



Published in final edited form as:

Depress Anxiety. 2010 July ; 27(7): 667–674. doi:10.1002/da.20691.

ADHD Prevalence and Association with Hoarding Behaviors in Childhood-Onset OCD

Brooke Sheppard¹, Denise Chavira, Ph.D.², Amin Azzam, M.D. M.A.¹, Marco A. Grados, M.D., M.P.H.³, Paula Umaña⁴, Helena Garrido, M.A.⁴, and Carol A. Mathews, M.D.^{1,*}

¹Department of Psychiatry, University of California, San Francisco, San Francisco, California

²Department of Psychiatry, University of California, San Diego, La Jolla, California

³Department of Psychiatry and Behavioral Sciences, Johns Hopkins School of Medicine, Baltimore, MD

⁴Departments of Psychiatry and Pediatrics, Hospital Nacional de Niños, San José, Costa Rica

Abstract

Background—It has been suggested that attention-deficit hyperactivity disorder (ADHD) and obsessive-compulsive disorder (OCD), both neurodevelopmental disorders with onset in childhood, are highly comorbid, but previous studies examining ADHD and OCD comorbidity have been quite variable, partly because of inconsistency in excluding individuals with tic disorders. Similarly, ADHD has been postulated to be associated with hoarding, although this potential relationship is largely methodologically unexplored. This study aimed to examine the prevalence of ADHD among individuals with childhood-onset OCD but without comorbid tic disorders, as well as to examine the relationship between clinically significant hoarding behaviors (hoarding) and ADHD.

Method—ADHD prevalence rates and the relationship between ADHD and hoarding were examined in 155 OCD-affected individuals (114 probands and 41 relatives, age range 4–82 years) recruited for genetic studies and compared to pooled prevalence rates derived from previously published studies.

Results—11.8% met criteria for definite ADHD, while an additional 8.6% had probable or definite ADHD (total=20.4%). 41.9% of participants with ADHD also had hoarding, compared to 29.2% of participants without ADHD. Hoarding was the only demographic or clinical variable independently associated with ADHD (odds ratio=9.54, $p<0.0001$).

Conclusion—ADHD rates were elevated in this sample of individuals with childhood-onset OCD compared to the general population rate of ADHD, and there was a strong association between ADHD and clinically significant hoarding behavior. This association is consistent with recent studies suggesting that individuals with hoarding may exhibit substantial executive functioning impairments and/or abnormalities, including attentional problems.

Keywords

Obsessive-Compulsive Disorder; Attention Deficit Hyperactivity Disorder; Comorbidity; Cognition; Hoarding; Executive Function

*Correspondence to: Carol A Mathews, M.D., University of California San Francisco, 401 Parnassus Avenue, San Francisco CA 94143-0984; cmathews@ippi.ucsf.edu.; phone: 415-476-7702; fax: 415-476-7320.

INTRODUCTION

Obsessive-compulsive disorder (OCD) is a neurodevelopmental disorder affecting about 2% of the population whose symptoms frequently begin in childhood, although a formal diagnosis is often not made until adulthood¹. OCD is highly comorbid with many psychiatric disorders, including other anxiety, depressive, and tic disorders²⁻⁴. However, its co-occurrence with attention-deficit hyperactivity disorder (ADHD), another common childhood-onset neurodevelopmental disorder that occurs in approximately 5% of the population, is less well understood⁵. This relationship is of interest for several reasons: 1) both can present with symptoms of inattention and distraction, and differentiating between primary attentional symptoms and attentional symptoms secondary to a core anxiety disorder is important for prognosis and treatment⁶; 2) OCD and ADHD are highly comorbid with Tourette Syndrome (TS)⁶, each occurring in up to 50% of individuals with TS, suggesting that these three disorders may be etiologically related⁷⁻⁹, and 3) family studies suggest that OCD and ADHD may co-segregate in families¹⁰⁻¹¹. Additionally, both ADHD and OCD are often missed or under-diagnosed, particularly during latency and early adolescence. Elucidating the relationship between these disorders will aid in appropriate diagnosis and treatment of these childhood-onset disorders, and will also advance our understanding their etiologies.

Reported prevalence rates of ADHD among individuals with OCD have varied widely, ranging from 0% to 51%¹²⁻¹³. These discrepancies are likely due to study variation in method of data acquisition, sample size, age of participants, recruitment sources, and inclusion/exclusion criteria. For example, Jaisoorya et al. examined only individuals with adult-onset OCD (mean age at interview of 23 years), likely artificially reducing the rates of ADHD in their sample (0%) due to recall bias and waning ADHD symptoms in adolescence and early adulthood. In contrast, Geller et al. sampled from a pediatric OCD referral clinic, where approximately half of the participants were under 12 years of age; in this case, the tertiary care referral source may have led to higher rates of ADHD (51%) than would be seen in other samples. In addition to differences in the age of the study sample, the presence of other comorbid disorders, in particular tic disorders, may impact reported ADHD rates in OCD samples. As noted, both OCD and ADHD are highly comorbid with TS, a tic disorder that onsets in early childhood and has a prevalence of 0.5 to 1%^{9,14}. While some of the early studies of OCD/ADHD comorbidity excluded TS and other tic disorders, many of the more recent studies (those that found higher rates of ADHD) did not (Table 1).

Further, although the relationship between tics, OCD, and ADHD has been relatively well studied, the relationship between another syndrome that frequently overlaps with OCD, and has been postulated to be highly comorbid with ADHD, clinically significant hoarding behavior (hoarding), has been comparatively under-examined¹⁵. Clinically significant hoarding is defined as the excessive acquisition of and unwillingness/inability to discard seemingly worthless items as they accumulate, leading to distress or impairment, including the inability to use work or living spaces for the purposes for which they were intended¹⁶⁻¹⁹. Hoarding behaviors occur in a number of psychiatric disorders, including OCD, where prevalence estimates range from 18-40%²⁰.

Recent research suggests that problems with executive functioning commonly seen in ADHD may also occur in both OCD and non-OCD associated hoarding, including indecisiveness, disorganization, procrastination, slowness in completing tasks, actual or perceived alterations in memory, and difficulty with concentration and attention^{15,18,21-27}. However, only three studies to date have directly or indirectly examined the relationship between hoarding (ascertained without regard to OCD status) and ADHD (Table 2)^{15,22,28}. In the Hartl et al.¹⁵ study, hoarders reported higher rates of both inattentive and hyperactive

ADHD symptoms and had higher rates of cognitive functioning deficits compared to non-hoarders. Although not directly assessing ADHD, Grisham et al²² also found that hoarders had more difficulty with sustained attention and increased impulsivity even when controlling for other clinically significant OCD symptoms, depression, and schizotypal symptoms, further suggesting an increased comorbidity between hoarding and ADHD²².

In contrast, Storch et al.²⁸ found no difference in the rates of ADHD for hoarding compared to non-hoarding participants aged 7–17 with OCD²⁸. However, given that the age of onset for hoarding symptoms is around 13, with symptoms progressing in severity over time^{29–30}, and the high rates of ADHD in the sample (29% for hoarders vs. 24% for non-hoarders), it is possible that the rate of individuals who would develop hoarding, and thus the relationship between hoarding and ADHD, was artificially low²⁸.

Given the variation in reported prevalence rates of ADHD in the context of OCD, the relative lack of studies excluding comorbid tic disorders, and the potential relationship between hoarding and ADHD, the aim of this study was to examine the prevalence of DSM-IV ADHD as well as attentional symptoms in a sample of OCD participants with childhood onset of symptoms and without comorbid tic disorders, as well as to examine the relationship between hoarding and ADHD. We hypothesized that ADHD rates would be elevated in OCD without tics over that in the general population, but would be lower than seen in OCD with tics, and that individuals with hoarding would have more DSM-IV ADHD symptoms than individuals without hoarding.

MATERIALS and METHODS

Participants

The study sample consisted of 155 OCD-affected individuals identified as a part of ongoing genetic studies of childhood-onset OCD (onset of symptoms before age 18) in the United States (n=132) and Costa Rica (n=23), including 114 OCD-affected probands and 41 OCD-affected relatives (29 first degree, 6 second degree, and 6 third degree or greater). OCD-affected probands were recruited into the genetic study via clinician referrals or through a recruitment table at the annual Obsessive-Compulsive Foundation meeting. OCD-affected relatives were recruited via probands. Exclusion criteria included history of TS, pervasive developmental disorders, bipolar disorder type 1, or a primary psychotic disorder. Relatives were included if they met DSM-IV criteria for OCD and did not have a tic disorder. The study was approved by the Institutional Review Boards of the University of California, San Francisco, the University of California, San Diego, and the Hospital Nacional de Niños in San José, Costa Rica. Informed consent (and assent for participants under age 13) was obtained for all participants.

Clinical Assessments

Diagnostic assessment instruments included the Yale-Brown Obsessive Compulsive Scale (YBOCS), the Leyton Obsessional Inventory - Childhood Version (LOI-CV), the Diagnostic Instrument for Genetic Studies (DIGS) or the Structured Clinical Interview for DSM-IV - Non-patient (SCID-NP) for adults, the Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS) for participants under age 18, the Conner's Adult ADHD Rating Scale Self-report Long Version (CAARS-S:L) for adults, the SNAP-IV Parent Rating Scale for participants under 18, and a semi-structured interview that assessed time course and impact of symptoms, presence of tics, treatment, developmental and medical history. Hoarding behaviors were identified using the YBOCS questions assessing the presence of hoarding obsessions and compulsions. The extent, type, and functional impact of hoarding behaviors were further assessed using a detailed semi-structured clinical interview.

Assessments were conducted by psychiatrists or psychologists specializing in OCD and trained in the research instruments (CAM, AA, HG).

Diagnostic Criteria

All diagnoses were made via a blinded best estimate/consensus process using all available clinical data³¹. Two ADHD classifications were examined: definite and probable ADHD. Participants were given a diagnosis of definite ADHD if they met full DSM-IV criteria. Participants were given a diagnosis of probable ADHD if they met all DSM-IV criteria but either 1) impairment was present, but could only be confirmed in one setting, or 2) impairment in two or more arenas was documented but age of symptom onset was unknown. These diagnoses were considered separately and jointly in the statistical analyses. As with ADHD, we examined two hoarding classifications: probable and definite. Participants were given a diagnosis of definite hoarding according to the definition proposed by Frost and Hartl (1996)³². Participants were given a diagnosis of probable hoarding if hoarding behaviors were present, and appeared upon interview to be substantial, but best estimators were unable to clearly establish impairment or distress. All other diagnoses, including OCD, were made according to DSM-IV criteria.

Statistical Analyses

Statistical analyses were done using STATA 11.0. We first examined the average prevalence of ADHD in OCD samples reported in the literature, initially in all published samples pooled, and then in those where tic disorders were excluded and those where tic disorders were not excluded separately. We then examined the rate of ADHD in our sample, and the association between ADHD and various clinical and demographic variables using chi square tests (for categorical variables) or t-tests (for continuous variables). Reported p-values are not corrected for multiple testing. Generalized estimating equations analyses were used to assess the association between ADHD and clinical variables of interest identified in the univariate analyses, controlling for demographic variables such as gender and age.

RESULTS

Table 3 provides the demographic and psychiatric characteristics of the sample. Sixty-four percent of participants were female. Participants had moderately severe OCD, on average (mean YBOCS total severity score = 25), and an early age of onset of symptoms (mean = 8.9 years). 21.4% of participants met criteria for definite hoarding, and an additional 11.1% met criteria for probable hoarding. The mean age of onset of hoarding symptoms was 13.4 years (SD=7.3). On average, relatives were older than were probands, more likely to be women, and less severely affected (Table 3). There were no significant differences between relatives and probands in age of OCD symptom onset, frequency of hoarding, or age of onset of hoarding symptoms. There were no differences between Costa Rican and US participants in hoarding rates. US participants were more likely to be female and had greater YBOCS severity scores (Table 4).

Comorbid psychiatric diagnoses

Of those participants for whom comorbidity data were available (N=124), depressive disorders were the most common (65.9%), followed by comorbid anxiety disorders (40.4%). 19.4% of the sample had no additional comorbidities (not including ADHD or hoarding), 37.1% had one additional comorbid psychiatric diagnosis, 25.8% had two, and 17.7% had greater than two. Probands and relatives did not differ significantly on rates of specific psychiatric comorbidities, except for depressive disorders. OCD-affected relatives had significantly fewer depressive disorders than probands (47.2% vs. 73.6%, $X^2=7.86$, $p=0.005$). US participants were more likely to have substance abuse/dependence than Costa

Rican participants; they did not differ in rates of any other psychiatric diagnoses. Number of comorbid psychiatric diagnoses did not differ between probands and relatives or between US and Costa Rican participants.

ADHD diagnoses in the current sample

11.8% of our sample met criteria for definite ADHD, and 8.6% met criteria for probable ADHD (total definite or probable ADHD = 20.4%). An additional 13.6% met symptom criteria for ADHD (primarily the inattentive subtype) but did not meet impairment or age of onset criteria. 50% had ADHD combined subtype, 33% had ADHD inattentive subtype, and 17% had ADHD hyperactive/impulsive subtype. The mean age of ADHD symptom onset was 4.3 years (SD=1.9). Probands had higher rates of ADHD diagnoses than relatives (24.6% vs. 9.5%, $\chi^2=4.22$, $p=0.04$). There were no differences between probands and relatives for prevalence of ADHD subtypes, mean number of symptoms, or age of onset (Table 3). There were no differences between Costa Rican and US participants in ADHD rates overall, although as age of onset data were not available for the Costa Rican participants, those who met the other criteria were given diagnoses of probable ADHD.

Prevalence of ADHD in OCD from previously published samples

Here we report the pooled prevalence of ADHD as derived from previously published studies and compare these rates to the ADHD rate of 11.8% found in our studies (Z score and corresponding p value). The mean ADHD prevalence rate for the previously published studies listed in Table 1 was 24.1% (11 studies, N (total number of participants)=955) ($Z=3.223$, $p=0.001$). For studies where tics were not excluded or were unknown (9 studies, N=864) the ADHD prevalence rate was 25.7% ($Z=4.869$, $p<0.0001$), whereas for studies where tics were excluded (2 studies, N=91) it was 9.9% ($Z=0.269$, $p=0.79$). When our sample was included (13 studies, N=1092), the pooled prevalence of ADHD in OCD participants overall was 22.3%, and the prevalence of ADHD in OCD participants without tics (3 studies, N= 246) was 11.0%.

Relationship between ADHD and comorbid psychiatric diagnoses

We next examined the relationships between ADHD and other psychiatric comorbid diagnoses, including hoarding, in the full sample and in probands and relatives separately (Table 3). Definite hoarding was the only comorbidity that was significantly associated with ADHD diagnoses, both in the full sample and in the proband sample; the association was not significant in the relatives. Of participants with ADHD, 42% met criteria for definite or probable hoarding. Examined in reverse, we found that 39.4% of OCD with hoarding met ADHD symptom criteria, while 21.9% met full DSM-IV ADHD criteria, and 34.4% met criteria for either definite or probable ADHD, compared to 17.5% of OCD-affected individuals without hoarding. Compared to non-hoarders, hoarders had more inattentive symptoms (mean of 4.3 symptoms vs. 3.1 symptoms, $t=-2.2431$, $p=0.0263$). There were no differences in the rates of hyperactive/impulsive symptoms between hoarders and non-hoarders (mean of 2.9 symptoms for each group).

We then examined the association between hoarding and ADHD, controlling for proband vs. relative status, sample (US vs. Costa Rican), age, gender, depression, and OCD severity (Table 5). The overall model was significant at $p=0.013$ ($\chi^2=17.84$); the only variable that was independently associated with ADHD was definite hoarding, with an odds ratio of 9.5 (95% CI=2.94–30.93) for hoarders vs. non-hoarders ($p<0.001$).

DISCUSSION

This study examined the prevalence of ADHD among individuals with childhood-onset OCD and its relation to clinical and demographic characteristics, with a particular focus on the relationship between ADHD and hoarding. It is the largest study to date in a sample of OCD-affected individuals without comorbid tic disorders. Our data suggest that ADHD symptoms are quite prominent among OCD-affected individuals, and that the rate of full syndrome ADHD as defined by the DSM-IV may also be elevated. We found, as hypothesized, that the rate of definite ADHD in our sample (11.8%) was significantly higher than the childhood ADHD rate in the general population (5%) ($Z=2.83$, $p=.005$). Additionally, the rate of ADHD in our sample was lower than the pooled prevalence rates derived from the available previously published studies of ADHD in OCD (24%) and consistent with the pooled prevalence rate of ADHD derived from previously published studies of non-tic related OCD samples only (9.9%).

Because of the high proportion of adults in our sample, leading to a potential underestimate of ADHD prevalence in our sample due to recall bias, and the lack of age of onset information for the Costa Rican participants, we also examined probable ADHD. When definite and probable ADHD were considered jointly, the prevalence rate increased to 20%. The proportion of individuals who met symptom criteria but did not meet diagnostic criteria for definite or probable ADHD was also high, at 13.6%. The vast majority of this group reported primarily inattentive symptoms.

We found, as hypothesized, that the rates of hoarding were higher in OCD-affected individuals who also had ADHD than in those who did not. In fact, the risk of ADHD was almost ten times higher in individuals with hoarding than in those without, and was the only independent predictor of ADHD in our study.

The strong association between ADHD and hoarding is consistent with recent studies suggesting that hoarders may have impairments in several areas of executive function, including attention, concentration, and organization²², preferring rather cognitive strategies that emphasize excessive attention to detail colored by indecision³³. What is not well understood is whether these problems are secondary to the hoarding syndrome, and thus are not truly representative of ADHD, or whether ADHD is indeed highly comorbid with hoarding, and perhaps arising from similar or overlapping etiologies. Our study provides support for the overlapping etiologies hypothesis: we found a substantially higher prevalence of individuals with hoarding in our sample who met full criteria for ADHD (that is, had an early age of onset and clear impairment) than in individuals without hoarding. The mean age of onset for hoarding symptoms was 14, while the mean age of onset for ADHD symptoms was 4, providing further evidence that the attentional symptoms are not merely secondary to hoarding. However, we also found elevated rates of ADHD symptoms that did not meet full DSM-IV criteria in hoarders compared to non-hoarders. We are unable to determine, in the context of this study, whether these individuals have attentional problems secondary to hoarding or whether they in fact also have ADHD comorbid with their OCD and hoarding; additional studies, such as segregation or twin studies, would be needed to more fully resolve this question.

It is interesting to note that the most prominent subtype of ADHD seen in hoarding was the inattentive subtype, and that hoarders had significantly higher rates of inattentive symptoms, but no differences in rates of hyperactive/impulsive symptoms. This finding is also consistent with the types of executive dysfunction previously reported in non-OCD hoarders, who as a group, although disorganized, are not impulsive, but rather have the opposite problem of excessive fear of making an error³².

There are a few limitations to this study. Although the sample size is larger than for other studies examining non-tic related OCD²⁻³, it is still relatively small, and may have resulted in an imprecise estimate of ADHD prevalence. We also had relatively fewer male participants in the study, which could be confounding due to the increased prevalence of ADHD in males compared with females. However, this is likely to lead to an under-estimate, rather than an over-estimate of the prevalence of ADHD in our sample. These problems are mitigated somewhat by the pooled prevalence rate of ADHD derived from previously reported samples, which is quite consistent to our reported rates. Similarly, the majority of our participants were adults, and ADHD diagnoses were therefore retrospective, potentially producing artificially low estimates of ADHD as a result of recall bias. We have attempted to mitigate this problem by also reporting rates of probable or definite ADHD, with the idea that adults who had ADHD as children may remember the symptoms but not adequately be able to recall or assess age of onset or degree of impairment. Finally, our hoarding sample consists only of = individuals with comorbid OCD and therefore, the ADHD association with hoarding that we identified cannot be generalized to the hoarding population as a whole. However, these results are consistent with the previous studies that found elevated rates of attentional deficits in hoarding samples recruited without regard to OCD diagnosis^{15,22}.

CONCLUSION

In summary, we found elevated rates of ADHD in our sample of non-tic related OCD-affected individuals, and further, an association between ADHD and hoarding symptoms in this sample. Not only are these findings clinically relevant, as the presence of comorbid ADHD may affect treatment choices for individuals with OCD and/or hoarding, but they are also etiologically relevant. Recent studies have suggested that co-occurring ADHD and OCD may actually be a distinct familial subtype, with OCD and ADHD co-segregating in some families¹⁰⁻¹¹. Although we are unable to further investigate this hypothesis in our sample, our data do suggest that if this is the case, hoarding symptoms may also be prominent in these families, and may mediate much (although likely not all) of the relationship between ADHD and OCD. The co-segregation of OCD, ADHD, and hoarding bears further examination in family and twin samples.

Acknowledgments

This research was supported by NARSAD and R01 NS048376

REFERENCES

1. Zohar AH. The epidemiology of obsessive-compulsive disorder in children and adolescents. *Child Adolesc Psychiatr Clin N Am* 1999;8(3):445-460. [PubMed: 10442225]
2. Riddle MA, Scahill L, King R, Hardin MT, Towbin KE, Ort SI, Leckman JF, Cohen DJ. Obsessive compulsive disorder in children and adolescents: phenomenology and family history. *J Am Acad Child Adolesc Psychiatry* 1990;29(5):766-772. [PubMed: 2228931]
3. Swedo SE, Rapoport JL, Leonard H, Lenane M, Cheslow D. Obsessive-compulsive disorder in children and adolescents. Clinical phenomenology of 70 consecutive cases. *Arch Gen Psychiatry* 1989;46(4):335-341. [PubMed: 2930330]
4. Geller D, Biederman J, Faraone SV, Frazier J, Coffey BJ, Kim G, Bellordre CA. Clinical correlates of obsessive compulsive disorder in children and adolescents referred to specialized and non-specialized clinical settings. *Depress Anxiety* 2000;11(4):163-168. [PubMed: 10945136]
5. Faraone SV, Sergeant J, Gillberg C, Biederman J. The worldwide prevalence of ADHD: is it an American condition? *World Psychiatry* 2003;2(2):104-113. [PubMed: 16946911]

6. de Geus F, Denys DA, Sitskoorn MM, Westenberg HG. Attention and cognition in patients with obsessive-compulsive disorder. *Psychiatry Clin Neurosci* 2007;61(1):45–53. [PubMed: 17239038]
7. Kadesjo B, Gillberg C. Tourette's disorder: epidemiology and comorbidity in primary school children. *J Am Acad Child Adolesc Psychiatry* 2000;39(5):548–555. [PubMed: 10802971]
8. Comings DE, Comings BG. Tourette syndrome: clinical and psychological aspects of 250 cases. *Am J Hum Genet* 1985;37(3):435–450. [PubMed: 3859204]
9. Gaze C, Kepley HO, Walkup JT. Co-occurring psychiatric disorders in children and adolescents with Tourette syndrome. *J Child Neurol* 2006;21(8):657–664. [PubMed: 16970866]
10. Geller D, Petty C, Vivas F, Johnson J, Pauls D, Biederman J. Further evidence for co-segregation between pediatric obsessive compulsive disorder and attention deficit hyperactivity disorder: a familial risk analysis. *Biol Psychiatry* 2007;61(12):1388–1394. [PubMed: 17241617]
11. Geller D, Petty C, Vivas F, Johnson J, Pauls D, Biederman J. Examining the relationship between obsessive-compulsive disorder and attention-deficit/hyperactivity disorder in children and adolescents: a familial risk analysis. *Biol Psychiatry* 2007;61(3):316–321. [PubMed: 16950231]
12. Jaisoorya TS, Janardhan Reddy YC, Srinath S. Is juvenile obsessive-compulsive disorder a developmental subtype of the disorder?--Findings from an Indian study. *Eur Child Adolesc Psychiatry* 2003;12(6):290–297. [PubMed: 14689261]
13. Geller DA, Biederman J, Faraone S, Agranat A, Cradock K, Hagermoser L, Kim G, Frazier J, Coffey BJ. Developmental aspects of obsessive compulsive disorder: findings in children, adolescents, and adults. *J Nerv Ment Dis* 2001;189(7):471–477. [PubMed: 11504325]
14. Stewart SE, Illmann C, Geller DA, Leckman JF, King R, Pauls DL. A controlled family study of attention-deficit/hyperactivity disorder and Tourette's disorder. *J Am Acad Child Adolesc Psychiatry* 2006;45(11):1354–1362. [PubMed: 17075358]
15. Hartl TL, Duffany SR, Allen GJ, Steketee G, Frost RO. Relationships among compulsive hoarding, trauma, and attention-deficit/hyperactivity disorder. *Behav Res Ther* 2005;43(2):269–276. [PubMed: 15629755]
16. Mueller A, Mitchell JE, Crosby RD, Glaesmer H, de Zwaan M. The prevalence of compulsive hoarding and its association with compulsive buying in a German population-based sample. *Behav Res Ther* 2009;47(8):705–709. [PubMed: 19457476]
17. Iervolino AC, Perroud N, Fullana MA, Guipponi M, Cherkas L, Collier DA, Mataix-Cols D. Prevalence and Heritability of Compulsive Hoarding: A Twin Study. *Am J Psychiatry*. 2009
18. Frost RO, Gross RC. The hoarding of possessions. *Behav Res Ther* 1993;31(4):367–381. [PubMed: 8512538]
19. Steketee G, Frost R. Compulsive hoarding: current status of the research. *Clin Psychol Rev* 2003;23(7):905–927. [PubMed: 14624821]
20. Frost RO, Krause MS, Steketee G. Hoarding and obsessive-compulsive symptoms. *Behav Modif* 1996;20(1):116–132. [PubMed: 8561769]
21. Hartl TL, Frost RO, Allen GJ, Deckersbach T, Steketee G, Duffany SR, Savage CR. Actual and perceived memory deficits in individuals with compulsive hoarding. *Depress Anxiety* 2004;20(2):59–69. [PubMed: 15390215]
22. Grisham JR, Brown TA, Savage CR, Steketee G, Barlow DH. Neuropsychological impairment associated with compulsive hoarding. *Behav Res Ther* 2007;45(7):1471–1483. [PubMed: 17341416]
23. Lawrence NS, Wooderson S, Mataix-Cols D, David R, Speckens A, Phillips ML. Decision making and set shifting impairments are associated with distinct symptom dimensions in obsessive-compulsive disorder. *Neuropsychology* 2006;20(4):409–419. [PubMed: 16846259]
24. Mataix-Cols D, Wooderson S, Lawrence N, Brammer MJ, Speckens A, Phillips ML. Distinct neural correlates of washing, checking, and hoarding symptom dimensions in obsessive-compulsive disorder. *Arch Gen Psychiatry* 2004;61(6):564–576. [PubMed: 15184236]
25. Luchian SA, McNally RJ, Hooley JM. Cognitive aspects of nonclinical obsessive-compulsive hoarding. *Behav Res Ther* 2007;45(7):1657–1662. [PubMed: 17014824]
26. Wincze JP, Steketee G, Frost RO. Categorization in compulsive hoarding. *Behav Res Ther* 2007;45(1):63–72. [PubMed: 16530724]

27. Tolin DF, Kiehl KA, Worhunsky P, Book GA, Maltby N. An exploratory study of the neural mechanisms of decision making in compulsive hoarding. *Psychol Med* 2008;1–12.
28. Storch EA, Lack CW, Merlo LJ, Geffken GR, Jacob ML, Murphy TK, Goodman WK. Clinical features of children and adolescents with obsessive-compulsive disorder and hoarding symptoms. *Compr Psychiatry* 2007;48(4):313–318. [PubMed: 17560950]
29. Ayers CR, Saxena S, Golshan S, Wetherell JL. Age at onset and clinical features of late life compulsive hoarding. *Int J Geriatr Psychiatry*. 2009
30. Grisham JR, Frost RO, Steketee G, Kim HJ, Hood S. Age of onset of compulsive hoarding. *J Anxiety Disord* 2006;20(5):675–686. [PubMed: 16112837]
31. Chavira DA, Shipon-Blum E, Hitchcock C, Cohan S, Stein MB. Selective mutism and social anxiety disorder: all in the family? *J Am Acad Child Adolesc Psychiatry* 2007;46(11):1464–1472. [PubMed: 18049296]
32. Frost RO, Hartl TL. A cognitive-behavioral model of compulsive hoarding. *Behav Res Ther* 1996;34(4):341–350. [PubMed: 8871366]
33. Samuels JF, Bienvenu OJ 3rd, Pinto A, Fyer AJ, McCracken JT, Rauch SL, Murphy DL, Grados MA, Greenberg BD, Knowles JA, Piacentini J, Cannistraro PA, Cullen B, Riddle MA, Rasmussen SA, Pauls DL, Willour VL, Shugart YY, Liang KY, Hoehn-Saric R, Nestadt G. Hoarding in obsessive-compulsive disorder: results from the OCD Collaborative Genetics Study. *Behav Res Ther* 2007;45(4):673–686. [PubMed: 16824483]
34. Toro J, Cervera M, Osejo E, Salamero M. Obsessive-compulsive disorder in childhood and adolescence: a clinical study. *J Child Psychol Psychiatry* 1992;33(6):1025–1037. [PubMed: 1400685]
35. Zohar AH, Ratzoni G, Pauls DL, Apter A, Bleich A, Kron S, Rappaport M, Weizman A, Cohen DJ. An epidemiological study of obsessive-compulsive disorder and related disorders in Israeli adolescents. *J Am Acad Child Adolesc Psychiatry* 1992;31(6):1057–1061. [PubMed: 1429405]
36. Hanna GL. Demographic and clinical features of obsessive-compulsive disorder in children and adolescents. *J Am Acad Child Adolesc Psychiatry* 1995;34(1):19–27. [PubMed: 7860451]
37. Geller DA, Biederman J, Griffin S, Jones J, Lefkowitz TR. Comorbidity of juvenile obsessive-compulsive disorder with disruptive behavior disorders. *J Am Acad Child Adolesc Psychiatry* 1996;35(12):1637–1646. [PubMed: 8973071]
38. Masi G, Millepiedi S, Mucci M, Bertini N, Pfanner C, Arcangeli F. Comorbidity of obsessive-compulsive disorder and attention-deficit/hyperactivity disorder in referred children and adolescents. *Compr Psychiatry* 2006;47(1):42–47. [PubMed: 16324901]

Table 1
Study characteristics and prevalence rates for studies examining ADHD rates in OCD participants.

Author	Year	Sample Size	Sample Ascertainment	Age (mean)	Gender (% Male)	ADHD Prevalence	TS/Tic Disorders Included
(Swedo et al.) ³	1989	70	Clinical drug trial	13.7	67	7 (10%)	No
(Riddle et al.) ²	1990	21	Clinic referrals	12.2	43	2 (10%)	No
(Toro et al.) ³⁴	1992	72	Clinic record review	12	65	4 (5.5%)	Yes
(Zohar et al.) ³⁵	1992	20	Epidemiological study	16-17	85	2 (10%)	Yes
(Haanna) ³⁶	1995	31	Clinic referral/drug trial	13.5	61	5 (16%)	Yes
(Geller et al.) ³⁷	1996	30	Clinic referrals	12.6	70	10 (33%)	Yes
(Geller et al.) ⁴	2000	187	OCD and general clinic referrals	11.9	70	99 (52%)	Yes
(Geller et al.) ¹³	2001	101	Pediatric OCD clinic referrals	<12=46 ≥12=55	65	43 (42.5%)	Yes
(Jaisoorya et al.) ¹²	2003	249	OCD clinic/Child Psych Clinic	23	67	10 (4%)	Yes
(Masi et al.) ³⁸	2006	94	Pediatric psychopharm. service referrals	13.5	69	24 (25.5%)	Yes
(Storch et al.) ²⁸	2007	80	OCD specialty clinic	13	43	20 (25%)	Not reported

Table 2

Study characteristics for studies examining attentional symptoms in hoarding participants.

Author	Year	Sample Size	Sample Ascertainment	Age (mean)	Gender (% male)	Increased Inattention In Hoarders?
(Hartl, et al) ¹⁵	2005	26	Self-help organizations for clutterers	54	15	Yes
(Grisham, et al) ²²	2007	30	Anxiety and mood d/o specialty clinic	55	33	Yes
(Storch, et al) ²⁸	2007	21	OCD specialty clinic	13	43	No

Increased inattention compared to control samples except for Storch et al, which compared OCD with hoarding to OCD without hoarding.

Table 3

Demographic and psychiatric characteristics of OCD-affected probands and their OCD-affected relatives.

	Total Sample (N=155)	Probands (N=114)	Relatives (N=41)	test	P
Age at Interview <i>m</i> (SD)	37.5 (16.3)	35 (14.1)	44 (19.9)	$F=3.1282$	0.002
OCD age at onset <i>m</i> (SD)	8.9 (4.1)	8.7 (3.8)	9.4 (4.8)	$F=0.9730$	0.332
Gender (% female)	63.9%	56.1%	85.4%	$\chi^2=11.16$	<0.001
YBOCS severity <i>m</i> (SD) (lifetime worst)	25 (9)	27.6 (7.5)	17.5 (8.6)	$F=6.87$	<0.001
ADHD (Def or Prob)	20.4%	24.6%	9.5%	$\chi^2=4.22$	0.044
ADHD age at onset <i>m</i> (SD)	4.3 (1.9)	4.1 (1.9)	5.7 (1.5)	$F=1.3788$	0.183
Meet Hyperactive/Impulsive Sx*	16.1%	17.1%	15.8%	$\chi^2=0.0367$	0.848
Meet Inattentive Sx*	25.2%	28.1%	17.1%	$\chi^2=1.9366$	0.164
Meet Combined Sx	7.1%	7.0%	7.3%	$\chi^2=0.0041$	0.949
Def. Hoarding	21.4%	19.3%	27.5%	$\chi^2=1.1830$	0.277
Def. or Prob Hoarding	32.5%	30.7%	37.5%	$\chi^2=0.6241$	0.430
Hoarding age of onset <i>m</i> (SD)	13 (7.3)	14 (8.3)	12 (5.4)	$F=0.6497$	0.518
Anxiety Disorders	40.4%	42.7%	34.4%	$\chi^2=0.6601$	0.417
Depressive Disorders	65.9%	73.0%	47.0%	$\chi^2=7.3815$	0.007
Bipolar Disorders	7.7%	7.1%	9.4%	$\chi^2=0.1756$	0.675
Eating Disorders	12.7%	11.3%	16.7%	$\chi^2=0.5763$	0.448
Substance Abuse/Dep.	27.5%	31.7%	16.7%	$\chi^2=2.4456$	0.118

* These numbers do not sum to 34% (% of the total sample that met symptom criteria for ADHD) because some individuals met criteria for both hyperactive/impulsive and inattentive symptoms.

Table 4

Psychiatric Comorbidity in ADHD vs. non-ADHD Affected OCD Participants

	ADHD	non-ADHD	Full Sample	Probands Only
			X² / p	Fisher's p
Probable or Definite Hoarding	41.9%	29.2%	1.8524 / 0.174	0.092
Definite Hoarding	35.5%	17.5%	4.7708 / 0.029*	0.013*
Anxiety Disorders	45%	39.6%	0.2013 / 0.654	0.590
Depressive Disorders	69.6%	67%	0.1076 / 0.743	1.000
Bipolar Disorders	4.8%	8.6%	0.3475 / 0.556	1.000
Eating Disorders	10%	13.6%	0.1910 / 0.662	0.676
Substance Abuse/Dependence	35%	26.4%	0.5910 / 0.442	0.567

*
 $p < 0.05$

Table 5
Demographic and Psychiatric Characteristics of the United States Sample and Costa Rican Sample.

	Total Sample (N=155)	US (N=132)	CR (N=23)	test	p
Age at Interview <i>m</i> (SD)	37.5 (16.3)	38.0	34.9	<i>t</i> =-82.58	0.410
OCD age at onset <i>m</i> (SD)	8.9 (4.1)	8.6	10.3	<i>t</i> =-1.7888	0.076
Gender (% female)	63.9%	67.4%	43.5%	$\chi^2=4.8672$	0.027*
YBOCS severity <i>m</i> (SD) (lifetime worst)	25 (9)	26	19	<i>t</i> =-3.3736	0.001*
ADHD (Def or Prob)	20.4%	21.4%	14.3%	$\chi^2=0.5601$	0.454
ADHD age at onset <i>m</i> (SD)	4.3 (1.9)	4.3 (1.9)	N/A	N/A	N/A
Meet Hyperactive/Impulsive Sx	16.1%	15.4%	12.0%	$\chi^2=0.1901$	0.663
Meet Inattentive Sx	25.2%	15.5%	12.8%	$\chi^2=0.1680$	0.682
Meet Combined Sx	7.1%	6.8%	8.7%	$\chi^2=0.1047$	0.746
Def. Hoarding	21.4%	22.1%	17.4%	$\chi^2=0.2618$	0.609
Def. or Prob Hoarding	32.5%	31.3%	39.1%	$\chi^2=0.5474$	0.459
Hoarding age of onset <i>m</i> (SD)	13 (7.3)	13.2	15.0	<i>T</i> =-0.0929	0.698
Anxiety Disorders	40.4%	42.1%	31.6%	$\chi^2=0.7289$	0.393
Depressive Disorders	65.9%	68.6%	52.4%	$\chi^2=2.0441$	0.153
Bipolar Disorders	7.7%	9.4%	0.0%	$\chi^2=2.1328$	0.144
Eating Disorders	12.7%	15.1%	0.0%	$\chi^2=2.9323$	0.087
Substance Abuse/Dep.	27.5%	31.2%	6.3%	$\chi^2=4.2543$	0.039*

Numbers include OCD-affected probands and OCD-affected relatives.

N/A=not available

* $p<0.05$

Table 6

Generalized Equations Estimate ADHD in OCD-affected individuals.

	Odds ratio (95% CI)	SE	Z	P
Gender	0.48 (0.16 – 1.47)	0.28	-1.28	0.20
Age	0.98 (0.94 – 1.01)	0.02	-1.30	0.20
Total YBOCS severity	1.02 (0.95 – 1.10)	0.04	0.57	0.57
Proband Status	1.55 (0.37 – 6.56)	1.14	0.60	0.55
Definite Hoarding	9.54 (2.94 – 30.93)	5.72	3.76	0.00
Depressive Disorder	0.57 (0.18 – 1.84)	0.34	-0.93	0.35
Costa Rican	0.45 (0.07 – 2.82)	0.42	-0.85	0.39

 $\chi^2=17.84$, $p=0.0127$