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REVIEW

Meta-Analysis of Intelligence Quotient (IQ) in Obsessive-Compulsive Disorder

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Abstract Obsessive compulsive disorder (OCD) is associated with a moderate degree of underperformance on cognitive tests, including deficient processing speed. However, despite little research focusing on Intelligence Quotient (IQ) in OCD, it has long been speculated that the disorder is associated with elevated intellectual capacity. The present meta-analytic study was, therefore, conducted to quantitatively summarize the literature on IQ in OCD systematically. We identified 98 studies containing IQ data among individuals with OCD and non-psychiatric comparison groups, and computed 108 effect sizes for Verbal IQ (VIQ, $n = 55$), Performance IQ (PIQ, $n = 13$), and Full Scale IQ (FSIQ, $n = 40$). Across studies, small effect sizes were found for FSIQ and VIQ, and a moderate effect size for PIQ, exemplifying reduced IQ in OCD. However, mean IQ scores across OCD samples were in the normative range. Moderator analyses revealed no significant moderating effect across clinical and demographic indices. We conclude that, although lower than controls, OCD is associated with normative FSIQ and VIQ, and relatively lowered PIQ. These results are discussed in light of neuropsychological research in OCD, and particularly the putative impact of reduced processing speed in this population. Recommendations for utilization of IQ tests in OCD, and directions for future studies are offered.

Keywords IQ · Intelligence · OCD · Intellectual functioning · Neuropsychology · Review

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Introduction

Research into intellectual capacity across a host of psychiatric disorders has documented a small but meaningful reduction in intelligence quotient (IQ; Mortensen et al. 2005; Keyes et al. 2016) relative to those unaffected. For example, reduced IQ has been documented in depression (Gorlyn et al. 2006), ADHD (Frazier et al. 2004) and schizophrenia (Mortensen et al. 2005). Utilizing large cohorts, some longitudinal studies have concluded that lower childhood IQ may be a risk factor for the development of psychiatric disorders later in life (Koenen et al. 2009). However, a recent large study demonstrated bidirectional causal relationships between psychopathology and IQ (Keyes et al. 2016). In particular, Keyes and colleagues examined a sample of 10,073 American adolescents for which IQ and psychopathology information was available and found that lifetime psychopathology was generally associated with lower IQ. Notwithstanding, the authors found that among individuals diagnosed with psychiatric disorders, elevated disorder-specific severity was associated with lowered IQ as well.

These findings of small to moderate reduction in IQ across multiple psychiatric disorders are not surprising given that a moderate degree of executive dysfunction has been documented across multiple disorders (Lipszyc and Schachar 2010; Snyder et al. 2015; Wright et al. 2014). Indeed, some executive functions (particularly updating working memory) have been found to be associated with intelligence (Friedman et al. 2006). Moreover, neuropsychological batteries commonly include Wechsler Adult Intelligence Scale (WAIS) subtests such as the Block Design, which is a good predictor of general intelligence (Lezak et al. 2012).

Reduced performance on neuropsychological tests relative to controls has been well documented in obsessive-compulsive disorder (OCD), with small to moderate effect sizes found for most domains, apart from verbal functions (Abramovitch et al. 2013; Shin et al. 2014; Snyder et al. 2014). However, investigations into IQ in OCD are scarce and present with mixed findings. One longitudinal study found a positive correlation between OCD symptom severity and IQ in a sample of youth with OCD (Peterson et al. 2001). Douglass et al. (1995) assessed a birth cohort of 930 eighteen year old individuals and found that, compared to participants with no OCD, the OCD sample (n = 37) had somewhat increased IQ, but this difference was non-significant. A third community study found that a sample of individuals diagnosed with OCD (n = 20) evidenced lower IQ compared to demographically matched participants without OCD (n = 20) (Zohar et al. 1992). Although these studies assessed community samples, they are characterized by small sample sizes of OCD participants, limiting meaningful inferences from their data. Interestingly, despite the paucity of empirical research, there is a prevalent notion among many professionals (as well as the lay public) that OCD is associated with 'higher than normal' IQ. It may be the case that a footnote included in Sigmund Freud's 'Rat Man' case description has propelled this notion. In this case history (published in 1909), Freud wrote: "*The very high average intellectual capacity among obsessional patients is probably also connected to this fact*" (Freud 1996). A similar assertion was made earlier by Pierre Janet in 1903 (Janet et al. 2005). Nevertheless, although others noted that this notion may be a result of clinical impressions rather than empirical data (Douglass et al. 1995; Rasmussen and Tsuang 1984) this hypothesis has never been directly empirically tested. Accordingly, the aim of the present meta-analysis was to systematically examine IQ in individuals with OCD as compared to control groups, and investigate possible moderators of IQ in OCD.

Despite reduced performance relative to non-psychiatric control samples on a host of neuropsychological constructs, verbal function and verbal memory appear to be preserved in OCD (Abramovitch and Cooperman 2015). A consistent finding in OCD, however, is slower processing speed, with meta-analyses indicating that individuals with OCD exhibit reduced processing speed about one-half of a standard deviation lower than controls (Abramovitch et al. 2013; Shin et al. 2014). Some authors have interpreted this difference as a core deficit in OCD that underlies poorer performance on tasks assessing executive functions (Bedard et al. 2009; Burdick et al. 2008). This notion has been recently supported in a large neuropsychological study of pediatric OCD. Geller et al. (2017) demonstrated that youth with OCD performed significantly worse than controls on timed visuospatial and working memory tasks, but intact performance on untimed tests assessing the same constructs (Geller et al. 2017).

Compared to Verbal IQ (VIQ), the Performance IQ (PIQ) index include more subtests that rely on time as a significant factor for scoring (Wechsler 2008). Thus, individuals characterized by slower processing speed, but with normative verbal functions, may exhibit a larger than expected discrepancy between verbal and performance IQ. This effect has been previously documented in depressed individuals (Kluger and Goldberg 1990; Pernicano 1986), but never directly assessed in the context of OCD. As alluded to, the goal of the present study was to conduct a systematic meta-analytic examination of IQ in OCD. In view of the overall moderate degree of neuropsychological underperformance in OCD, we expected to find lower full scale IQ with small to moderate effect sizes when compared to controls. However, we hypothesized that the discrepancy in VIQ between OCD and control samples will be smaller compared to the discrepancy on PIQ. Finally, given that the overall magnitude of cognitive deficiencies in OCD is small to moderate, and in light of findings in other disorders, we expected that although IQ scores would be lower in OCD compared to controls, these scores would still fall within the normative range.

Methods

Retrieval and Selection of Studies

Studies on OCD that included IQ data were identified by searching MEDLINE, ISI Web of Science, and PyscInfo electronic databases, as well as individual publication reference lists through October 2015. The use of primary keywords focusing on IQ (e.g., 'intelligence quotient', 'IQ', 'intellectual ability', 'verbal IQ', 'full scale IQ', 'performance IQ', 'estimated IQ') was expanded to include names of common intelligence tests (e.g., 'WAIS', 'WRAT', 'NART', 'MWT' etc.), as well as keywords associated with common subtests commonly used to estimate IQ (e.g., 'vocabulary', 'information', 'block design', etc.). Two raters were trained by the first author. One rater conducted the literature search and was subsequently joined by the second rater to conduct data extraction. This process was closely supervised and revisited by the first author throughout all stages of the study. To be considered for inclusion, studies had to be published in English in peer reviewed journals, include a sample of adult (18 years old or older) participants diagnosed with primary OCD, and a screened non-psychiatric control group. Studies were only included if they had sufficient IQ data to produce effect sizes and provided a standardized score (i.e., WAIS IQ index scores, WAIS scaled scores, or T scores). In addition, studies had to utilize a formal well-validated IQ test to be included (e.g., WAIS, WRAT, Shipley), and when methods of IQ estimation were employed, we only included those for which psychometric data has been published with at least satisfactory reliability and validity. Studies conducted in non-English speaking countries were included only if they used a psychometrically valid translation of an IQ test, or a test in the native language that was validated against other well-recognized IQ tests. For studies in which an administration of an IQ test was noted, but presented data did not allow for calculations of effect sizes, we contacted the authors via email, followed by a second attempt when no response was received. Although our initial search yielded 320 studies, upon further examination, 212 studies were excluded for the reasons shown in Fig. 1.

The following variables were coded from each study where possible: (a) OCD and control group sample sizes, (b) mean age, (c) mean age of OCD onset, (d) years of education, (e) percent of males in the OCD group, (f) mean scores on measures of OCD severity (e.g., the Yale-Brown Obsessive Compulsive Scale) and depressive symptoms (e.g., Beck Depression Inventory), (g) percent of OCD participants with at least one diagnosed comorbidity, (h) percent of OCD patients receiving medications, and (i) percent of participants using SRIs or other (e.g., antipsychotic) medication. Table 1, summarizes the characteristics of the included studies. Studies originated from 15 different countries: the largest number of studies were conducted in South Korea (n = 21), followed by United Kingdom (n = 15), United States (n = 13), Germany (n = 11), India (n = 10), Australia (n = 8), Japan (n = 4), Netherlands (n = 4), Spain (n = 3), China (n = 3), Italy (n = 2), Canada (n = 1), Iran (n = 1), Romania (n = 1), and South Africa (n = 1).

Statistical Analyses

Three separate random effect model meta-analyses were conducted (for FSIQ, PIQ, and VIQ) using the Comprehensive Meta-Analysis software package V3.0 (Borenstein et al. 2014). To correct for small sample sizes, the Hedge's g effect size computation was used: $g = d[1 - (3/4\ N) - 9]$, where N represents the cumulative sample size for both OCD and control groups (Hedge's and Olkin 1985). The magnitude of Hedges' g coefficients is equivalent to Cohen's d effect sizes, where .2, .5, and .8 are considered small, medium and large effect sizes, respectively. Analyses also included computation of Fail Safe N (Orwin 1983), and a Funnel Plot with Egger's Test (Egger et al. 1997). Potential moderators for IQ variability within the OCD samples included education, age, gender, severity of OCD, severity of depressive symptoms, medication use, and the presence of comorbid psychiatric diagnoses. Overall, 19 studies provided information for all of these variables across the three IQ scales. Given the need to assess moderators separately for each IQ scale, we did not have sufficient studies to conduct a reliable multivariate regression. In addition, as the first study to assess IQ in OCD, we were more interested in individual moderators' effect on effect sizes, rather than relative moderator explained variance. Therefore, we conducted meta regression analyses for individual variables, separately for each IQ scale.

Fig. 1 Study selection process

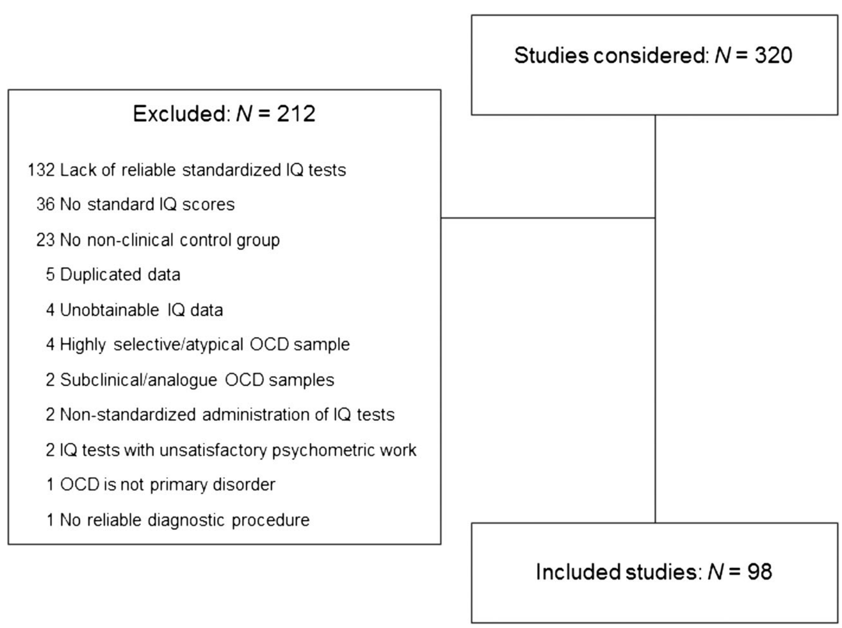

Table 1 Sample and methodological characteristics of 98 studies included in the meta-analysis

Study characteristic	Mean	SD	Range	Studies reporting
N of OCD samples	28.44	17.83	9–110	98
N of control samples	27.35	19.06	10–169	98
Age of OCD (years)	32.71	4.78	23–45	98
Males in OCD samples (%)	51.93	16.68	0–100	92
OCD mean education	13.67	1.55	9.96–16.10	63
Age of onset	18.51	2.69	11.20–23.67	59
Y-BOCS total score OCD	22.94	3.13	16.2–30.00	83
BDI	15.55	3.69	3.80–21.50	40
Hamilton	8.86	3.33	2.47–15.50	25
Percent medicated	43.52	37	0–100	88
Percent with co-morbidity	23.76	25.58	0–100	55

SD = standard deviation; OCD = obsessive-compulsive disorder; Y-BOCS = Yale-Brown obsessive-compulsive scale; BDI = Beck depression Inventory

Results

Publication Bias

Orwin Fail Safe N calculations revealed that 158 studies with an average effect size of 0.2 would be necessary to decrease the overall effect size found in this meta-analysis ($g = -.29$, $p < .001$) to a trivial level. This number is larger than the number of studies included in the present meta-analysis, and thus suggests an absence of a publication bias. Further analyses of Egger's regression intercept test and a funnel plot (Egger et al. 1997) were conducted. Visual inspection of the funnel plot revealed no indication for asymmetry (See Fig. 2), and the Egger's regression intercept test revealed no significant effect ($t(106) = 0.33$, $p = .67$). Thus, we concluded that it is unlikely that a publication bias affected our results.

IQ Effect Sizes

The overall mean effect sizes for FSIQ and VIQ indicated lower IQ across OCD samples relative to controls, yet the magnitude of the differences were relatively small (FSIQ $n = 40$, Hedges's $g = -.35$, $p < .0001$, 95% CI [−.44, −.25]); VIQ $n = 55$, $g = -.19$, $p < 0001$, 95% CI [−.27, −.12]). In contrast, the mean effect size for PIQ ($n = 13$, $g = -.59$, $p < .0001$, 95% CI [−.80, −.37]), which was in the same direction, was of medium magnitude. Heterogeneity across effect sizes for FSIQ ($I^2 = 15.87$), and VIQ ($I^2 = 00$), was found to be non-significant, albeit significant for PIQ ($I^2 = 46.01$) which may stem from the relatively small sample size for PIQ (see Table 2). Individual study sample sizes, confidence intervals, Z values, p values, heterogeneity coefficients, type of IQ test used, and mean IQ scores for FSIQ, VIQ, and PIQ are presented in Tables 3, 4 and 5 respectively.

Moderators of IQ Scores among OCD Groups

The following moderators were analyzed for their relationship to IQ scores among the OCD samples: education, age, gender, severity of OCD (as measured by the Y-BOCS), severity of depressive symptoms (as measured by the BDI), medication use, and presence of comorbid psychiatric diagnoses. Meta regression moderator analysis were conducted for each moderators for FSIQ, VIQ, and PIQ, separately. These analyses did not reveal any significant moderating effects.

Discussion

To our knowledge no study to date focused on IQ in OCD. Nevertheless, the availability of IQ data from previous studies affords a quantitative review to test the long-standing impression that individual with OCD possess higher than average IQ. To our knowledge this is the first such investigation, and in accordance with our first hypothesis (and in contrast to the aforementioned myth) we found significantly *lower* VIQ, PIQ, and FSIQ across OCD samples compared to controls. Unweighted means indicated a 6.79 difference in PIQ, a 1.89 points difference in VIQ, and a 4.05 difference in FSIQ. These differences correspond to weighted effect sizes of −.59, −.19, and −.34, for PIQ, VIQ, and FSIQ respectively. Small to moderate effect sizes exemplifying reduced IQ have also been reported for individuals with depression, psychotic disorders, PTSD, and ADHD (Bremner et al. 2004; Frazier et al. 2004; Gorlyn et al. 2006; Mortensen et al. 2005). However, in accordance with our second hypothesis, and in contrast with research indicating no meaningful VIQ-PIQ discrepancy in most disorders, our results show a larger discrepancy between PIQ and VIQ in OCD compared to controls. Such a discrepancy has been previously demonstrated in a

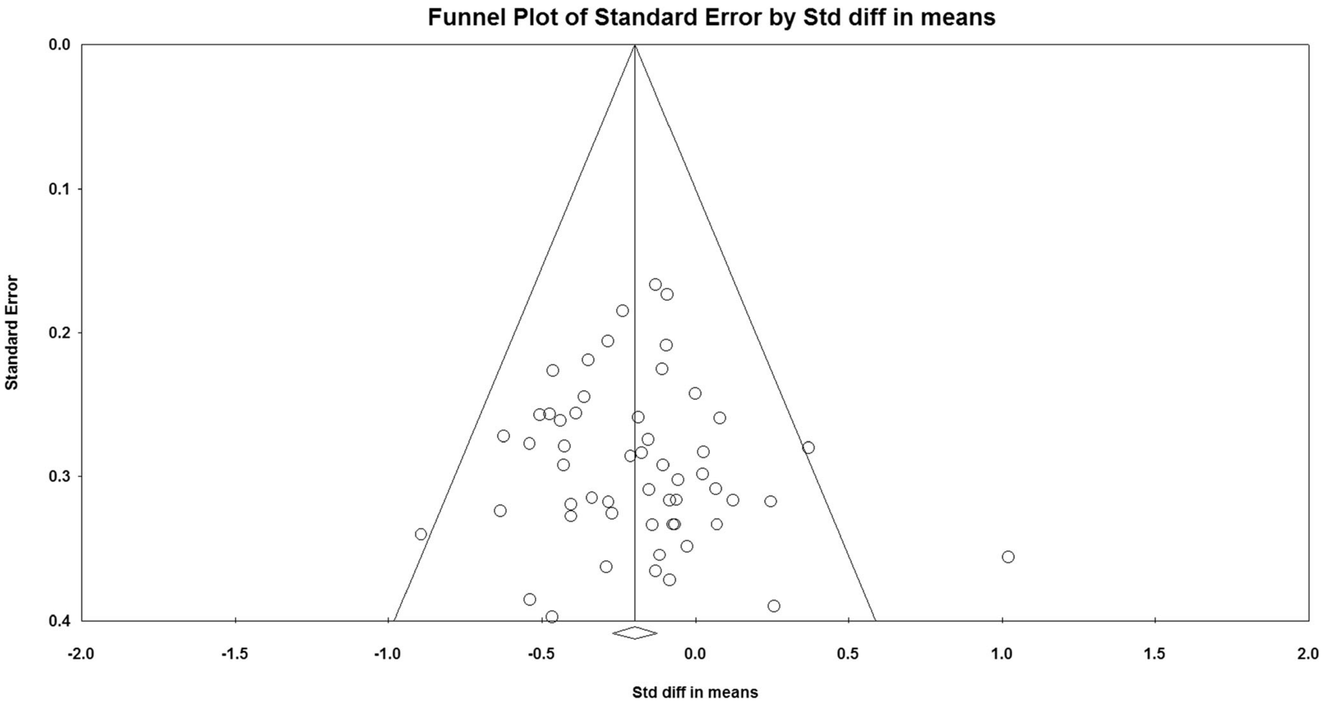

Fig. 2 Funnel plot of standard error by Hedges' *g*

sample of individuals diagnosed with affective disorders, and to a smaller extent in schizophrenia (Pernicano 1986). In fact, a meta-analysis examining VIQ-PIQ discrepancies found that affective disorders were associated with a similar effect size compared to our findings (Kluger and Goldberg 1990).

The rationale underlying our hypothesis pertaining to lower PIQ in OCD stemmed from some consistent findings regarding slower processing speed in OCD that may affect performance on neuropsychological tests assessing different constructs (Abramovitch and Cooperman 2015). This effect has been demonstrated both in adult and pediatric OCD populations (Bedard et al. 2009; Burdick et al. 2008; Geller et al. 2017). Given that such a difference has been associated with some mild forms of brain damage, it has been suggested that this effect in depressed patients results from a disorder-specific pathophysiology (Kluger and Goldberg 1990). However, Gorlyn et al. (2006) administered the WAIS-III to a sample of 121 unmedicated adults with major depressive disorder, and 41 non-psychiatric controls and found a moderate VIQ-PIQ discrepancy that was fully accounted for by slower processing speed (Gorlyn et al. 2006). Unfortunately there is a lack of studies administering and presenting the results of complete sets of scores from IQ tests in OCD. Thus, our theoretical explanation for this discrepancy is currently speculative and requires direct investigation. Notably, these findings, highlighting small to moderate degree of reduced but normative IQ in OCD compared to controls, echo findings from recent meta-analyses of neuropsychological test performance in adult OCD, indicating small to moderate effect sizes (Abramovitch et al. 2013; Shin et al. 2014; Snyder et al. 2014). In particular, these findings are in support of the increasingly prevalent view brought forth by Abramovitch et al. (2013) suggesting that OCD may be associated with underperformance on neuropsychological tests across several domains, but not to a degree that may be considered a clinically significant impairment.

Moderator analyses for PIQ, VIQ, and FSIQ within the OCD samples yielded no significant moderating effects. This finding echoes the vast majority of studies that report

Table 2 Mean effect size and distribution coefficients for FSIQ, PIQ, VIQ

	N Studies	*g*	Variance	CI -	CL+	Z	*p*	*Q*	Df(*Q*)	*p*	I^2
FSIQ	40	−0.345	0.00	−0.44	−0.25	−7.23	0.000	46.354	39	0.195	15.87
PIQ	13	−0.587	0.01	−0.80	−0.37	−5.30	0.000	22.227	12	0.035	46.01
VIQ	55	−0.194	0.00	−0.27	−0.12	−5.26	0.000	47.279	54	0.729	0.00

FSIQ = full scale IQ; PIQ = performance IQ; VIQ = verbal IQ

Table 3 Selected methodological characteristics and effect sizes for FSIQ

	OCD n	M IQ OCD	Control n	M IQ Controls	IQ *g*	Lower limit	Upper limit	Z	*p*-Value	IQ test
Bedard 2009	40	102.4	22	103.6	−0.09	−0.60	0.43	−0.32	0.746	WAIS-III
Cha 2008	47	108.8	20	119.2	−0.79	−1.33	−0.26	−2.90	0.004	WAIS-III
Choi 2006	22	107.7	22	114.3	−0.66	−1.25	−0.06	−2.15	0.031	WAIS-R
Fontenelle 2011	11	113.8	10	115.9	−0.25	−1.07	0.58	−0.58	0.560	WAIS
Gu 2008	21	113.4	21	114.7	−0.11	−0.71	0.48	−0.38	0.706	WAIS-R
Hur 2012	31	112.7	52	113.5	−0.07	−0.52	0.37	−0.33	0.741	WAIS-R
Hwang 2007	24	107.3	24	109.0	−0.18	−0.74	0.38	−0.64	0.524	WAIS-R
Jung 2009	15	110.9	15	114.9	−0.35	−1.05	0.36	−0.97	0.333	WAIS-R
Jung 2011	20	108.4	20	111.5	−0.26	−0.87	0.35	−0.84	0.401	WAIS-R
Jung 2013	19	108.9	18	111.1	−0.18	−0.81	0.45	−0.56	0.573	WAIS-R
Kang 2012	18	107.8	18	111.7	−0.34	−0.98	0.31	−1.03	0.304	WAIS-R
Kim 2002	39	108.5	31	113.5	−0.45	−0.92	0.02	−1.87	0.062	WAIS-R
Kim 2003	19	107.1	21	112.8	−0.57	−1.19	0.05	−1.80	0.072	WAIS-R
Kim 2007	15	109.4	15	115.3	−0.61	−1.33	0.10	−1.68	0.092	WAIS-III
Kim 2010	30	113.8	27	114.5	−0.06	−0.57	0.46	−0.21	0.830	WAIS-III
Kwon 2003	14	114.1	14	116.4	−0.28	−1.00	0.44	−0.76	0.449	WAIS-III
Lochner 2011	15	118.6	17	122.2	−0.33	−1.01	0.35	−0.95	0.340	WAIS-III
Marsh 2014	22	112.7	21	116.2	−0.24	−0.83	0.35	−0.80	0.426	WASI
Marsh 2015	33	110.5	33	111.3	−0.06	−0.54	0.42	−0.25	0.802	WASI
Murayama 2013	22	104.7	10	112.3	−0.79	−1.55	−0.04	−2.06	0.039	WAIS-R
Murphy 2004	16	118.8	16	117.1	0.20	−0.48	0.87	0.57	0.569	WAIS-III
Nabeyama 2008	11	99.7	19	105.4	−0.71	−1.46	0.03	−1.87	0.061	WAIS-R
Nakao 2005	24	99.2	12	106.6	−0.95	−1.66	−0.24	−2.62	0.009	WAIS-R
Nakao 2009	40	102.0	25	108.1	−0.59	−1.09	−0.08	−2.28	0.022	WAIS-R
Oh 2012	20	108.7	19	112.0	−0.27	−0.89	0.35	−0.86	0.392	WAIS-R
Page 2009	10	114.0	11	117.0	−0.15	−0.98	0.67	−0.36	0.715	WAIS-R
Park 2010	69	107.8	69	116.0	−0.77	−1.11	−0.42	−4.38	0.000	WAIS-R
Pasquini 2010	15	108.2	13	118.3	−0.71	−1.46	0.03	−1.88	0.061	WAIS-R
Peng 2014	15	106.9	28	102.9	0.26	−0.36	0.88	0.83	0.407	WAIS-R
Posner 2014	23	107.1	20	118.2	−0.52	−1.12	0.08	−1.71	0.087	WASI
Shim 2009	110	109.1	169	113.9	−0.43	−0.67	−0.19	−3.48	0.000	WAIS-R
Shin 2004	30	107.8	30	119.1	−0.95	−1.48	−0.43	−3.54	0.000	WAIS-R
Shin 2010	82	111.8	41	112.7	−0.09	−0.46	0.28	−0.47	0.642	WAIS-R
Shin 2012	85	109.3	71	110.1	−0.07	−0.38	0.24	−0.44	0.659	WAIS-R
Simpson 2006	30	109.6	35	114.6	−0.39	−0.88	0.10	−1.57	0.115	WASI
Szabó 2013	28	110.4	30	109.5	0.08	−0.42	0.59	0.32	0.746	WAIS
Tolin 2001	14	104.6	14	113.0	−0.80	−1.55	−0.05	−2.09	0.037	Shipley
Wen 2014	26	106.2	20	110.4	−0.33	−0.91	0.24	−1.13	0.259	WAIS-R
Wilhelm 1997	36	111.1	24	112.1	−0.14	−0.65	0.37	−0.54	0.589	WAIS-III
Yucel 2007	19	110.2	19	115.5	−0.53	−1.16	0.11	−1.63	0.104	WAIS
Total	**1180**		**1116**		**−0.35**	**−0.43**	**−0.26**	**−8.12**	**0.000**	

FSIQ = Full scale IQ; M IQ OCD = Mean IQ in OCD samples; M IQ Controls = Mean IQ in control samples; WAIS = Wechsler Adult Intelligence Scale; WAIS-III = Wechsler Adult Intelligence Scale 3rd ed.; WASI = Wechsler Abbreviated Scale of Intelligence; Shipley = Shipley Institute of Living Scale

no association between cognitive functioning and OCD symptom severity (for a review see Abramovitch and Cooperman 2015). Only a minority of studies identified such an association (e.g., Kitis et al. 2007; Nedeljkovic et al. 2009; Penades et al. 2005). Indeed 3 separate meta-analytic investigations of neuropsychological indices in OCD concluded that there is no major moderator of a cognitive domain, apart for a few random effects that are specific to a task or to a subdomain,

Table 4 Selected methodological characteristics and effect sizes for VIQ

	OCD n	M IQ OCD	Control n	M IQ Controls	IQ *g*	Lower limit	Upper limit	Z	*p*-Value	IQ test
Agam 2014	21	110.0	20	113.0	−0.33	−0.93	0.27	−1.07	0.657	WRAT
Badcock 2007	14	109.1	24	103.6	1.00	0.32	1.68	2.86	0.829	NART
Banca 2015	28	115.4	35	118.4	−0.50	−1.00	0.00	−1.97	0.022	NART
Becker 2014	24	109.0	24	114.0	−0.42	−0.99	0.14	−1.47	0.373	MWT
Beucke 2012	19	104.0	19	107.0	−0.27	−0.89	0.36	−0.83	0.050	MWT
Beucke 2014	46	106.2	46	107.1	−0.09	−0.50	0.31	−0.44	0.423	MWT
Cabrera 2001	21	110.6	21	109.5	0.07	−0.53	0.66	0.22	0.065	WAIS-R
Cha 2008	47	111.8	20	119.4	−0.62	−1.14	−0.09	−2.29	0.437	WAIS-III
Chamberlain 2006	20	115.7	20	117.3	−0.28	−0.89	0.33	−0.89	0.601	NART
Chamberlain 2007	20	114.2	20	118.2	−0.62	−1.25	0.00	−1.96	0.240	NART
Clayton 1999	17	105.8	14	108.3	−0.28	−0.98	0.41	−0.80	0.843	NART
De Geus 2007b	39	102.0	26	106.2	−0.47	−0.97	0.03	−1.85	0.831	NART
Deckersbach 2005	20	113.9	20	110.9	0.24	−0.37	0.85	0.78	0.540	WAIS-R
Dittrich 2011	68	115.3	65	115.8	−0.09	−0.43	0.25	−0.52	0.842	NART
Dittrich 2013	13	117.2	13	119.5	−0.45	−1.21	0.30	−1.17	0.724	NART
Endrass 2008	20	107.6	20	108.2	−0.06	−0.67	0.55	−0.20	0.206	WST
Endrass 2010	18	108.4	18	107.8	0.07	−0.57	0.71	0.21	0.168	WST
Endrass 2013	25	110.2	25	112.2	−0.17	−0.72	0.38	−0.61	0.051	WST
Ersche 2011	18	107.9	18	108.4	−0.06	−0.70	0.57	−0.20	0.759	NART
Head 1989	15	113.1	15	114.2	−0.13	−0.82	0.57	−0.35	0.405	NART
Ischebeck 2014	20	108.1	20	111.3	−0.40	−1.01	0.22	−1.26	0.127	WST
Jelinek 2014	70	103.0	36	106.0	−0.28	−0.68	0.12	−1.38	0.141	MWT
Jurado 2001	27	101.9	27	107.6	−0.53	−1.07	0.00	−1.95	0.635	WAIS
Kathmann 2005	33	110.0	27	109.0	0.08	−0.42	0.58	0.31	0.626	WAIS-R
Kaufmann 2013	19	104.0	19	107.0	−0.27	−0.89	0.36	−0.83	0.743	MWT
Kuelz 2004	21	110.9	35	117.8	−0.42	−0.96	0.12	−1.53	0.009	MWT
Kuelz 2006	30	111.2	39	116.8	−0.36	−0.83	0.12	−1.47	0.937	MWT
Lawrence 2006	39	114.3	40	115.1	−0.11	−0.54	0.33	−0.47	0.674	NART
Lennertz 2012	21	114.7	21	116.6	−0.15	−0.74	0.45	−0.49	0.131	MWT
Lochner 2011	15	119.4	17	120.8	−0.11	−0.79	0.56	−0.33	0.578	WAIS-III
Lucey 1997	19	108.0	19	114.3	−0.87	−1.53	−0.22	−2.63	0.826	NART
Martin 1993	17	116.6	16	116.8	−0.03	−0.69	0.64	−0.08	0.461	WAIS
Martin 1995	18	116.0	18	117.0	−0.14	−0.78	0.50	−0.42	0.112	NART
Menzies 2007	31	113.3	31	115.9	−0.38	−0.88	0.11	−1.51	0.853	NART
Morein-Zamir 2009	40	116.3	20	117.3	−0.15	−0.68	0.38	−0.56	0.200	NART
Morein-Zamir 2010	18	107.9	18	108.4	−0.07	−0.71	0.57	−0.22	0.163	NART
Morein-Zamir 2013	20	116.0	32	117.5	−0.21	−0.76	0.34	−0.74	1.000	NART
Moritz 2007	71	109.5	30	114.1	−0.35	−0.77	0.08	−1.59	0.186	MWT
Moritz 2010	18	110.2	28	111.1	−0.05	−0.64	0.53	−0.18	0.474	MWT
Nedeljkovic 2009	59	106.2	59	108.1	−0.24	−0.60	0.12	−1.28	0.093	NART
Pasquini 2010	15	112.2	13	119.3	−0.52	−1.26	0.21	−1.39	0.040	WAIS-R
Penades 2005	35	110.0	33	110.0	0.00	−0.47	0.47	0.00	0.438	WAIS-III
Penades 2007	27	113.0	25	111.0	0.36	−0.18	0.91	1.32	0.790	WAIS-III
Peng 2014b	30	104.2	30	107.2	−0.18	−0.68	0.32	−0.72	0.823	WAIS-R
Purcell 1998b	30	105.5	30	109.1	−0.43	−0.94	0.07	−1.68	0.934	NART
Rampacher 2010	40	109.0	40	114.6	−0.46	−0.90	−0.02	−2.05	0.509	MWT-B
Riesel 2014	72	107.2	72	108.5	−0.13	−0.45	0.20	−0.78	0.700	MWT-B
Savage 1999	20	115.5	20	116.9	−0.08	−0.69	0.53	−0.27	0.923	WAIS-R
Starcke 2009	14	116.4	15	117.4	−0.08	−0.79	0.63	−0.22	0.722	LPS-4

Table 4 (continued)

	OCD n	M IQ OCD	Control n	M IQ Controls	IQ *g*	Lower limit	Upper limit	Z	*p*-Value	IQ test
Starcke 2010	23	116.0	22	115.7	0.02	−0.55	0.60	0.08	0.218	LPS-4
Tolin 2011	9	114.1	25	111.4	0.25	−0.49	1.00	0.66	0.657	WTAR
Watkins 2005	20	111.9	20	111.0	0.12	−0.49	0.73	0.39	0.829	NART
Whitton 2014	25	111.1	25	110.9	0.03	−0.52	0.57	0.10	0.022	NART
Whitton 2014b	23	110.2	24	110.9	−0.10	−0.66	0.46	−0.36	0.373	NART
Yucel 2007	19	109.3	19	112.7	−0.40	−1.02	0.23	−1.23	0.050	WAIS
Total	**1521**		**1448**		**−0.19**	**−0.27**	**−0.12**	**−5.26**	**0.000**	

FSIQ = Full scale IQ; M IQ OCD = Mean IQ in OCD samples; M IQ Controls = Mean IQ in control samples; WRAT = Wide Range Achievement Test; NART = National Adult Reading Test; MWT = Multiple Choice Vocabulary Test; MET = Multiple Choice Vocabulary Test; WAIS-R = Wechsler Adult Intelligence Scale Revised; WAIS-III = Wechsler Adult Intelligence Scale 3rd ed.; WST = Wortschatztest, German Vocabulary Test; LPS-4 = Leistungsprüfsystem, Performance Test System; WTAR = Wechsler Test of Adult Reading

largely limited to specific executive function, and characterized by weak association (Abramovitch et al. 2013; Shin et al. 2014; Snyder et al. 2014).

A limitation of our findings that should be taken into account when considering our meta-analytic findings is that it was not possible to account for OCD symptom dimensions in our analyses. Indeed, whereas OCD is a highly heterogeneous condition (e.g., McKay et al. 2004), most of the studies in the present meta-analysis did not assess the degree to which their samples contained individuals with contamination obsessions, for example, as opposed to harming obsessions. It is plausible that the heterogeneity of OCD symptoms accounts for some of our findings. Moreover, whereas hoarding is now regarded as a separate condition from OCD, it was previously considered an OCD symptom and some studies might have included individuals with hoarding symptoms in their OCD samples. Importantly, there are known neuropsychological differences between individuals with and without hoarding (Grisham et al. 2007), which might also have affected our results. We encourage future researchers to specifically examine relationships between particular OCD symptom dimensions (e.g., Abramowitz et al. 2010) and IQ, including in the context of PIQ-VIQ discrepancy due to slowness. It is important to highlight this limitation as this study can only report on standalone associations between the outcome measures and potential confounds.

Clinically and conceptually, the myth of superior intelligence in OCD may have deleterious consequences. In examining the extent to which this belief is widespread, we encountered a number of statements such as "*Research indicates that OCD sufferers often exhibit high creativity and imagination and above-average intelligence*." (Hagen 2016), that are

Table 5 Selected methodological characteristics and effect sizes for PIQ

	OCD n	M IQ OCD	Control n	M IQ Controls	IQ *g*	Lower limit	Upper limit	Z	*p*-Value	IQ test
Abbruzzesse 1995	33	102.5	33	109.3	−0.53	−1.01	−0.04	−2.13	0.033	WAIS-R
Cha 2008	47	101.9	20	116.4	−1.33	−1.89	−0.76	−4.61	0.000	WAIS-III
Ghassemzadeh 2012	34	103.1	29	110.7	−0.50	−1.00	0.00	−1.97	0.049	Raven APM
Han 2011	10	112.1	20	114.3	−0.16	−0.90	0.58	−0.42	0.675	WAIS-III
Kuelz 2004	21	100.5	35	106.0	−0.41	−0.95	0.13	−1.48	0.138	Raven SPM
Kuelz 2006	30	97.2	39	103.7	−0.47	−0.94	0.01	−1.92	0.055	Raven SPM
Lochner 2011	15	113.1	17	118.7	−0.50	−1.19	0.19	−1.42	0.155	WAIS-III
Neilen 2002	27	112.5	26	113.5	−0.08	−0.61	0.45	−0.30	0.763	Raven SPM
Nielen 2003	19	114.1	24	117.3	−1.26	−1.91	−0.61	−3.81	0.000	Raven SPM
Nielen 2009	29	111.9	27	113.5	−0.17	−0.69	0.35	−0.64	0.525	Raven SPM
Pasquini 2010	15	100.7	13	113.5	−0.86	−1.61	−0.10	−2.22	0.026	WAIS-R
Singh 2015	30	101.2	25	116.1	−1.05	−1.61	−0.49	−3.69	0.000	Raven SPM
Yucel 2007	19	109.1	19	115.2	−0.47	−1.10	0.16	−1.45	0.148	WAIS
Total	**329**		**327**		**−0.57**	**−0.73**	**−0.42**	**−7.16**	**0.000**	

FSIQ = Full scale IQ; M IQ OCD = Mean IQ in OCD samples; M IQ Controls = Mean IQ in control samples; WAIS-R = Wechsler Adult Intelligence Scale Revised; WAIS-III = Wechsler Adult Intelligence Scale 3rd ed.; Raven APM = Raven Advance Progressive Matrices; Raven SPM = Raven Progressive Matrices disseminated to the public and professionals by some outlets without proper supporting scientific evidence. There are also television shows, such as the USA Network series *Monk*, which show individuals with OCD using their above average intelligence—in this case to solve challenging mysteries. Yet, such beliefs about OCD may facilitate the misconception that there are advantages associated with the disorder, potentially decreasing one's motivation to seek professional help.

Conclusion

Our results indicate that individuals with OCD are characterized by lower FSIQ compared to controls, although their mean IQ was found in the normative range. Separate analyses of VIQ and PIQ indicated a slightly lower verbal IQ, but a larger discrepancy in PIQ. Such a discrepancy is not common in the context of psychopathology, and may be a result of reduced processing speed that affects primarily PIQ scores. Future studies should examine this proposed effect empirically. Importantly, in light of this discrepancy, we recommend that estimations of FSIQ in OCD, would be based on VIQ, avoiding the potential bias created by reduced processing speed. Finally, these results may help in putting a halt to a longstanding myth regarding the association between OCD and superior IQ.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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