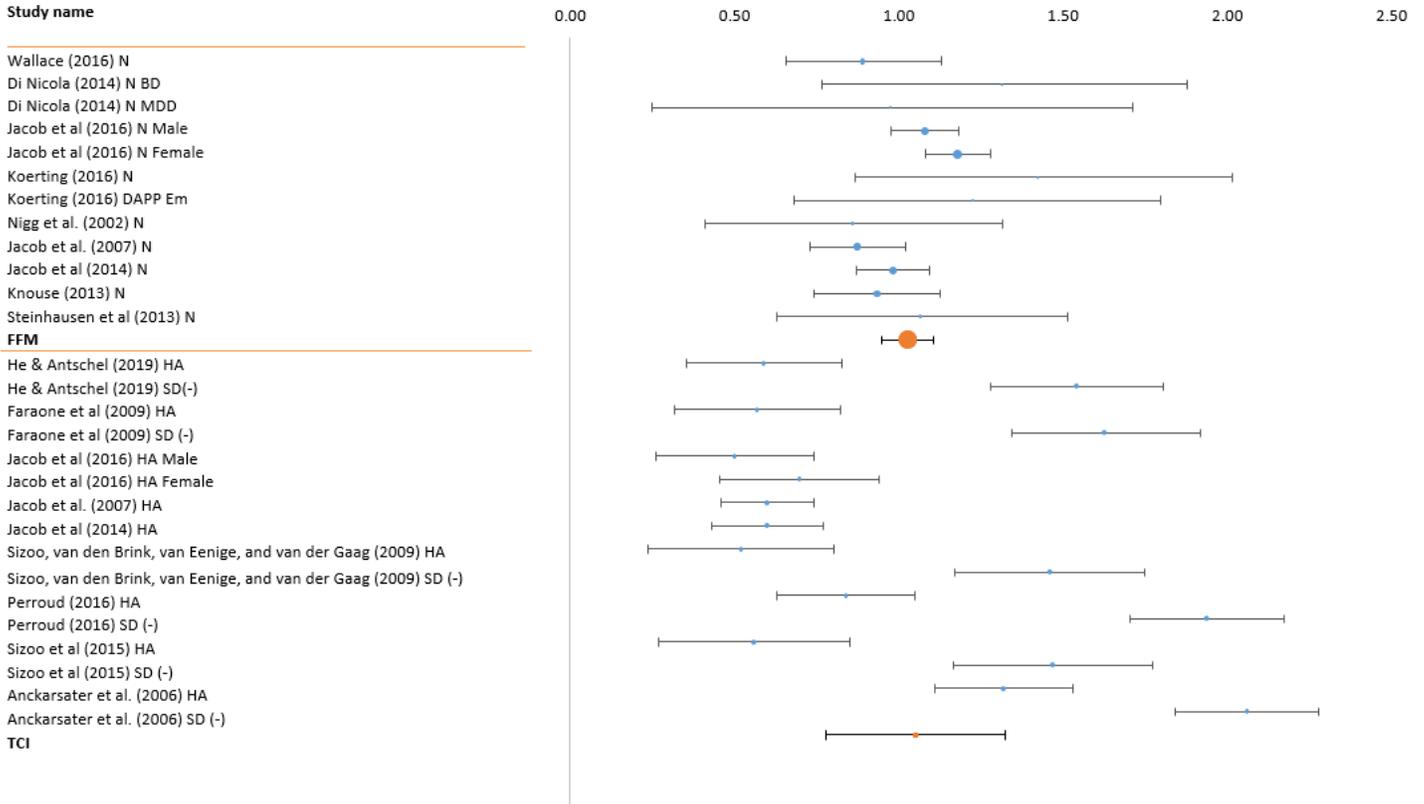


Note: FFM=Five-Factor Model; TCI=Temperament and Character Inventory; DAPP-BQ= Dimensional Assessment of Personality Pathology, Brief Questionnaire; BD=Bipolar Disorder; MDD=Major Depressive Disorder; C= Conscientiousness; Comp=Compulsivity; NS= Novelty Seeking; P=Persistence; (-) indicates that the dimension is represented by the opposite dimension of its pole (e.g., NS (-) represents Conscientious Inhibition).

Figure 2

Forest Plot 1

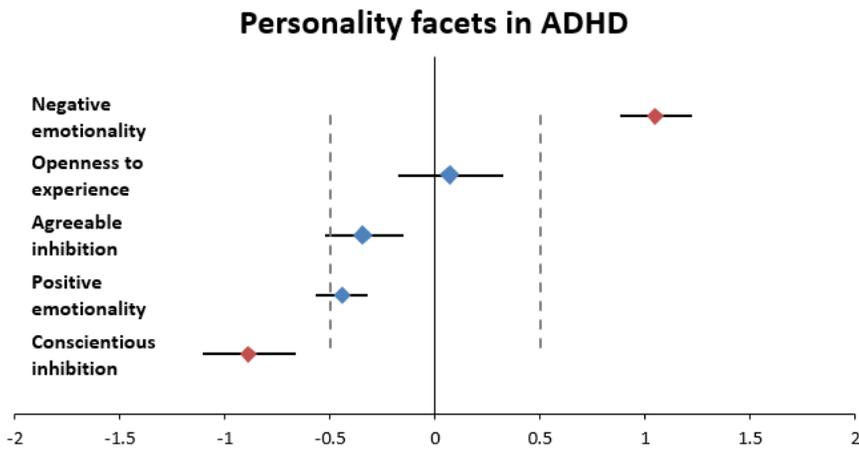
## ADHD – IFFM Negative Emotionality



Note: FFM=Five-Factor Model; TCI=Temperament and Character Inventory; DAPP-BQ= Dimensional Assessment of Personality Pathology, Brief Questionnaire; BD=Bipolar Disorder; MDD=Major Depressive Disorder; N=Neuroticism; HA=Harm Avoidance; SD=Self-Directedness; Em=Emotionality; (-) indicates that the dimension is represented by the opposite dimension of its pole (e.g., SD (-) represents Negative Emotionality).

Figure 3

Forest Plot 2



Combined effect sizes (Cohen's d) from 16 to 30 datasets derived from the FFM family, TCI related measures, one DAPP-Q study.

Figure 4

Forest Plot 3