

# Prevalence of co-occurring mental health diagnoses in the autism population: A systematic review and meta-analysis

Meng-Chuan Lai, MD, PhD <sup>a,b,c,d,e,\*</sup>; Caroline Kassee, MHSc <sup>a,\*</sup>; Richard Besney, BSc <sup>a</sup>; Sarah Bonato, MIS <sup>a</sup>; Laura Hull, MSc <sup>f</sup>; William Mandy, DClinPsy, PhD <sup>f</sup>; Peter Szatmari, MD <sup>a,b,c</sup>; Stephanie H. Ameis MD, MSc <sup>a,b,c</sup>

\* Equal first author contributions

## Institutional Affiliations:

- a. The Margaret and Wallace McCain Centre for Child, Youth & Family Mental Health and Campbell Family Mental Health Research Institute, Centre for Addiction and Mental Health, Toronto, Canada
- b. Centre for Brain and Mental Health and Department of Psychiatry, The Hospital for Sick Children, Toronto, Canada
- c. Department of Psychiatry, Faculty of Medicine, University of Toronto, Toronto, Canada
- d. Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom
- e. Department of Psychiatry, National Taiwan University Hospital and College of Medicine, Taipei, Taiwan
- f. Research Department of Clinical, Educational and Health Psychology, University College London, London, United Kingdom

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**Running Title:** Co-occurring mental health conditions in autism: a meta-analysis

**Correspondence:** Meng-Chuan Lai ([mengchuan.lai@utoronto.ca](mailto:mengchuan.lai@utoronto.ca)): Tel +1 416 5358501 ext. 34050, Fax +1 416 9794996; 80 Workman Way, Toronto, ON M6J 1H4, Canada

## Abstract

**Background:** Co-occurring mental health/psychiatric conditions (CMHCs) are common in autism, impeding quality of life. Reported prevalence rates range widely. Better prevalence estimates and identification of moderators are needed to enhance recognition and care, and to guide future research.

**Methods:** We conducted a systematic review and meta-analysis according to PRISMA and MOOSE standards (pre-registered protocol: PROSPERO CRD42018103176). We searched publications from January 1<sup>st</sup>, 1993 to February 1<sup>st</sup>, 2019 using Medline, Embase, PsycINFO, Scopus, Web of Science and from the grey literature. Included articles: (1) were published in English/French, (2) reported the prevalence of CMHCs in autism and (3) reported confirmed clinical diagnoses of CMHCs and autism using DSM/ICD criteria. Risk of bias was assessed. Pooled estimates of prevalence for different CMHCs in autism were determined using random-effects models. Heterogeneity was investigated using random-effects meta-regression models.

**Findings:** Of 9,746 unique studies, 432 were selected for full-text review. Meta-analyses from 96 studies showed overall pooled estimates of: ADHD 28% (95%CI 25-32%), anxiety disorders 20% (17-23%), sleep-wake disorders 13% (9-17%), disruptive/impulse-control/conduct disorders 12% (10-15%), depressive disorders 11% (9-13%), obsessive-compulsive disorder 9% (7-10%), bipolar disorders 5% (3-6%) and schizophrenia spectrum disorders 4% (3-5%). Estimates in clinical sample-based studies were higher than population/registry-based studies. Age, gender, intellectual functioning and country of study were associated with heterogeneity, yet remaining heterogeneity not explained was still very substantial (all  $I^2 > 95\%$ ).

**Interpretation:** CMHCs are more prevalent in the autism population than in the general population. Careful assessment of mental health is an essential component of care for all people on the autism spectrum.

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## Introduction

Autism spectrum disorder (hereafter ‘autism’) is a neurodevelopmental condition characterised by early-onset social-communication difficulties and repetitive/stereotyped behaviours. Autism has been increasingly recognised with a current prevalence of ~1%.<sup>1</sup> Co-occurring mental health/psychiatric conditions (CMHCs) have been frequently reported in individuals with autism (note: we acknowledge there is no single way to refer to individuals on the autism spectrum that is universally accepted, and in the stakeholder communities preferences vary between person-first language (‘individual with autism’) and identity-first language (‘autistic individual’);<sup>2</sup> in this paper ‘individual with autism’ is used simply following the journal’s convention, rather than indicating any superiority over identity-first language), with a general impression that as many as 70% of individuals with autism have at least one CMHC, with almost 50% diagnosed with multiple CMHCs.<sup>3,4</sup> The evolution of classification systems pertaining to how autism and CMHCs are defined and diagnosed, and shifts in official exclusion criteria for CMHCs in the context of autism, play critical roles in how CMHCs are recognised. In addition, various patterns of co-occurrence may result from (1) overlap of specific symptoms of CMHCs and of autism (according to current behaviour-based criteria),<sup>5</sup> (2) potentially shared underlying mechanisms cutting across diagnostic categories of autism and CMHCs<sup>6</sup> and (3) life experiences associated with being on the autism spectrum from early in life.<sup>7</sup>

For people with autism, having CMHCs increases the possibility of poorer long-term outcomes,<sup>8–11</sup> including higher mortality.<sup>12</sup> Co-occurrence of autism and attention-deficit/hyperactivity disorder (ADHD) is associated with greater impairments in adaptive functioning, health-related quality of life and executive functioning than having autism alone.<sup>13–16</sup> Similarly, co-occurring anxiety in individuals with autism amplifies autistic symptoms, including social impairments,<sup>17–19</sup> sensory features and repetitive behaviours,<sup>19–22</sup> and may be associated with the development of depression,<sup>23,24</sup> contributing to heightened risk of suicide and early mortality.<sup>25</sup> Aggression, self-injury and oppositional behaviour may also begin or increase with the onset of depression.<sup>26</sup> Autism diagnoses are also associated with increased risk of severe mental illnesses, including psychosis spectrum and bipolar spectrum disorders.<sup>27</sup> CMHCs in autism tend to persist from childhood into adolescence,<sup>28</sup> and rates of co-occurring psychopathology increase in adults with autism,<sup>29</sup> contributing to substantial long-term negative impact on health and quality of life.

Accurate ‘prior knowledge’ of the prevalence of CMHCs in autism provides critical background information for adequate mental health evaluation and service delivery. However, prevalence estimates in the current literature vary greatly across studies.<sup>3</sup> Reported rates may differ due to different ascertainment methods or to heterogeneity amongst subgroups of autism.<sup>30</sup> In particular, it is unclear whether intellectual functioning or gender influences the recognition and diagnosis of CMHCs, and to what extent patterns of CMHCs are dependent on age. Prevalence variation may also result from socio-demographic differences between samples (eg, health care accessibility or socio-economic status). In this context, we aimed to determine the best estimates of CMHCs in autism and to identify the extent to which the aforementioned moderators account for heterogeneity amongst studies.

## **Methods**

### *Search Strategy*

We conducted this systematic review and meta-analysis (Prospero Registration Number: CRD42018103176) according to both MOOSE<sup>31</sup> and PRISMA<sup>32</sup> standards. A health-science librarian (SB) developed the search strategy in consultation with the research team, for the following bibliographic databases: Medline/Medline In Process & Other Non-Indexed Citations/Medline E-Pub Ahead of Print, EMBASE, PsycINFO, Scopus and Web of Science. Autism and CMHCs were defined using a combination of keywords and controlled vocabulary terms applicable to each individual database (Appendix p1-6). There were no publication type or language restrictions at this stage, but the search results were limited to human studies and journal articles published between January 1<sup>st</sup>, 1993 (to capture studies after the publication of ICD-10 and DSM-IV) and February 1<sup>st</sup>, 2019. A targeted grey literature search was also completed for emerging but unpublished research, including databases and websites providing information on dissertations, conference publications and other research studies in progress. The bibliographic database searches were supplemented by scanning the reference lists of identified relevant studies for additional research. References were managed using Mendeley (<https://www.mendeley.com/>), in which duplicates were removed.

### *Study Selection*

Two reviewers (CK, RB) screened titles and abstracts with support from a third reviewer (M-CL), using broad criteria to allow for the inclusion of any potentially relevant study for further evaluation. All studies included at this stage were published in English or French, reported original research using an observational design (cross-sectional or cohort) on the co-occurrence of the following CMHCs (ie, DSM-5-based *broad categories*) in populations with autism as primary diagnoses: ADHD; anxiety disorders; depressive disorders; schizophrenia spectrum and other psychotic disorders; bipolar and related disorders; obsessive-compulsive and related disorders (OCD); disruptive, impulse-control and conduct disorders; sleep-wake disorders; trauma and stress-related disorders; substance-related and addictive disorders; and gender dysphoria. Case reports, experimental studies (eg, clinical trials, observational studies on task performances) and studies with no prevalence information for primary autism populations or those with an autism sample size <20 were excluded. This autism sample size threshold was chosen to enable the opportunity to draw upon the maximum amount of information in the current literature and sample broadly to minimize bias.

Full-text articles were evaluated for inclusion by the same reviewers. Studies were included if they reported: (1) autism and CMHC diagnoses confirmed with DSM/ICD criteria *and* confirmed by clinical assessment, parent report or medical records/databases with a stated diagnosis; (2) current (instead of lifetime) diagnoses of CMHCs; and (3) the number of people with autism and CMHCs as subsets of the total autism sample (ie, autism as the primary exposure/diagnosis and CMHCs as the outcome variable). Articles were excluded if they reported: (1) CMHCs not confirmed with DSM/ICD criteria; (2) lifetime diagnoses of CMHCs, as they are more susceptible to recall biases<sup>33</sup> and obfuscate age-stratification analyses; (3) missing CMHCs information and/or it was impossible to disaggregate information so as to determine individual CMHC prevalence in autism samples; or (4) insufficient information for a risk of bias assessment (no studies were excluded based on this criterion). Disagreements of eligibility were reconciled amongst CK, RB and M-CL, and coauthors (WM, LH, SHA, PS) were consulted when required. See Appendix for detailed information on included/excluded studies.

### *Data Abstraction and Study Quality*

A standardised data extraction form was developed (available on request). Two reviewers (CK, RB) extracted and cross-checked data independently for included full-text articles, including study information, participant characteristics, and information needed to calculate pooled estimates of prevalence for each CMHC in autism.

The Hoy Risk of Bias Tool (which measures internal and external validity and has been used extensively to evaluate prevalence studies of various health conditions with different designs) was used to evaluate the study quality, of those articles that met full-text inclusion criteria.<sup>34</sup> It provides a summary score representing risk of bias based on 10 items, each scored 0 or 1 for absence or presence of bias. Summary scores of 0-3, 4-6, and 7-10 indicate low, moderate and high risk of bias, respectively. All studies were independently rated by CK and RB and checked by M-CL to resolve disagreement. Inter-rater reliability was calculated using intra-class correlations.<sup>35</sup>

### *Data Synthesis and Analysis*

We extracted data based on broad categories (as conceptualised in DSM-5) instead of specific individual diagnoses within a category (eg, ‘anxiety disorders’ instead of ‘generalised anxiety disorder’, ‘social anxiety disorder’, etc.) because available data of the latter were more limited and inconsistent across studies compared to the former. The total number in the autism sample with each CMHC was calculated using the broad categories where possible (Appendix p7-22).

A meta-analysis with a random-effects model, based on a proportions approach, was used to determine the prevalence of different CMHCs in the autism population for CMHCs with  $N \geq 15$  data-points (studies) available to ensure adequate statistical power for subgroup analysis and meta-regression.<sup>36</sup> A *meta-analysis of proportions* aims to obtain a more precise estimate of the overall proportion of a certain case/event, by computing a one-dimensional binomial measure: an average of the proportions of multiple studies, weighted by the inverse of their sampling variances in the appropriate statistical model.<sup>36,37</sup> A larger study is given more weight, so its effect size has a greater impact on the overall pooled estimate. This approach was selected given: (1) the large variability of comparison groups in the literature of CMHCs in autism (ranging from clinical to nonclinical groups) that hinders reliable and valid estimation of odds ratios; and

(2) proportions of CMHCs in an autism sample may be better understood intuitively by clinicians.

All statistical analyses were conducted using the *meta*, *metafor* and *weightr* packages in R (<https://www.r-project.org/>). Pooled estimates of prevalence were calculated using the double arcsine transformation. This was done in order to correct for non-normally distributed raw proportions that were distributed outside of the range of 0.2 to 0.8.<sup>37</sup> Heterogeneity estimates for the pooled estimate of prevalence were quantified using the  $I^2$  statistic, and its significance determined using the Cochran's Q test p-value. The  $I^2$  value is defined as the ratio of true heterogeneity to total observed variation and allows for comparison across meta-analyses (as it is not affected by sample size): 0%, 25%, 50% and 75% indicate zero, low, moderate and high levels of heterogeneity, respectively.<sup>36</sup> Both 95% confidence intervals (CIs) and prediction intervals (PIs) were reported for pooled estimates of prevalence. In order to test the robustness of our statistical model, we re-ran the main analyses using a normal-binomial model, where the within-study variance is modelled using exact likelihood solutions for the binomial distribution.<sup>38</sup>

The effects of moderators (ie, study design, age, percent-female, country-of-origin and percent-ID [intellectual disability]) were assessed using random-effects moderator analysis of subgroups and meta-regression analyses. These moderators were chosen a priori based on hypothesised sources of heterogeneity that typically stratify populations in epidemiological<sup>39</sup> and autism research.<sup>40</sup> First, a moderator analysis of subgroups compared prevalence estimates from population/registry-based studies to clinical sample-based studies.<sup>41</sup> 'Population/registry-based studies' ('Pop Reg') were defined as those whose sample encompassed the entirety of the population of people with autism in a clearly defined region, or via random sampling in the population, in the form of census studies or health registries. In contrast, 'clinical sample-based studies' ('Clin Com') recruited individuals from clinical or community service settings, which encompassed patients/clients from treatment centres, hospitals, special schools or associated community recruitment; they were therefore a *non-randomly sampled* subset of the total autism population, which may have higher rates of CMHCs than the general population.

On meta-regression examining other moderators, age was put as the reported mean or weighted mean age, or, if this was not provided, as the midpoint of age range as per prior validated methodology.<sup>40</sup> Countries were coded by the United Nation's latest (2017) Human Development Index (HDI), which is a measure of achievement in life expectancy, education and

per-capita-income where higher scores (up to 1.000) reflect higher development.<sup>42</sup> The proportion of the autism sample who were female was put as a percentage. The same applied to ID when reported directly; for studies reporting mean sample IQ and standard deviations only, percent-ID (defined as  $IQ < 70$ ) was estimated using the z distribution. For studies that gave age-stratified prevalence information, percent-female and percent-ID for each stratum were imputed using values from the whole autism sample, if specific information for each age stratum was not available. For longitudinal studies reporting current diagnoses, information from the last measured time-point was used.  $I^2$ ,  $R^2$ , QM and QE statistics were used to quantify heterogeneity and the results of moderator analyses.<sup>36</sup> The QE and QM statistics with accompanying p-values were used to determine unexplained residual heterogeneity and the significance of the moderators, respectively.<sup>41</sup> For all tests,  $p < 0.05$  was considered statistically significant.

A series of sensitivity analyses were performed (Appendix p76-112). As funnel plot asymmetry is not informative in the presence of very high heterogeneity as is present in the current analysis, funnel plot asymmetry and Egger's regression tests were not used to statistically examine small study biases as conventionally suggested;<sup>36</sup> funnel plots were provided for illustration purposes only (Appendix p85-92). Publication year was examined as a univariable moderator. Outlier analyses were conducted to determine the influence of outliers on the pooled estimates.<sup>43</sup> Baujat plots and studentized residual inspections were used to detect outlier studies in the meta-analyses. In Baujat plots, studies that appear in the top right quadrant of the plot contribute most to heterogeneity and were considered outliers,<sup>44</sup> whilst studentized residuals larger than three in absolute value were also considered outliers. Identified outliers were then removed and the overall pooled estimates were re-calculated for each CMHC to compare with the main findings. Studies were also ordered by precision to visually illustrate individual study effects on the pooled estimates. Finally, we examined if conducting the meta-analyses of proportions separately by study design, or when excluding smaller-sample studies/data-points (ie, lowest quintile per CMHC), show similar findings as the main results (Appendix p111-112).

## Results

We screened a total of 9,746 unique citations and reviewed the full text of 432 articles, with 100 unique studies being systematically reviewed based on inclusion and exclusion criteria



(Figure 1); none were further excluded at this stage due to insufficient information to assess risk of bias or being of too low quality to include. Data for different CMHCs were extracted and stratified according to age ranges as reported, so in certain cases there were several data-points from the same study (Appendix p7-21). Overall, 96 studies were meta-analysed. Trauma and stress-related disorders, substance-related and addictive disorders and gender dysphoria were not meta-analysed (N<15 data-points; Appendix p22).<sup>36</sup>

For risk of bias assessment, the case 2A intra-class correlation between reviewers was high (0.96; 95%CI 0.91-0.98). Risk of bias scores ranged from 0-4 (low to moderate biases), indicating satisfactory methodological quality in the meta-analysed literature. The most common risk was studies not having a target population that was a close representation of the national population.

The overall pooled estimates of CMHC prevalence in the autism population varied between 4% to 28% (Table 1; forest plots are shown in Appendix p28-35 due to limited space in the manuscript). All meta-analyses showed very substantial levels of heterogeneity and wide prediction intervals. Sensitivity analyses using the normal-binomial model for overall pooled estimates yielded comparable results from those of the main model (ie, 95%CI substantially overlap,  $I^2$  point estimates were similar, and point estimates of prevalence were 2-4% lower using the normal-binomial model; Appendix p110).

Study design subgroup moderator analysis showed that for all CMHCs except sleep-wake disorders, prevalence estimates from clinical sample-based studies were statistically significantly higher than those from population/registry-based studies (Table 1). Prediction intervals were wide for all CMHCs, across study designs. Remaining heterogeneity not explained by study design was still very substantial.

For meta-regressions (Table 2), due to the possibility of multi-collinearity arising from interrelated moderators,<sup>45</sup> age, HDI, percent-female and percent-ID were first assessed independently by univariable meta-regression models (Appendix p36-75). Thereafter, multivariable meta-regression models examined the combined effect of study design, age, percent-female, HDI and percent-ID for each CMHC. If data were missing for a specific variable, that study was excluded in both univariable and multivariable analyses.

Across studies, increased age was associated with lower prevalence of ADHD, and higher prevalence of depressive, bipolar and schizophrenia spectrum disorders. Studies with higher

percentage of females tended toward higher prevalence of depressive disorders. Studies including higher percentage of people with ID tended toward higher prevalence of schizophrenia spectrum disorders. Studies from countries with higher HDI tended to report lower prevalence of OCD.

In terms of studies not meta-analysed (Appendix p22), for trauma and stress-related disorders, post-traumatic stress disorder was most commonly reported, with prevalence estimates ranging 0-3·6%. For substance-related and addictive disorders, alcohol abuse and/or dependence were most commonly reported, with prevalence estimates ranging 0-11%. Gender dysphoria was reported in zero studies so far.

Finally, we carried out a series of additional sensitivity analyses. For all CMHCs (statistically significant only for anxiety, disruptive/impulse-control/conduct and schizophrenia spectrum disorders), there was a pattern of more recent publications reporting lower prevalence rates (Appendix p76-84). Funnel plot inspection across CMHCs indicated potential small study biases, although this interpretation is significantly limited by the high heterogeneity of the data (Appendix p85-92). Outlier removal did not significantly change the overall pooled estimates or 95%CIs/PIs across CMHCs (Appendix p93-109). Re-running the meta-analyses of proportions separately by study design, or with the smaller-sample (lowest quintile) data-points excluded per CMHC, did not show major differences from the main findings (ie, 95%CIs overlapped), except for a trend of lower rates particularly in clinical sample-based studies when smaller-sample studies were excluded (Appendix p111-112).

## **Discussion**

Overall, 100 studies were included in our systematic review with 96 meta-analysed. Meta-analyses identified eight frequently reported CMHCs, with pooled prevalence estimates of: ADHD 28% (95%CI 25-32%), anxiety disorders 20% (17-23%), sleep-wake disorders 13% (9-17%), disruptive/impulse-control/conduct disorders 12% (10-15%), depressive disorders 11% (9-13%), obsessive-compulsive disorder 9% (7-10%), bipolar disorders 5% (3-6%) and schizophrenia spectrum disorders 4% (3-5%). Prevalence tended to be higher in clinical samples compared with population/registry-based data, implying high needs of care for CMHCs especially in the clinical population. Some heterogeneity could be explained by age, gender,

intelligence composition of the sample, the country of origin or publication year of the study. However, there remained very substantial unexplained heterogeneity for all CMHCs after accounting for a priori-defined moderators and exploration of the effects of outliers, suggesting that other potential contributors to heterogeneity in the literature of CMHCs in autism were still not well accounted for. Furthermore, the wide prediction intervals may temper the usefulness of our prevalence estimates. For highly variable observational and epidemiological data such as those included in our meta-analyses, on a substantially heterogeneous condition such as autism,<sup>46</sup> an ongoing challenge is to delineate the many contributors to heterogeneity and to make more precise predictions accordingly.

The most striking and clinically relevant finding is that CMHCs are highly prevalent in the autism population, mostly significantly higher than general population prevalence rates reported in representative studies (Table 1). This is shown by non-overlapping prevalence estimates/CIs in people with autism (especially those from population/registry-based studies) and the prevalence/CIs found in the general population (with the exception of impulse-control disorders). However, we are not able to derive reliable and valid odds ratios in individuals with autism compared to the general population from the present meta-analyses, given the widely different sampling frames, measurement tools, comparison/control groups and variation in reporting in the meta-analysed studies.

When parsing out heterogeneity, we observed a similar pattern of emergence of psychopathology in people with autism as found in the general population. For example, depressive, bipolar and schizophrenia spectrum disorders become more prevalent with increased age and studies with more females found higher rates of depression.<sup>47</sup> ADHD diagnosis is more prevalent in younger than older ages, as has been observed in the general population.<sup>48</sup> More of the sample with ID was associated with higher probability of schizophrenia spectrum diagnoses, which matches with findings in the ID population.<sup>49</sup> Based on these, we speculate that autism may heighten the probability of developing major psychiatric disorders in a general manner, but the extent to which the patterns of emergence and factors influencing their onset and course (especially regarding the change of CMHC burden during transition stages, eg, from youth to adulthood) are different from those in neurotypical people awaits further longitudinal investigations that are sensitive to temporal relations and can capture unique phenotypic presentations of CMHCs in individuals with autism. Reasons for lower prevalence of OCD from

countries with higher HDI are unclear but may relate to different levels of autism-specific support and diagnostic practice in different countries.<sup>50</sup> More recent publication years were associated with lower reported rates of CMHCs, especially anxiety, disruptive/impulse-control/conduct and schizophrenia spectrum disorders. The underlying reasons mostly likely include progressions of research design and sampling strategies, with more large-scale population/registry-based studies published in recent years, which tend to report lower rates (as shown in the subgroup analyses).

Although the high rates of these psychiatric diagnoses can reflect true comorbidity in autism, it is still likely that measurement error and diagnostic ambiguity contribute to current rates. Diagnosing CMHCs in autism based on standard clinical practice or interview schedules designed for general population often encounters challenges and uncertainties in differential diagnosis. In certain scenarios, whether ‘mental health symptoms’ are in fact part of the presentation of autism (eg, sensory issues and avoidant behaviour being interpreted as ‘generalised anxiety’) is difficult to determine without in-depth, personalised assessment, hence rates of CMHCs may be inflated for this reason. In some other scenarios, the autism background may overshadow true CMHC symptoms (eg, not verbally reporting depressive mood due to emotion recognition and/or communication difficulties), contributing to under-estimation of rates of CMHCs. Furthermore, it can be difficult to disentangle whether functional impairment is secondary to co-occurring psychiatric symptoms (as would be necessary to warrant a CMHC diagnosis in autism), or secondary to the key characteristics of autism (meaning a CMHC diagnosis might not be warranted). These challenges point to the urgent need for new development and novel use of available mental health assessment schedules for people with autism and/or other neurodevelopmental disabilities. Such assessments should also incorporate a temporally focused terminology to disentangle the temporal development of CMHCs in autism,<sup>51</sup> to better inform causal pathways and, most importantly, clinical formulation for personalised treatment.

The high prevalence of CMHCs in autism implies that mental health assessment should be an integral aspect of clinical care with regular screening, evaluation and treatment undertaken as part of ongoing support for individuals with autism. The approach to treatment and support should be personalised and holistic, instead of treating psychiatric diagnoses in isolation, as if unrelated to the autism background. Acknowledging that autism increases the risk of major

psychiatric disorders (eg, OCD, depressive, bipolar and schizophrenia spectrum disorders) also necessitates clinical attention especially during youth and transition ages when the probability of developing these conditions increases substantially. This careful approach to assessment and care of mental health challenges in people on the autism spectrum has not yet been incorporated into real-world clinical settings,<sup>52,53</sup> even though mental health promotion has been endorsed by individuals with autism and their families as the top concern (<http://www.jla.nihr.ac.uk/priority-setting-partnerships/autism/top-10-priorities/>).

Uncovering reasons for high co-occurrence of CMHCs in autism has both scientific and clinical implications. For example, the co-occurrence of ADHD and autism may be underpinned partly by shared genetic contribution<sup>54,55</sup> and neuro-cognitive architecture,<sup>56-58</sup> as is the case for autism and anxiety.<sup>59</sup> Investigation into mechanisms and developmental trajectories leading to increased risk for CMHCs in autism, either biological or experiential, will inform targeted preventive measures and mental health promotion.

## **Strengths and Limitations**

This systematic review and meta-analysis, to our knowledge, is by far the most comprehensive, up-to-date review of literature about the prevalence of often reported CMHCs in the autism population. In addition, it is the first to take age, gender and intelligence compositions into account systematically, and across both population/registry-based and clinical sample-based studies. Inclusion criteria for both CMHCs and autism were carefully defined, providing prevalence estimates that are valid reflections of the current literature.

However, there are multiple limitations. Due to our strict inclusion/exclusion criteria, some studies carrying useful information (eg, those reporting lifetime CMHCs) were not included for review. For some CMHCs the meta-regression analyses might be under-powered (eg, a recommendation is 10 data-points per covariate),<sup>36</sup> hence our results of the source of heterogeneity should be considered exploratory and require future confirmation. Some clinical/community-based studies could have samples overlapping with those in the larger population/registry-based studies, but it is impossible to disentangle this analytically due to a lack of such primary information in the data sources; to address this we estimated the pooled prevalence separately for the two categories (Appendix p111-112), which showed comparable

rates as those derived from the moderator analyses (Table 1). Further, very substantial heterogeneity remained unaccounted for across all CMHCs examined, even after accounting for hypothetical contributors derived from existing epidemiological literature and excluding outlier studies. Also, prediction intervals for all pooled estimates of prevalence were wide, predicting high variability of estimates in future studies until the heterogeneity of autism can be more clearly parsed out. A fundamental limitation of the autism research literature (including those about CMHCs) is the huge heterogeneity. Potential small study effects (some may relate to publication bias and some reflect other, including true heterogeneity) were noted for many CMHCs, limiting the generalisability of findings and again signifying the impact of large heterogeneity in this literature. Fine-grained primary empirical research design is required to further elucidate heterogeneity (eg, measuring CMHCs in stratified autism subgroups such as by intellectual/communication abilities, gender, clinical profile, genetic or neurological background). Given the complexity and variation of how CMHCs were reported in the literature, we were unable to meta-analyse illness loads (ie, number of CMHCs or clinical severity) or patterns of co-occurrence (ie, what CMHCs tend to aggregate). More consistent report of illness loads and patterns of co-occurrence in future primary studies will provide further insight. Also, due to changes in diagnostic classifications of both autism and CMHCs over the past decades, differences in diagnostic categories used between studies can result in varied estimates of CMHC prevalence in autism. Finally, all findings were derived from observational studies; the causal and developmental relations underlying such associations await clarification by new primary studies that measure temporal relations between autism and CMHCs<sup>51</sup> and investigate underpinning mechanisms.

## **Conclusions**

CMHCs are common in autism, with apparently high prevalence across a variety of diagnostic categories. Such co-occurrence warrants clinical attention and aetiological investigations to uncover shared underpinnings and sources of vulnerability associated with autism. Mental health promotion should be an essential component of care for all individuals on the autism spectrum. Valid and standardised measures of mental health challenges in people with autism and/or other neurodevelopmental disabilities are needed to facilitate accurate diagnosis.



## Research in Context

### **Evidence before this study**

Prior to conducting this systematic review and meta-analysis, as a preparatory scoping review we searched PubMed for published observational studies, using combinations of search terms that include ‘autis\*’, ‘mental health’, ‘psychiatr\*’, ‘comorbid\*’, ‘co-occurring’ and ‘disorder’. Our search did not have language or date restrictions. We identified a wide variety of observational studies reporting divergent prevalence rates of mental health symptoms or psychiatric diagnoses (using various tools and definitions) in the autism population, with substantial variability in study design (ie, from small-sample clinical studies to national population-based registry studies), across wide age range, gender composition, rates of co-occurring intellectual disability and countries of origin. Most commonly studied conditions include ADHD, anxiety, depression, bipolar disorder, OCD, psychosis and sleep difficulties. However, the range of reported prevalence of co-occurring psychiatric diagnoses varies hugely (eg, 1-86% for ADHD, 1-70% for depressive disorders). What could be detrimental is that the prevalence rates of specific co-occurring psychiatric diagnoses cited in other empirical research, review and guideline papers vary greatly depending on the cited studies. Based on these observations, we consider it to be necessary to conduct systematic reviews and meta-analyses to determine the best estimates of co-occurring psychiatric conditions in autism and to identify sources of heterogeneity amongst studies. Such ‘prior knowledge’ will provide critical background information for adequate mental health evaluation and service delivery. We designed two protocols, one focusing on co-occurring psychiatric diagnoses and another focusing on mental health symptoms in the autism population, and pre-registered them with PROSPERO (CRD42018103176, CRD42018103178). We reported findings from the first protocol in this paper.

### **Added value of this study**

We identified eight co-occurring psychiatric diagnoses most commonly reported in the literature. From 96 meta-analysed studies, we found the pooled prevalence rates in the autism population ranged from 28% for ADHD, 20% for anxiety disorders, 13% for sleep-wake disorders, 12% for disruptive/impulse-control/conduct disorders, 11% for depressive disorders, 9% for obsessive-compulsive disorder, to 5% for bipolar disorders and 4% for schizophrenia



spectrum disorders. Estimates in clinical sample-based studies were higher than population/registry-based studies. Age, gender, intellectual functioning, country of study and publication year were associated with heterogeneity in the literature, yet there are still substantial remaining, unexplained sources of heterogeneity.

**Implications of all the available evidence**

Co-occurring psychiatric diagnoses are common in the autism population across the lifespan. Mental health promotion, improved assessment and adequate treatment of mental health concerns are essential for care and support for the autism population.

**Author Contributions**

M-CL and CK contributed equally as first authors. M-CL, PS and SHA contributed to study concept and design. M-CL and CK contributed to drafting of the manuscript. All authors contributed to literature search, data collection, data analysis, data interpretation and critical revision of the manuscript for important intellectual content. CK contributed to statistical analysis. M-CL and SHA obtained funding support for this study. CK, RB, SB contributed to administrative, technical or material support.

**Conflict of Interest Disclosures**

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## TABLES

**Table 1. Pooled Estimate of Prevalence and Moderator Analysis of Study Design**

	POOLED ESTIMATE OF PREVALENCE		MODERATOR ANALYSIS: STUDY DESIGN					<sup>d</sup> Reported prevalence in the general population
<sup>a</sup> Co-occurring mental health condition	Prevalence in autism population <sup>b</sup> (95%CI) <sup>b</sup> [95%PI]	I <sup>2</sup> % (95%CI) [Cochran's Q Test p-value]	Pop Reg (95%CI) [95%PI]	Clin Com (95%CI) [95%PI]	R <sup>2</sup> % ( <sup>c</sup> QE p-value)	I <sup>2</sup> % (95%CI)	<sup>c</sup> QM p-value	Prevalence (95%CI or standard error)
<b>ADHD</b> (N = 89) (n = 210,249)	28% (25-32%) [4-63%]	99.65 (99.55-99.85) [<0.0001]	22% (17-26%) [1-55%]	34% (29-39%) [7-69%]	2.05 (<0.0001)	99.64 (99.60-99.84)	<0.001	7.2% (6.7-7.8%) (point prevalence, aged ≤18 years) <sup>50</sup>
<b>Anxiety Disorders</b> (N = 68) (n = 169,829)	20% (17-23%) [2-48%]	99.53 (99.42-99.87) [<0.0001]	15% (11-19%) [0.5-42%]	26% (22-31%) [1-56%]	0.00 (<0.0001)	99.54 (99.20-99.85)	<0.001	7.3% (4.8-10.9%) (current prevalence, across ages) <sup>60</sup>
<b>Depressive Disorders</b> (N = 65) (n = 162,671)	11% (9-13%) [0-33%]	99.41 (99.39-99.81) [<0.0001]	8% (5-11%) [0.01-28%]	14% (11-18%) [1-38%]	0.23 (<0.0001)	99.40 (99.37-99.80)	<0.001	4.7% (4.4-5.0 %) (point prevalence of MDD, across ages) <sup>61</sup>
<b>Bipolar and Related Disorders</b> (N = 38) (n = 153,192)	5% (3-6%) [0-19%]	99.50 (99.40-99.82) [<0.0001]	3% (2-5%) [0-16%]	7% (4-10%) [0-24%]	0.35 (<0.0001)	99.50 (99.48-99.81)	0.018	0.71% (0.56-0.86%) for Bipolar I; 0.50% (0.35-0.64%) for Bipolar II (1-year prevalence, across ages) <sup>62</sup>
<b>Schizophrenia</b>	4%	99.18	2%	7%	0.00	99.18	<0.001	0.456% (0.409-



<b>Spectrum and Psychotic Disorders</b> (N = 42) (n = 166,627)	(3-5%) [0-14%]	(99.00-99.87) [<0.0001]	(1-4%) [0-11%]	(4-9%) [0-19%]	(<0.000 1)	(99.01- 99.84)		0.503%) (1-year prevalence, across ages) <sup>63</sup>
<b>Obsessive-Compulsive Disorder</b> (N = 47) (n = 53,243)	9% (7-10%) [1-21%]	96.85 (96.75-99.87) [<0.0001]	4% (2-6%) [0-13%]	12% (10-15%) [3-26%]	12.51 (<0.000 1)	96.20 (96.17- 99.37)	<0.001	0.7% (0.4-1.1%) (1-year prevalence, aged ≥18 years) <sup>64</sup>
<b>Disruptive, Impulse-Control and Conduct Disorders</b> (N = 50) (n = 140,946)	12% (10-15%) [0-36%]	99.52 (99.47-99.90) [<0.0001]	7% (4-10%) [0-28%]	22% (17-27%) [3-50%]	0.00 (<0.000 1)	99.53 (99.42- 99.88)	<0.001	8.9% (standard error=0.5%) (1-year prevalence, aged ≥18 years) <sup>65</sup>
<b>Sleep-Wake Disorders</b> (N = 26) (n = 190,963)	13% (9-17%) [0-43%]	99.87 (99.78-99.93) [<0.0001]	11% (7-17%) [0-39%]	16% (8-25%) [0-47%]	8.52 (<0.000 1)	99.85 (99.77- 99.91)	0.356	3.7% (1-year prevalence, aged ≤18 years) <sup>66</sup>

- N = number of data-points in meta-analyses; n = sample size for individuals with autism included across studies
- CI = confidence interval, PI = prediction interval
- QE = test of residual heterogeneity; QM = test of moderators, statistical significance at  $p < 0.05$
- General population estimates were selected from latest meta-analyses and/or large-scale population-based studies; see citations

**Table 2. Univariable and Multivariable Meta-Regressions**

	<b>UNIVARIABLE META-REGRESSION</b>				<b><sup>c</sup> MULTIVARIABLE META-REGRESSION</b>		
<b><sup>a</sup> Co-occurring mental health condition</b>	<b>Covariate</b>	<b><sup>b</sup> R<sup>2</sup>%</b>	<b>I<sup>2</sup>% (95%CI)</b>	<b>QM p-value</b>	<b><sup>b</sup> R<sup>2</sup>%</b>	<b>I<sup>2</sup>% (95%CI)</b>	<b>QM p-value</b>
<b>ADHD (N = 89) (n = 210,249)</b>	Age	7.72	99.78 (99.70-99.84)	<0.001	13.06	99.73 (99.61-99.82)	0.019
	%ID	0.00	99.77 (99.68-99.85)	0.764			
	HDI	3.55	99.79 (99.72-99.85)	0.050			
	%Female	1.50	99.75 (99.66-99.82)	0.137			
<b>Anxiety Disorders (N = 68) (n = 169,829)</b>	Age	0.00	99.80 (99.72-99.86)	0.557	3.87	99.76 (99.65-99.85)	0.226
	%ID	0.00	99.80 (99.71-99.87)	0.353			
	HDI	0.00	99.80 (99.73-99.87)	0.977			
	%Female	0.00	99.76 (99.67-99.84)	0.937			
<b>Depressive Disorders (N = 65) (n = 162,671)</b>	Age	21.42	99.61 (99.46-99.75)	<0.001	43.39	99.34 (99.02-99.61)	<0.001
	%ID	0.00	99.65 (99.49-99.78)	0.817			
	HDI	0.00	99.72 (99.61-99.81)	0.839			
	%Female	6.17	99.66 (99.52-99.77)	0.025			
<b>Bipolar and</b>	Age	17.72	99.61	0.004	30.38	99.47	0.001

<b>Related Disorders</b> <b>(N = 38)</b> <b>(n = 153,192)</b>			(99.39-99.78)			(99.10-99.74)	
	%ID	8.71	99.62 (99.38-99.80)	0.071			
	HDI	0.00	99.71 (99.55-99.83)	0.856			
	%Female	3.25	99.68 (99.49-99.81)	0.133			
<b>Schizophrenia Spectrum and Psychotic Disorders</b> <b>(N = 42)</b> <b>(n = 166,627)</b>	Age	24.00	99.66 (99.51-99.82)	<0.001	38.48	99.53 (99.31-99.80)	<0.001
	%ID	20.29	99.67 (99.52-99.84)	<0.001			
	HDI	0.00	99.76 (99.65-99.87)	0.193			
	%Female	3.72	99.74 (99.63-99.87)	0.193			
<b>Obsessive-Compulsive Disorder</b> <b>(N = 47)</b> <b>(n = 53,243)</b>	Age	0.30	99.08 (98.63-99.44)	0.302	65.32	95.36 (92.13-97.46)	<0.001
	%ID	4.86	98.41 (97.55-99.10)	0.117			
	HDI	33.59	98.76 (98.08-99.22)	<0.001			
	%Female	0.23	98.87 (98.28-99.32)	0.299			
<b>Disruptive, Impulse-Control and Conduct Disorders</b> <b>(N = 50)</b> <b>(n = 140,946)</b>	Age	0.00	99.84 (99.76-99.90)	0.372	10.61	99.80 (99.67-99.90)	0.115
	%ID	0.00	99.83 (99.73-99.90)	0.569			
	HDI	0.00	99.85 (99.78-99.90)	0.786			
	%Female	0.00	99.84 (99.77-99.90)	0.336			
<b>Sleep-Wake Disorders</b>	Age	0.00	99.86 (99.77-99.93)	0.855	48.27	98.95 (97.76-99.66)	0.002

<b>(N = 26)</b> <b>(n = 190,963)</b>	%ID	0.00	99.42 (98.92-99.78)	0.951			
	HDI	0.00	99.87 (99.79-99.94)	0.412			
	%Female	0.00	99.86 (99.77-99.93)	0.426			

- a. N = number of data-points in meta-analyses; n = sample size for individuals with autism included across studies  
b. QE test of residual heterogeneity for  $R^2$  is statistically significant for all CMHC meta-analysed, with  $p < 0.0001$ , for all cases  
c. For all CMHCs, multivariable meta-regression model covariates are study design, age, percent-female, percent-ID and HDI

## FIGURES

**Figure 1. PRISMA Flowchart for Study Selection**

# **Prevalence of co-occurring mental health diagnoses in the autism population: A systematic review and meta-analysis**

Meng-Chuan Lai, MD, PhD <sup>a,b,c,d,e,\*</sup>; Caroline Kasse, MHSc <sup>a,\*</sup>; Richard Besney, BSc <sup>a</sup>; Sarah Bonato, MIS <sup>a</sup>; Laura Hull, MSc <sup>f</sup>; William Mandy, DClinPsy, PhD <sup>f</sup>; Peter Szatmari, MD <sup>a,b,c</sup>; Stephanie H. Ameis MD, MSc <sup>a,b,c</sup>

\* Equal first author contributions

## **Institutional Affiliations:**

- a. The Margaret and Wallace McCain Centre for Child, Youth & Family Mental Health and Campbell Family Mental Health Research Institute, Centre for Addiction and Mental Health, Toronto, Canada
- b. Centre for Brain and Mental Health and Department of Psychiatry, The Hospital for Sick Children, Toronto, Canada
- c. Department of Psychiatry, Faculty of Medicine, University of Toronto, Toronto, Canada
- d. Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom
- e. Department of Psychiatry, National Taiwan University Hospital and College of Medicine, Taipei, Taiwan
- f. Research Department of Clinical, Educational and Health Psychology, University College London, London, United Kingdom

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**Running Title:** Co-occurring mental health conditions in autism: a meta-analysis

**Correspondence:** Meng-Chuan Lai ([mengchuan.lai@utoronto.ca](mailto:mengchuan.lai@utoronto.ca)): Tel +1 416 5358501 ext. 34050, Fax +1 416 9794996; 80 Workman Way, Toronto, ON M6J 1H4, Canada

## Abstract

**Background:** Co-occurring mental health/psychiatric conditions (CMHCs) are common in autism, impeding quality of life. Reported prevalence rates range widely. Better prevalence estimates and identification of moderators are needed to enhance recognition and care, and to guide future research.

**Methods:** We conducted a systematic review and meta-analysis according to PRISMA and MOOSE standards (pre-registered protocol: PROSPERO CRD42018103176). We searched publications from January 1<sup>st</sup>, 1993 to February 1<sup>st</sup>, 2019 using Medline, Embase, PsycINFO, Scopus, Web of Science and from the grey literature. Included articles: (1) were published in English/French, (2) reported the prevalence of CMHCs in autism and (3) reported confirmed clinical diagnoses of CMHCs and autism using DSM/ICD criteria. Risk of bias was assessed. Pooled estimates of prevalence for different CMHCs in autism were determined using random-effects models. Heterogeneity was investigated using random-effects meta-regression models.

**Findings:** Of 9,746 unique studies, 432 were selected for full-text review. Meta-analyses from 96 studies showed overall pooled estimates of: ADHD 28% (95%CI 25-32%), anxiety disorders 20% (17-23%), sleep-wake disorders 13% (9-17%), disruptive/impulse-control/conduct disorders 12% (10-15%), depressive disorders 11% (9-13%), obsessive-compulsive disorder 9% (7-10%), bipolar disorders 5% (3-6%) and schizophrenia spectrum disorders 4% (3-5%). Estimates in clinical sample-based studies were higher than population/registry-based studies. Age, gender, intellectual functioning and country of study were associated with heterogeneity, yet remaining heterogeneity not explained was still very substantial (all  $I^2 > 95\%$ ).

**Interpretation:** CMHCs are more prevalent in the autism population than in the general population. Careful assessment of mental health is an essential component of care for all people on the autism spectrum.

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## Introduction

Autism spectrum disorder (hereafter ‘autism’) is a neurodevelopmental condition characterised by early-onset social-communication difficulties and repetitive/stereotyped behaviours. Autism has been increasingly recognised with a current prevalence of ~1%.<sup>1</sup> Co-occurring mental health/psychiatric conditions (CMHCs) have been frequently reported in individuals with autism (note: we acknowledge there is no single way to refer to individuals on the autism spectrum that is universally accepted, and in the stakeholder communities preferences vary between person-first language (‘individual with autism’) and identity-first language (‘autistic individual’);<sup>2</sup> in this paper ‘individual with autism’ is used simply following the journal’s convention, rather than indicating any superiority over identity-first language), with a general impression that as many as 70% of individuals with autism have at least one CMHC, with almost 50% diagnosed with multiple CMHCs.<sup>3,4</sup> The evolution of classification systems pertaining to how autism and CMHCs are defined and diagnosed, and shifts in official exclusion criteria for CMHCs in the context of autism, play critical roles in how CMHCs are recognised. In addition, various patterns of co-occurrence may result from (1) overlap of specific symptoms of CMHCs and of autism (according to current behaviour-based criteria),<sup>5</sup> (2) potentially shared underlying mechanisms cutting across diagnostic categories of autism and CMHCs<sup>6</sup> and (3) life experiences associated with being on the autism spectrum from early in life.<sup>7</sup>

For people with autism, having CMHCs increases the possibility of poorer long-term outcomes,<sup>8–11</sup> including higher mortality.<sup>12</sup> Co-occurrence of autism and attention-deficit/hyperactivity disorder (ADHD) is associated with greater impairments in adaptive functioning, health-related quality of life and executive functioning than having autism alone.<sup>13–16</sup> Similarly, co-occurring anxiety in individuals with autism amplifies autistic symptoms, including social impairments,<sup>17–19</sup> sensory features and repetitive behaviours,<sup>19–22</sup> and may be associated with the development of depression,<sup>23,24</sup> contributing to heightened risk of suicide and early mortality.<sup>25</sup> Aggression, self-injury and oppositional behaviour may also begin or increase with the onset of depression.<sup>26</sup> Autism diagnoses are also associated with increased risk of severe mental illnesses, including psychosis spectrum and bipolar spectrum disorders.<sup>27</sup> CMHCs in autism tend to persist from childhood into adolescence,<sup>28</sup> and rates of co-occurring psychopathology increase in adults with autism,<sup>29</sup> contributing to substantial long-term negative impact on health and quality of life.



Accurate ‘prior knowledge’ of the prevalence of CMHCs in autism provides critical background information for adequate mental health evaluation and service delivery. However, prevalence estimates in the current literature vary greatly across studies.<sup>3</sup> Reported rates may differ due to different ascertainment methods or to heterogeneity amongst subgroups of autism.<sup>30</sup> In particular, it is unclear whether intellectual functioning or gender influences the recognition and diagnosis of CMHCs, and to what extent patterns of CMHCs are dependent on age. Prevalence variation may also result from socio-demographic differences between samples (eg, health care accessibility or socio-economic status). In this context, we aimed to determine the best estimates of CMHCs in autism and to identify the extent to which the aforementioned moderators account for heterogeneity amongst studies.

## **Methods**

### *Search Strategy*

We conducted this systematic review and meta-analysis (Prospero Registration Number: CRD42018103176) according to both MOOSE<sup>31</sup> and PRISMA<sup>32</sup> standards. A health-science librarian (SB) developed the search strategy in consultation with the research team, for the following bibliographic databases: Medline/Medline In Process & Other Non-Indexed Citations/Medline E-Pub Ahead of Print, EMBASE, PsycINFO, Scopus and Web of Science. Autism and CMHCs were defined using a combination of keywords and controlled vocabulary terms applicable to each individual database (Appendix p1-6). There were no publication type or language restrictions at this stage, but the search results were limited to human studies and journal articles published between January 1<sup>st</sup>, 1993 (to capture studies after the publication of ICD-10 and DSM-IV) and February 1<sup>st</sup>, 2019. A targeted grey literature search was also completed for emerging but unpublished research, including databases and websites providing information on dissertations, conference publications and other research studies in progress. The bibliographic database searches were supplemented by scanning the reference lists of identified relevant studies for additional research. References were managed using Mendeley (<https://www.mendeley.com/>), in which duplicates were removed.

### *Study Selection*

Two reviewers (CK, RB) screened titles and abstracts with support from a third reviewer (M-CL), using broad criteria to allow for the inclusion of any potentially relevant study for further evaluation. All studies included at this stage were published in English or French, reported original research using an observational design (cross-sectional or cohort) on the co-occurrence of the following CMHCs (ie, DSM-5-based *broad categories*) in populations with autism as primary diagnoses: ADHD; anxiety disorders; depressive disorders; schizophrenia spectrum and other psychotic disorders; bipolar and related disorders; obsessive-compulsive and related disorders (OCD); disruptive, impulse-control and conduct disorders; sleep-wake disorders; trauma and stress-related disorders; substance-related and addictive disorders; and gender dysphoria. Case reports, experimental studies (eg, clinical trials, observational studies on task performances) and studies with no prevalence information for primary autism populations or those with an autism sample size <20 were excluded. This autism sample size threshold was chosen to enable the opportunity to draw upon the maximum amount of information in the current literature and sample broadly to minimize bias.

Full-text articles were evaluated for inclusion by the same reviewers. Studies were included if they reported: (1) autism and CMHC diagnoses confirmed with DSM/ICD criteria *and* confirmed by clinical assessment, parent report or medical records/databases with a stated diagnosis; (2) current (instead of lifetime) diagnoses of CMHCs; and (3) the number of people with autism and CMHCs as subsets of the total autism sample (ie, autism as the primary exposure/diagnosis and CMHCs as the outcome variable). Articles were excluded if they reported: (1) CMHCs not confirmed with DSM/ICD criteria; (2) lifetime diagnoses of CMHCs, as they are more susceptible to recall biases<sup>33</sup> and obfuscate age-stratification analyses; (3) missing CMHCs information and/or it was impossible to disaggregate information so as to determine individual CMHC prevalence in autism samples; or (4) insufficient information for a risk of bias assessment (no studies were excluded based on this criterion). Disagreements of eligibility were reconciled amongst CK, RB and M-CL, and coauthors (WM, LH, SHA, PS) were consulted when required. See Appendix for detailed information on included/excluded studies.

#### *Data Abstraction and Study Quality*

A standardised data extraction form was developed (available on request). Two reviewers (CK, RB) extracted and cross-checked data independently for included full-text articles, including study information, participant characteristics, and information needed to calculate pooled estimates of prevalence for each CMHC in autism.

The Hoy Risk of Bias Tool (which measures internal and external validity and has been used extensively to evaluate prevalence studies of various health conditions with different designs) was used to evaluate the study quality, of those articles that met full-text inclusion criteria.<sup>34</sup> It provides a summary score representing risk of bias based on 10 items, each scored 0 or 1 for absence or presence of bias. Summary scores of 0-3, 4-6, and 7-10 indicate low, moderate and high risk of bias, respectively. All studies were independently rated by CK and RB and checked by M-CL to resolve disagreement. Inter-rater reliability was calculated using intra-class correlations.<sup>35</sup>

### *Data Synthesis and Analysis*

We extracted data based on broad categories (as conceptualised in DSM-5) instead of specific individual diagnoses within a category (eg, ‘anxiety disorders’ instead of ‘generalised anxiety disorder’, ‘social anxiety disorder’, etc.) because available data of the latter were more limited and inconsistent across studies compared to the former. The total number in the autism sample with each CMHC was calculated using the broad categories where possible (Appendix p7-22).

A meta-analysis with a random-effects model, based on a proportions approach, was used to determine the prevalence of different CMHCs in the autism population for CMHCs with  $N \geq 15$  data-points (studies) available to ensure adequate statistical power for subgroup analysis and meta-regression.<sup>36</sup> A *meta-analysis of proportions* aims to obtain a more precise estimate of the overall proportion of a certain case/event, by computing a one-dimensional binomial measure: an average of the proportions of multiple studies, weighted by the inverse of their sampling variances in the appropriate statistical model.<sup>36,37</sup> A larger study is given more weight, so its effect size has a greater impact on the overall pooled estimate. This approach was selected given: (1) the large variability of comparison groups in the literature of CMHCs in autism (ranging from clinical to nonclinical groups) that hinders reliable and valid estimation of odds ratios; and

(2) proportions of CMHCs in an autism sample may be better understood intuitively by clinicians.

All statistical analyses were conducted using the *meta*, *metafor* and *weightr* packages in R (<https://www.r-project.org/>). Pooled estimates of prevalence were calculated using the double arcsine transformation. This was done in order to correct for non-normally distributed raw proportions that were distributed outside of the range of 0.2 to 0.8.<sup>37</sup> Heterogeneity estimates for the pooled estimate of prevalence were quantified using the  $I^2$  statistic, and its significance determined using the Cochran's Q test p-value. The  $I^2$  value is defined as the ratio of true heterogeneity to total observed variation and allows for comparison across meta-analyses (as it is not affected by sample size): 0%, 25%, 50% and 75% indicate zero, low, moderate and high levels of heterogeneity, respectively.<sup>36</sup> Both 95% confidence intervals (CIs) and prediction intervals (PIs) were reported for pooled estimates of prevalence. In order to test the robustness of our statistical model, we re-ran the main analyses using a normal-binomial model, where the within-study variance is modelled using exact likelihood solutions for the binomial distribution.<sup>38</sup>

The effects of moderators (ie, study design, age, percent-female, country-of-origin and percent-ID [intellectual disability]) were assessed using random-effects moderator analysis of subgroups and meta-regression analyses. These moderators were chosen a priori based on hypothesised sources of heterogeneity that typically stratify populations in epidemiological<sup>39</sup> and autism research.<sup>40</sup> First, a moderator analysis of subgroups compared prevalence estimates from population/registry-based studies to clinical sample-based studies.<sup>41</sup> 'Population/registry-based studies' ('Pop Reg') were defined as those whose sample encompassed the entirety of the population of people with autism in a clearly defined region, or via random sampling in the population, in the form of census studies or health registries. In contrast, 'clinical sample-based studies' ('Clin Com') recruited individuals from clinical or community service settings, which encompassed patients/clients from treatment centres, hospitals, special schools or associated community recruitment; they were therefore a *non-randomly sampled* subset of the total autism population, which may have higher rates of CMHCs than the general population.

On meta-regression examining other moderators, age was put as the reported mean or weighted mean age, or, if this was not provided, as the midpoint of age range as per prior validated methodology.<sup>40</sup> Countries were coded by the United Nation's latest (2017) Human Development Index (HDI), which is a measure of achievement in life expectancy, education and

per-capita-income where higher scores (up to 1.000) reflect higher development.<sup>42</sup> The proportion of the autism sample who were female was put as a percentage. The same applied to ID when reported directly; for studies reporting mean sample IQ and standard deviations only, percent-ID (defined as  $IQ < 70$ ) was estimated using the z distribution. For studies that gave age-stratified prevalence information, percent-female and percent-ID for each stratum were imputed using values from the whole autism sample, if specific information for each age stratum was not available. For longitudinal studies reporting current diagnoses, information from the last measured time-point was used.  $I^2$ ,  $R^2$ , QM and QE statistics were used to quantify heterogeneity and the results of moderator analyses.<sup>36</sup> The QE and QM statistics with accompanying p-values were used to determine unexplained residual heterogeneity and the significance of the moderators, respectively.<sup>41</sup> For all tests,  $p < 0.05$  was considered statistically significant.

A series of sensitivity analyses were performed (Appendix p76-112). As funnel plot asymmetry is not informative in the presence of very high heterogeneity as is present in the current analysis, funnel plot asymmetry and Egger's regression tests were not used to statistically examine small study biases as conventionally suggested;<sup>36</sup> funnel plots were provided for illustration purposes only (Appendix p85-92). Publication year was examined as a univariable moderator. Outlier analyses were conducted to determine the influence of outliers on the pooled estimates.<sup>43</sup> Baujat plots and studentized residual inspections were used to detect outlier studies in the meta-analyses. In Baujat plots, studies that appear in the top right quadrant of the plot contribute most to heterogeneity and were considered outliers,<sup>44</sup> whilst studentized residuals larger than three in absolute value were also considered outliers. Identified outliers were then removed and the overall pooled estimates were re-calculated for each CMHC to compare with the main findings. Studies were also ordered by precision to visually illustrate individual study effects on the pooled estimates. Finally, we examined if conducting the meta-analyses of proportions separately by study design, or when excluding smaller-sample studies/data-points (ie, lowest quintile per CMHC), show similar findings as the main results (Appendix p111-112).

## Results

We screened a total of 9,746 unique citations and reviewed the full text of 432 articles, with 100 unique studies being systematically reviewed based on inclusion and exclusion criteria

(Figure 1); none were further excluded at this stage due to insufficient information to assess risk of bias or being of too low quality to include. Data for different CMHCs were extracted and stratified according to age ranges as reported, so in certain cases there were several data-points from the same study (Appendix p7-21). Overall, 96 studies were meta-analysed. Trauma and stress-related disorders, substance-related and addictive disorders and gender dysphoria were not meta-analysed (N<15 data-points; Appendix p22).<sup>36</sup>

For risk of bias assessment, the case 2A intra-class correlation between reviewers was high (0.96; 95%CI 0.91-0.98). Risk of bias scores ranged from 0-4 (low to moderate biases), indicating satisfactory methodological quality in the meta-analysed literature. The most common risk was studies not having a target population that was a close representation of the national population.

The overall pooled estimates of CMHC prevalence in the autism population varied between 4% to 28% (Table 1; forest plots are shown in Appendix p28-35 due to limited space in the manuscript). All meta-analyses showed very substantial levels of heterogeneity and wide prediction intervals. Sensitivity analyses using the normal-binomial model for overall pooled estimates yielded comparable results from those of the main model (ie, 95%CI's substantially overlap,  $I^2$  point estimates were similar, and point estimates of prevalence were 2-4% lower using the normal-binomial model; Appendix p110).

Study design subgroup moderator analysis showed that for all CMHCs except sleep-wake disorders, prevalence estimates from clinical sample-based studies were statistically significantly higher than those from population/registry-based studies (Table 1). Prediction intervals were wide for all CMHCs, across study designs. Remaining heterogeneity not explained by study design was still very substantial.

For meta-regressions (Table 2), due to the possibility of multi-collinearity arising from interrelated moderators,<sup>45</sup> age, HDI, percent-female and percent-ID were first assessed independently by univariable meta-regression models (Appendix p36-75). Thereafter, multivariable meta-regression models examined the combined effect of study design, age, percent-female, HDI and percent-ID for each CMHC. If data were missing for a specific variable, that study was excluded in both univariable and multivariable analyses.

Across studies, increased age was associated with lower prevalence of ADHD, and higher prevalence of depressive, bipolar and schizophrenia spectrum disorders. Studies with higher

percentage of females tended toward higher prevalence of depressive disorders. Studies including higher percentage of people with ID tended toward higher prevalence of schizophrenia spectrum disorders. Studies from countries with higher HDI tended to report lower prevalence of OCD.

In terms of studies not meta-analysed (Appendix p22), for trauma and stress-related disorders, post-traumatic stress disorder was most commonly reported, with prevalence estimates ranging 0-3·6%. For substance-related and addictive disorders, alcohol abuse and/or dependence were most commonly reported, with prevalence estimates ranging 0-11%. Gender dysphoria was reported in zero studies so far.

Finally, we carried out a series of additional sensitivity analyses. For all CMHCs (statistically significant only for anxiety, disruptive/impulse-control/conduct and schizophrenia spectrum disorders), there was a pattern of more recent publications reporting lower prevalence rates (Appendix p76-84). Funnel plot inspection across CMHCs indicated potential small study biases, although this interpretation is significantly limited by the high heterogeneity of the data (Appendix p85-92). Outlier removal did not significantly change the overall pooled estimates or 95%CIs/PIs across CMHCs (Appendix p93-109). Re-running the meta-analyses of proportions separately by study design, or with the smaller-sample (lowest quintile) data-points excluded per CMHC, did not show major differences from the main findings (ie, 95%CIs overlapped), except for a trend of lower rates particularly in clinical sample-based studies when smaller-sample studies were excluded (Appendix p111-112).

## **Discussion**

Overall, 100 studies were included in our systematic review with 96 meta-analysed. Meta-analyses identified eight frequently reported CMHCs, with pooled prevalence estimates of: ADHD 28% (95%CI 25-32%), anxiety disorders 20% (17-23%), sleep-wake disorders 13% (9-17%), disruptive/impulse-control/conduct disorders 12% (10-15%), depressive disorders 11% (9-13%), obsessive-compulsive disorder 9% (7-10%), bipolar disorders 5% (3-6%) and schizophrenia spectrum disorders 4% (3-5%). Prevalence tended to be higher in clinical samples compared with population/registry-based data, implying high needs of care for CMHCs especially in the clinical population. Some heterogeneity could be explained by age, gender,

intelligence composition of the sample, the country of origin or publication year of the study. However, there remained very substantial unexplained heterogeneity for all CMHCs after accounting for a priori-defined moderators and exploration of the effects of outliers, suggesting that other potential contributors to heterogeneity in the literature of CMHCs in autism were still not well accounted for. Furthermore, the wide prediction intervals may temper the usefulness of our prevalence estimates. For highly variable observational and epidemiological data such as those included in our meta-analyses, on a substantially heterogeneous condition such as autism,<sup>46</sup> an ongoing challenge is to delineate the many contributors to heterogeneity and to make more precise predictions accordingly.

The most striking and clinically relevant finding is that CMHCs are highly prevalent in the autism population, mostly significantly higher than general population prevalence rates reported in representative studies (Table 1). This is shown by non-overlapping prevalence estimates/CIs in people with autism (especially those from population/registry-based studies) and the prevalence/CIs found in the general population (with the exception of impulse-control disorders). However, we are not able to derive reliable and valid odds ratios in individuals with autism compared to the general population from the present meta-analyses, given the widely different sampling frames, measurement tools, comparison/control groups and variation in reporting in the meta-analysed studies.

When parsing out heterogeneity, we observed a similar pattern of emergence of psychopathology in people with autism as found in the general population. For example, depressive, bipolar and schizophrenia spectrum disorders become more prevalent with increased age and studies with more females found higher rates of depression.<sup>47</sup> ADHD diagnosis is more prevalent in younger than older ages, as has been observed in the general population.<sup>48</sup> More of the sample with ID was associated with higher probability of schizophrenia spectrum diagnoses, which matches with findings in the ID population.<sup>49</sup> Based on these, we speculate that autism may heighten the probability of developing major psychiatric disorders in a general manner, but the extent to which the patterns of emergence and factors influencing their onset and course (especially regarding the change of CMHC burden during transition stages, eg, from youth to adulthood) are different from those in neurotypical people awaits further longitudinal investigations that are sensitive to temporal relations and can capture unique phenotypic presentations of CMHCs in individuals with autism. Reasons for lower prevalence of OCD from



countries with higher HDI are unclear but may relate to different levels of autism-specific support and diagnostic practice in different countries.<sup>50</sup> More recent publication years were associated with lower reported rates of CMHCs, especially anxiety, disruptive/impulse-control/conduct and schizophrenia spectrum disorders. The underlying reasons mostly likely include progressions of research design and sampling strategies, with more large-scale population/registry-based studies published in recent years, which tend to report lower rates (as shown in the subgroup analyses).

Although the high rates of these psychiatric diagnoses can reflect true comorbidity in autism, it is still likely that measurement error and diagnostic ambiguity contribute to current rates. Diagnosing CMHCs in autism based on standard clinical practice or interview schedules designed for general population often encounters challenges and uncertainties in differential diagnosis. In certain scenarios, whether ‘mental health symptoms’ are in fact part of the presentation of autism (eg, sensory issues and avoidant behaviour being interpreted as ‘generalised anxiety’) is difficult to determine without in-depth, personalised assessment, hence rates of CMHCs may be inflated for this reason. In some other scenarios, the autism background may overshadow true CMHC symptoms (eg, not verbally reporting depressive mood due to emotion recognition and/or communication difficulties), contributing to under-estimation of rates of CMHCs. Furthermore, it can be difficult to disentangle whether functional impairment is secondary to co-occurring psychiatric symptoms (as would be necessary to warrant a CMHC diagnosis in autism), or secondary to the key characteristics of autism (meaning a CMHC diagnosis might not be warranted). These challenges point to the urgent need for new development and novel use of available mental health assessment schedules for people with autism and/or other neurodevelopmental disabilities. Such assessments should also incorporate a temporally focused terminology to disentangle the temporal development of CMHCs in autism,<sup>51</sup> to better inform causal pathways and, most importantly, clinical formulation for personalised treatment.

The high prevalence of CMHCs in autism implies that mental health assessment should be an integral aspect of clinical care with regular screening, evaluation and treatment undertaken as part of ongoing support for individuals with autism. The approach to treatment and support should be personalised and holistic, instead of treating psychiatric diagnoses in isolation, as if unrelated to the autism background. Acknowledging that autism increases the risk of major

psychiatric disorders (eg, OCD, depressive, bipolar and schizophrenia spectrum disorders) also necessitates clinical attention especially during youth and transition ages when the probability of developing these conditions increases substantially. This careful approach to assessment and care of mental health challenges in people on the autism spectrum has not yet been incorporated into real-world clinical settings,<sup>52,53</sup> even though mental health promotion has been endorsed by individuals with autism and their families as the top concern (<http://www.jla.nihr.ac.uk/priority-setting-partnerships/autism/top-10-priorities/>).

Uncovering reasons for high co-occurrence of CMHCs in autism has both scientific and clinical implications. For example, the co-occurrence of ADHD and autism may be underpinned partly by shared genetic contribution<sup>54,55</sup> and neuro-cognitive architecture,<sup>56-58</sup> as is the case for autism and anxiety.<sup>59</sup> Investigation into mechanisms and developmental trajectories leading to increased risk for CMHCs in autism, either biological or experiential, will inform targeted preventive measures and mental health promotion.

## **Strengths and Limitations**

This systematic review and meta-analysis, to our knowledge, is by far the most comprehensive, up-to-date review of literature about the prevalence of often reported CMHCs in the autism population. In addition, it is the first to take age, gender and intelligence compositions into account systematically, and across both population/registry-based and clinical sample-based studies. Inclusion criteria for both CMHCs and autism were carefully defined, providing prevalence estimates that are valid reflections of the current literature.

However, there are multiple limitations. Due to our strict inclusion/exclusion criteria, some studies carrying useful information (eg, those reporting lifetime CMHCs) were not included for review. For some CMHCs the meta-regression analyses might be under-powered (eg, a recommendation is 10 data-points per covariate),<sup>36</sup> hence our results of the source of heterogeneity should be considered exploratory and require future confirmation. Some clinical/community-based studies could have samples overlapping with those in the larger population/registry-based studies, but it is impossible to disentangle this analytically due to a lack of such primary information in the data sources; to address this we estimated the pooled prevalence separately for the two categories (Appendix p111-112), which showed comparable

rates as those derived from the moderator analyses (Table 1). Further, very substantial heterogeneity remained unaccounted for across all CMHCs examined, even after accounting for hypothetical contributors derived from existing epidemiological literature and excluding outlier studies. Also, prediction intervals for all pooled estimates of prevalence were wide, predicting high variability of estimates in future studies until the heterogeneity of autism can be more clearly parsed out. A fundamental limitation of the autism research literature (including those about CMHCs) is the huge heterogeneity. Potential small study effects (some may relate to publication bias and some reflect other, including true heterogeneity) were noted for many CMHCs, limiting the generalisability of findings and again signifying the impact of large heterogeneity in this literature. Fine-grained primary empirical research design is required to further elucidate heterogeneity (eg, measuring CMHCs in stratified autism subgroups such as by intellectual/communication abilities, gender, clinical profile, genetic or neurological background). Given the complexity and variation of how CMHCs were reported in the literature, we were unable to meta-analyse illness loads (ie, number of CMHCs or clinical severity) or patterns of co-occurrence (ie, what CMHCs tend to aggregate). More consistent report of illness loads and patterns of co-occurrence in future primary studies will provide further insight. Also, due to changes in diagnostic classifications of both autism and CMHCs over the past decades, differences in diagnostic categories used between studies can result in varied estimates of CMHC prevalence in autism. Finally, all findings were derived from observational studies; the causal and developmental relations underlying such associations await clarification by new primary studies that measure temporal relations between autism and CMHCs<sup>51</sup> and investigate underpinning mechanisms.

## **Conclusions**

CMHCs are common in autism, with apparently high prevalence across a variety of diagnostic categories. Such co-occurrence warrants clinical attention and aetiological investigations to uncover shared underpinnings and sources of vulnerability associated with autism. Mental health promotion should be an essential component of care for all individuals on the autism spectrum. Valid and standardised measures of mental health challenges in people with autism and/or other neurodevelopmental disabilities are needed to facilitate accurate diagnosis.



## Research in Context

### **Evidence before this study**

Prior to conducting this systematic review and meta-analysis, as a preparatory scoping review we searched PubMed for published observational studies, using combinations of search terms that include ‘autis\*’, ‘mental health’, ‘psychiatr\*’, ‘comorbid\*’, ‘co-occurring’ and ‘disorder’. Our search did not have language or date restrictions. We identified a wide variety of observational studies reporting divergent prevalence rates of mental health symptoms or psychiatric diagnoses (using various tools and definitions) in the autism population, with substantial variability in study design (ie, from small-sample clinical studies to national population-based registry studies), across wide age range, gender composition, rates of co-occurring intellectual disability and countries of origin. Most commonly studied conditions include ADHD, anxiety, depression, bipolar disorder, OCD, psychosis and sleep difficulties. However, the range of reported prevalence of co-occurring psychiatric diagnoses varies hugely (eg, 1-86% for ADHD, 1-70% for depressive disorders). What could be detrimental is that the prevalence rates of specific co-occurring psychiatric diagnoses cited in other empirical research, review and guideline papers vary greatly depending on the cited studies. Based on these observations, we consider it to be necessary to conduct systematic reviews and meta-analyses to determine the best estimates of co-occurring psychiatric conditions in autism and to identify sources of heterogeneity amongst studies. Such ‘prior knowledge’ will provide critical background information for adequate mental health evaluation and service delivery. We designed two protocols, one focusing on co-occurring psychiatric diagnoses and another focusing on mental health symptoms in the autism population, and pre-registered them with PROSPERO (CRD42018103176, CRD42018103178). We reported findings from the first protocol in this paper.

### **Added value of this study**

We identified eight co-occurring psychiatric diagnoses most commonly reported in the literature. From 96 meta-analysed studies, we found the pooled prevalence rates in the autism population ranged from 28% for ADHD, 20% for anxiety disorders, 13% for sleep-wake disorders, 12% for disruptive/impulse-control/conduct disorders, 11% for depressive disorders, 9% for obsessive-compulsive disorder, to 5% for bipolar disorders and 4% for schizophrenia

spectrum disorders. Estimates in clinical sample-based studies were higher than population/registry-based studies. Age, gender, intellectual functioning, country of study and publication year were associated with heterogeneity in the literature, yet there are still substantial remaining, unexplained sources of heterogeneity.

**Implications of all the available evidence**

Co-occurring psychiatric diagnoses are common in the autism population across the lifespan. Mental health promotion, improved assessment and adequate treatment of mental health concerns are essential for care and support for the autism population.

**Author Contributions**

M-CL and CK contributed equally as first authors. M-CL, PS and SHA contributed to study concept and design. M-CL and CK contributed to drafting of the manuscript. All authors contributed to literature search, data collection, data analysis, data interpretation and critical revision of the manuscript for important intellectual content. CK contributed to statistical analysis. M-CL and SHA obtained funding support for this study. CK, RB, SB contributed to administrative, technical or material support.

**Conflict of Interest Disclosures**

None reported.

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## TABLES

**Table 1. Pooled Estimate of Prevalence and Moderator Analysis of Study Design**

	POOLED ESTIMATE OF PREVALENCE		MODERATOR ANALYSIS: STUDY DESIGN					<sup>d</sup> Reported prevalence in the general population
<sup>a</sup> Co-occurring mental health condition	Prevalence in autism population <sup>b</sup> (95%CI) <sup>b</sup> [95%PI]	I <sup>2</sup> % (95%CI) [Cochran's Q Test p-value]	Pop Reg (95%CI) [95%PI]	Clin Com (95%CI) [95%PI]	R <sup>2</sup> % ( <sup>c</sup> QE p-value)	I <sup>2</sup> % (95%CI)	<sup>c</sup> QM p-value	Prevalence (95%CI or standard error)
<b>ADHD</b> (N = 89) (n = 210,249)	28% (25-32%) [4-63%]	99.65 (99.55-99.85) [<0.0001]	22% (17-26%) [1-55%]	34% (29-39%) [7-69%]	2.05 (<0.0001)	99.64 (99.60-99.84)	<0.001	7.2% (6.7-7.8%) (point prevalence, aged ≤18 years) <sup>50</sup>
<b>Anxiety Disorders</b> (N = 68) (n = 169,829)	20% (17-23%) [2-48%]	99.53 (99.42-99.87) [<0.0001]	15% (11-19%) [0.5-42%]	26% (22-31%) [1-56%]	0.00 (<0.0001)	99.54 (99.20-99.85)	<0.001	7.3% (4.8-10.9%) (current prevalence, across ages) <sup>60</sup>
<b>Depressive Disorders</b> (N = 65) (n = 162,671)	11% (9-13%) [0-33%]	99.41 (99.39-99.81) [<0.0001]	8% (5-11%) [0.01-28%]	14% (11-18%) [1-38%]	0.23 (<0.0001)	99.40 (99.37-99.80)	<0.001	4.7% (4.4-5.0 %) (point prevalence of MDD, across ages) <sup>61</sup>
<b>Bipolar and Related Disorders</b> (N = 38) (n = 153,192)	5% (3-6%) [0-19%]	99.50 (99.40-99.82) [<0.0001]	3% (2-5%) [0-16%]	7% (4-10%) [0-24%]	0.35 (<0.0001)	99.50 (99.48-99.81)	0.018	0.71% (0.56-0.86%) for Bipolar I; 0.50% (0.35-0.64%) for Bipolar II (1-year prevalence, across ages) <sup>62</sup>
<b>Schizophrenia</b>	4%	99.18	2%	7%	0.00	99.18	<0.001	0.456% (0.409-

<b>Spectrum and Psychotic Disorders</b> (N = 42) (n = 166,627)	(3-5%) [0-14%]	(99.00-99.87) [<0.0001]	(1-4%) [0-11%]	(4-9%) [0-19%]	(<0.000 1)	(99.01- 99.84)		0.503%) (1-year prevalence, across ages) <sup>63</sup>
<b>Obsessive-Compulsive Disorder</b> (N = 47) (n = 53,243)	9% (7-10%) [1-21%]	96.85 (96.75-99.87) [<0.0001]	4% (2-6%) [0-13%]	12% (10-15%) [3-26%]	12.51 (<0.000 1)	96.20 (96.17- 99.37)	<0.001	0.7% (0.4-1.1%) (1-year prevalence, aged ≥18 years) <sup>64</sup>
<b>Disruptive, Impulse-Control and Conduct Disorders</b> (N = 50) (n = 140,946)	12% (10-15%) [0-36%]	99.52 (99.47-99.90) [<0.0001]	7% (4-10%) [0-28%]	22% (17-27%) [3-50%]	0.00 (<0.000 1)	99.53 (99.42- 99.88)	<0.001	8.9% (standard error=0.5%) (1-year prevalence, aged ≥18 years) <sup>65</sup>
<b>Sleep-Wake Disorders</b> (N = 26) (n = 190,963)	13% (9-17%) [0-43%]	99.87 (99.78-99.93) [<0.0001]	11% (7-17%) [0-39%]	16% (8-25%) [0-47%]	8.52 (<0.000 1)	99.85 (99.77- 99.91)	0.356	3.7% (1-year prevalence, aged ≤18 years) <sup>66</sup>

- N = number of data-points in meta-analyses; n = sample size for individuals with autism included across studies
- CI = confidence interval, PI = prediction interval
- QE = test of residual heterogeneity; QM = test of moderators, statistical significance at  $p < 0.05$
- General population estimates were selected from latest meta-analyses and/or large-scale population-based studies; see citations

**Table 2. Univariable and Multivariable Meta-Regressions**

	<b>UNIVARIABLE META-REGRESSION</b>				<b><sup>c</sup> MULTIVARIABLE META-REGRESSION</b>		
<b><sup>a</sup> Co-occurring mental health condition</b>	<b>Covariate</b>	<b><sup>b</sup> R<sup>2</sup>%</b>	<b>I<sup>2</sup>% (95%CI)</b>	<b>QM p-value</b>	<b><sup>b</sup> R<sup>2</sup>%</b>	<b>I<sup>2</sup>% (95%CI)</b>	<b>QM p-value</b>
<b>ADHD (N = 89) (n = 210,249)</b>	Age	7.72	99.78 (99.70-99.84)	<0.001	13.06	99.73 (99.61-99.82)	0.019
	%ID	0.00	99.77 (99.68-99.85)	0.764			
	HDI	3.55	99.79 (99.72-99.85)	0.050			
	%Female	1.50	99.75 (99.66-99.82)	0.137			
<b>Anxiety Disorders (N = 68) (n = 169,829)</b>	Age	0.00	99.80 (99.72-99.86)	0.557	3.87	99.76 (99.65-99.85)	0.226
	%ID	0.00	99.80 (99.71-99.87)	0.353			
	HDI	0.00	99.80 (99.73-99.87)	0.977			
	%Female	0.00	99.76 (99.67-99.84)	0.937			
<b>Depressive Disorders (N = 65) (n = 162,671)</b>	Age	21.42	99.61 (99.46-99.75)	<0.001	43.39	99.34 (99.02-99.61)	<0.001
	%ID	0.00	99.65 (99.49-99.78)	0.817			
	HDI	0.00	99.72 (99.61-99.81)	0.839			
	%Female	6.17	99.66 (99.52-99.77)	0.025			
<b>Bipolar and</b>	Age	17.72	99.61	0.004	30.38	99.47	0.001

<b>Related Disorders</b> (N = 38) (n = 153,192)			(99.39-99.78)			(99.10-99.74)	
	%ID	8.71	99.62 (99.38-99.80)	0.071			
	HDI	0.00	99.71 (99.55-99.83)	0.856			
	%Female	3.25	99.68 (99.49-99.81)	0.133			
<b>Schizophrenia Spectrum and Psychotic Disorders</b> (N = 42) (n = 166,627)	Age	24.00	99.66 (99.51-99.82)	<0.001	38.48	99.53 (99.31-99.80)	<0.001
	%ID	20.29	99.67 (99.52-99.84)	<0.001			
	HDI	0.00	99.76 (99.65-99.87)	0.193			
	%Female	3.72	99.74 (99.63-99.87)	0.193			
<b>Obsessive-Compulsive Disorder</b> (N = 47) (n = 53,243)	Age	0.30	99.08 (98.63-99.44)	0.302	65.32	95.36 (92.13-97.46)	<0.001
	%ID	4.86	98.41 (97.55-99.10)	0.117			
	HDI	33.59	98.76 (98.08-99.22)	<0.001			
	%Female	0.23	98.87 (98.28-99.32)	0.299			
<b>Disruptive, Impulse-Control and Conduct Disorders</b> (N = 50) (n = 140,946)	Age	0.00	99.84 (99.76-99.90)	0.372	10.61	99.80 (99.67-99.90)	0.115
	%ID	0.00	99.83 (99.73-99.90)	0.569			
	HDI	0.00	99.85 (99.78-99.90)	0.786			
	%Female	0.00	99.84 (99.77-99.90)	0.336			
<b>Sleep-Wake Disorders</b>	Age	0.00	99.86 (99.77-99.93)	0.855	48.27	98.95 (97.76-99.66)	0.002



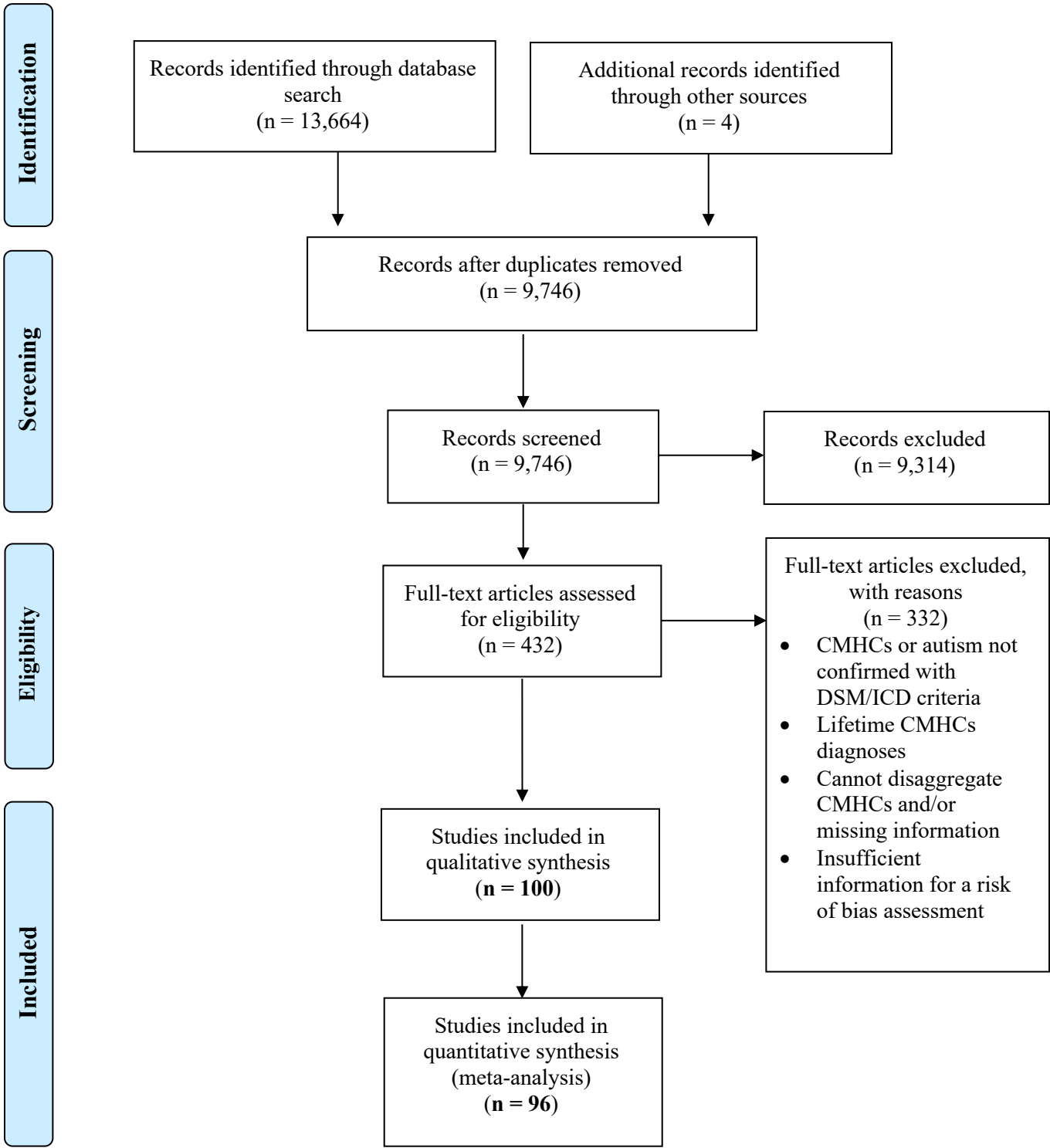
<b>(N = 26)</b> <b>(n = 190,963)</b>	%ID	0.00	99.42 (98.92-99.78)	0.951			
	HDI	0.00	99.87 (99.79-99.94)	0.412			
	%Female	0.00	99.86 (99.77-99.93)	0.426			

- a. N = number of data-points in meta-analyses; n = sample size for individuals with autism included across studies
- b. QE test of residual heterogeneity for  $R^2$  is statistically significant for all CMHC meta-analysed, with  $p < 0.0001$ , for all cases
- c. For all CMHCs, multivariable meta-regression model covariates are study design, age, percent-female, percent-ID and HDI

## FIGURES

**Figure 1. PRISMA Flowchart for Study Selection**

Figure 1



## Response to Reviewer

### **Reviewer #2:**

*Forest plots are OK.*

*In terms of the combining different study designs, the data-driven sensitivity analysis (to show that excluding various studies would make not much difference to the overall prevalence) is missing the point. The authors have already shown the prevalence rate is higher in clinical studies, what is moot is whether it is meaningful to combine these two sets of prevalence due to selection bias for patients in clinical studies (as authors say p7). Wouldn't population studies generally include those in clinical studies? If there is no overlap, ie people in clinical studies will not have been entered into population studies then you could justify it on the grounds that the population register excludes clinical population. However, I don't think this is how it works which is why I'm advocating presenting the pooled estimates separately.*

**Reply:** The data-driven sensitivity analysis is intended to address the reviewer's earlier point about potential impact of smaller-N studies. We agree with the reviewer's concern of 'sample overlap' (i.e. some of the clinical/community-based studies could have overlapping sample with the larger population/registry-based studies), but this is impossible to be disentangled analytically due to no primary information provided in the primary data sources, so we have no way to know if this is the case. If we understand correctly, we have addressed the point of 'presenting the pooled estimates separately' in the latest added analysis on Appendix p111-112 and briefly highlighted this to the readers in the manuscript. To clarify these points further, and also based on the Editor's suggestion, we have added the following text in the limitations section, on p.13, **"Some clinical/community-based studies could have samples overlapping with those in the larger population/registry-based studies, but it is impossible to disentangle this analytically due to a lack of such primary information in the data sources; to address this we estimated the pooled prevalence separately for the two categories (Appendix p111-112), which showed comparable rates as those derived from the moderator analyses (Table 1)."**

## Online Appendix

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### Appendix1-Method: Search Strategy

Database: Ovid MEDLINE(R) <1946 to February 1<sup>st</sup> 2019>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <February 1<sup>st</sup> 2019>, Ovid MEDLINE(R) Epub Ahead of Print <February 1<sup>st</sup> 2019>  
Search Strategy:

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1  exp Mental Disorders/
2  exp Intellectual Disability/
3  exp Behavioral Symptoms/
4  exp Mental Health/
5  exp Mentally Ill Persons/
6  exp Amnesia/
7  exp Delirium/
8  exp Hallucinations/
9  exp Schizophrenia/
10 exp Mood Disorders/
11 exp Anxiety Disorders/
12 exp Dissociative Disorders/
13 exp Cognition Disorders/
14 exp Dissociative Disorders/
15 exp "Feeding and Eating Disorders"/
16 exp Personality Disorders/
17 exp Gambling/
18 exp Sexual Dysfunctions, Psychological/
19 exp Sleep Wake Disorders/
20 exp "Trauma and Stressor Related Disorders"/
21 exp Neurodevelopmental Disorders/
22 exp Communication Disorders/
23 exp Motor Disorders/
24 exp Tic Disorders/
25 exp "Schizophrenia Spectrum and other Psychotic Disorders"/
26 exp "Bipolar and Related Disorders"/
27 exp Elimination Disorders/
28 exp Substance-Related Disorders/
29 exp Restless Legs Syndrome/
30 dementia$.mp.

```

31 delusional\$.mp.  
32 (manic adj3 disorder\$).mp.  
33 (emotionally adj3 labile adj3 disorder\$).mp.  
34 (asthenic adj3 disorder\$).mp.  
35 (post\$ encephalitic adj3 syndrome\$).mp.  
36 (behav\$ adj3 disorder\$).mp.  
37 (postconcussional adj3 syndrome\$).  
38 (post\$ concessional adj3 syndrome).mp.  
39 hypomani\$.mp.  
40 depressive\$.mp.  
41 depression\$.mp.  
42 cyclothymi\$.mp.  
43 dysthymi\$.mp.  
44 agoraphobi\$.mp.  
45 (panic adj3 disorder\$).mp.  
46 (acute stress adj3 reaction\$).mp.  
47 (adjustment adj3 disorder\$).mp.  
48 (dissociative adj3 disorder\$).mp.  
49 (conversion adj3 disorder\$).mp.  
50 (dissociative adj3 fugue\$).mp.  
51 (dissociative adj3 stupor\$).mp.  
52 (trance adj3 disorder\$).mp.  
53 (possession adj3 disorder\$).mp.  
54 (ganser\$ adj3 syndrome\$).mp.  
55 (somatoform adj3 disorder\$).mp.  
56 (somatization adj3 disorder\$).mp.  
57 (hypochondriacal adj3 disorder\$).mp.  
58 neurastheni\$.mp.  
59 (depersonalization\$ adj3 syndrome\$).mp.  
60 (derealization\$ adj3 syndrome\$).mp.  
61 insomni\$.mp.  
62 hypersomn\$.mp.  
63 sleepwalk\$.mp.  
64 sleep walk\$.mp.  
65 somnambulism\$.mp.  
66 sleep terror\$.mp.  
67 night terror\$.mp.  
68 nightmare\$.mp.  
69 (sexual adj3 aversion\$).mp.  
70 (fail\$ adj3 genital\$ adj3 respons\$).mp.  
71 (orgasm\$ adj3 dysfunct\$).mp.  
72 (prematur\$ adj3 ejaculat\$).mp.  
73 (nonorganic adj3 vaginism\$).mp.  
74 (non\$ organic adj3 vaginism\$).mp  
75 (nonorganic adj3 dyspareu\$).mp.  
76 (non\$ organic adj3 dyspareu\$).mp.  
77 (excessiv\$ adj3 sexual\$ adj3 driv\$).mp.  
78 (compulsi\$ adj3 sexual\$ adj3 behav\$).mp.  
79 (habit adj3 disorder\$).mp.  
80 (impuls\$ adj3 disorder\$).mp.  
81 (patholog\$ adj3 gamb1\$).mp.  
82 (patholog\$ adj3 firesett\$).mp.  
83 (patholog\$ adj3 fire\$ adj3 setting).mp.  
84 pyroman\$.mp.  
85 (patholog\$ adj3 steal\$).mp.  
86 kleptoman\$.mp.

87 trichotilloman\$.mp.  
 88 (gender\$ adj3 ident\$ adj3 disorder\$).mp.  
 89 transsexual\$.mp.  
 90 transvest\$.mp.  
 91 fetish\$.mp.  
 92 exhibition\$.mp.  
 93 voyeur\$.mp.  
 94 paedophili\$.mp.  
 95 sadomasoch\$.mp.  
 96 (disorder\$ adj3 sexual\$ adj3 prefer\$).mp.  
 97 (egodyston\$ adj3 sexual\$ adj3 orientate\$).mp.  
 98 (speech adj3 disorder\$).mp.  
 99 (language adj3 disorder\$).mp.  
 100 (acquired adj3 aphasi\$).mp.  
 101 (landau\$ kleffner adj3 syndrome\$).mp.  
 102 (reading adj3 disorder\$).mp.  
 103 (spelling adj3 disorder\$).mp.  
 104 (disorder\$ adj3 arithmetic\$).mp.  
 105 (disorder\$ adj3 scholastic\$).mp.  
 106 (rett\$ adj3 syndrom\$).mp.  
 107 (hyperkinet\$ adj3 disorder\$).mp.  
 108 (oppositional adj3 defiant adj3 disorder\$).mp.  
 109 (sibling\$ adj3 rival\$ adj3 disorder\$).mp.  
 110 (disorder\$ adj3 social\$ adj3 function\$).mp.  
 111 mutism\$.mp.  
 112 (attachment\$ adj3 disorder\$).mp.  
 113 (motor\$ adj3 disorder\$).mp.  
 114 (tic\$ adj3 disorder\$).mp.  
 115 (non\$ organic adj3 enures\$).mp.  
 116 (nonorganic adj3 enures\$).mp.  
 117 (nonorganic adj3 encopres\$).mp.  
 118 pica\$.mp.  
 119 stutter\$.mp.  
 120 cluttering\$.mp.  
 121 (global adj3 developmental adj3 delay\$).mp.  
 122 (fluency adj3 disorder\$).mp.  
 123 cataton\$.mp.  
 124 (panic adj3 attack\$).mp.  
 125 (body adj3 dysmorphi\$ adj3 disorder\$).mp.  
 126 (hoarding\$ adj3 disorder\$).mp.  
 127 trichotillomani\$.mp.  
 128 (hair\$ adj3 pulling adj3 disorder\$).mp.  
 129 excoriation\$.mp.  
 130 (skin\$ adj3 picking adj3 disorder\$).mp.  
 131 (disinhibit\$ adj3 social\$ adj3 engag\$ adj3 disorder\$).mp.  
 132 (functional adj3 neurological\$ adj3 symptom\$ adj3 disorder\$).mp.  
 133 (factitious adj3 disorder\$).mp.  
 134 (rumination adj3 disorder\$).mp.  
 135 (food adj3 intak\$ adj3 disorder\$).mp.  
 136 (feeding adj3 disorder\$).mp.  
 137 (hypersomnolence adj3 disorder\$).mp.  
 138 narcolep\$.mp.  
 139 (sleep adj3 apnea\$).mp.  
 140 (sleep\$ adj3 hypoventil\$).mp.  
 141 parasomn\$.mp.  
 143 (restless adj3 leg\$ adj3 syndrome\$).mp.

144 (delayed adj3 ejaculat\$).mp.  
 145 (erectile adj3 disorder\$).mp.  
 146 (orgasm\$ adj3 disorder).mp.  
 147 (arousal adj3 disorder\$).mp.  
 148 (genital\$ adj3 pelvic\$ adj3 pain\$ adj3 disorder\$).mp.  
 149 (penetration adj3 disorder\$).mp.  
 150 (prematur\$ adj3 ejaculat\$).mp.  
 151 (sexual adj3 dysfunct\$).mp.  
 152 (gender adj3 dysphor\$).mp.  
 153 (intermittent\$ adj3 explosive adj3 disorder\$).mp.  
 154 (alcohol\$ adj3 disorder\$).mp.  
 155 (alcohol\$ adj3 intoxicat\$).mp.  
 156 (alcohol\$ adj3 withdrawal\$).mp.  
 157 (caffeine\$ adj3 disorder\$).mp.  
 158 (caffeine\$ adj3 intoxicat\$).mp.  
 159 (caffeine adj3 withdraw\$).mp.  
 160 (cannabis\$ adj3 disorder\$).mp.  
 161 (cannabis\$ adj3 intoxicat\$).mp.  
 162 (cannabis\$ adj3 withdraw\$).mp.  
 163 (hallucinogen\$ adj3 disorder\$).mp.  
 164 (phencyclidine\$ adj3 disorder\$).mp.  
 165 (phencyclidin\$ adj3 intoxicat\$).mp.  
 166 (hallucinogen\$ adj3 intoxication\$).mp.  
 167 (inhalant\$ adj3 disorder\$).mp.  
 168 (inhalant\$ adj3 intoxica\$).mp.  
 169 (opi\$ adj3 disorder\$).mp.  
 170 (opi\$ adj3 intoxicat\$).mp.  
 171 (opi\$ adj3 withdraw\$).mp.  
 172 (sedative\$ adj3 disorder\$).mp.  
 173 (hypnotic\$ adj3 disorder\$).mp.  
 174 (anxiolytic\$ adj3 intoxicat\$).mp.  
 175 (sedative\$ adj3 withdraw\$).mp.  
 176 (hypnotic\$ adj3 withdraw\$).mp.  
 177 (anxiolytic\$ adj3 withdraw\$).mp.  
 178 (stimulant\$ adj3 disorder\$).mp.  
 179 (stimulant\$ adj3 intoxicat\$).mp.  
 180 (stimulant\$ adj3 withdraw\$).mp.  
 181 (tobacco\$ adj3 disorder\$).mp.  
 182 (tobacco adj3 withdraw\$).mp.  
 183 (substance\$ adj3 disorder).mp.  
 184 (gambl\$ adj3 disorder\$).mp.  
 185 (frotteuris\$ adj3 disorder\$).mp.  
 186 pedophil\$.mp.  
 187 paraphil\$.mp.  
 188 (intellectual adj3 disabil\$).mp.  
 189 (mental\$ adj3 retard\$).mp.  
 190 (behav\$ adj3 symptom\$).mp.  
 191 suicid\$.mp.  
 192 mental health.mp.  
 193 mental\$ ill\$.mp.  
 194 amnes\$.mp.  
 195 delirium\$.mp.  
 196 hallucination\$.mp.  
 197 schizo\$.mp.  
 198 self? harm\$.mp.  
 199 self? injur\$.mp.



200 psychosis\$.mp.  
 201 psychotic\$.mp.  
 202 (mood adj3 disorder\$.mp.  
 203 (affective\$ adj3 disorder\$.mp.  
 204 depression\$.mp.  
 205 depressive\$.mp.  
 206 cyclothymic\$.mp.  
 207 anxiety.mp.  
 208 anxious\$.mp.  
 209 agoraphobi\$.mp.  
 210 (neurotic adj3 disorder\$.mp.  
 211 mental\$ disorder\$.mp.  
 212 (obsessiv\$ compulsive adj3 disorder\$.mp.  
 213 substance abuse\$.mp.  
 214 drug abus\$.mp.  
 215 addict\$.mp.  
 216 (panic adj3 disorder\$.mp.  
 217 phobic\$.mp.  
 218 phobia\$.mp.  
 219 (bipolar adj3 disorder\$.mp.  
 220 (impuls\$ adj3 disorder\$.mp.  
 221 (conduct\$ adj3 disorder\$.mp.  
 223 (elimination adj3 disorder\$.mp.  
 224 (eating adj3 disorder\$.mp.  
 225 (anorex\$ adj3 nervos\$.mp.  
 226 bulimia\$.mp.  
 227 bulimic\$.mp.  
 228 (bing\$ eating adj3 disorder\$.mp.  
 229 (cognition adj3 disorder\$.mp.  
 230 dyslexi\$.mp.  
 231 dyscalcul\$.mp.  
 232 (oppositional adj3 defiant adj3 disorder\$.mp.  
 233 (attention\$ adj3 deficit\$ adj3 disorder\$.mp.  
 234 (communication adj3 disorder\$.mp.  
 235 (motor skill\$ adj3 disorder\$.mp.  
 236 paraphili\$.mp.  
 237 (personality\$ adj3 disorder\$.mp.  
 238 alcoholism\$.mp.  
 239 alcoholic\$.mp.  
 240 (posttrauma\$ adj3 Stress\$ adj3 disorder\$.mp.  
 241 (post\$ trauma\$ adj3 Stress\$ adj3 disorder\$.mp.  
 242 PTSD.mp.  
 243 (acute adj3 stress\$ adj3 disorder\$.mp.  
 244 adhd.mp.  
 245 exp Comorbidity/  
 246 exp "Diagnosis, Dual (Psychiatry)"/  
 247 comorbid\$.mp.  
 248 concurrent\$.mp.  
 249 (dual\$ adj3 diagnos\$.mp.  
 250 multimorbid\$.mp.  
 251 co-occur\$.mp.  
 252 cooccur\$.mp.  
 253 exp Child Development Disorders, Pervasive/  
 254 autistic\$.mp.  
 255 autism\$.mp.  
 256 (kanner\$ adj3 syndrome\$.mp.

```
257 (pervasiv$ adj3 child$ adj3 development$ adj3 disorder$).mp.  
258 asperger$.mp.  
259 ASD.mp.  
260 or/1-241 [mental disorders set]  
261 or/242-249 [comorbid set]  
262 or/250-256 [autism set]  
263 animals/ not humans.sh.  
264 257 and 258 and 259  
265 261 not 260  
266 limit 262 to yr="1993 -Current"
```

**Appendix2-Tables1-9: Raw Data and Summary for Systematic Review and Meta-analyses**Legend

Pop Reg = Population-based/Registry-based studies; Clin Com = Clinical studies from community samples

NA indicates missing data

Superscripts

(a) Age calculated as the midpoint of an age range

(b) HDI is the average of all the countries in the study

(c) Percent ID estimated using the z distribution, from reported mean IQ and standard deviation

(d) Age-stratified data, where the data for covariates are taken from the whole autism sample

\* value estimated from reported data (ie, when cases are reported across nearby age bands) or general population data (ie, age calculated as the mid-point of the given number [50+] and average life expectancy of the country) – applicable only in Houghton et al. 2017 &amp; Houghton et al. 2018

**1. ADHD in autism**

Case definition: ADHD reported as the number of people in the autism sample with “any ADHD”, “all ADHD”, or “at least one ADHD” using DSM-IV, DSM-5 or ICD-9/10 criteria.

Author Year	Cases	Total Autism	Design Code	Study Design	Age	Country	HDI	% Female	% ID
1. Abdallah 2011 <sup>1</sup>	74	414	0	Pop Reg	16-28	Denmark	0.929	19.1	21.3
2. Albores-Gallo 2017 <sup>2</sup>	25	55	1	Clin Com	4 <sup>a</sup>	Mexico	0.774	21.81	NA
3. Albores-Gallo 2017 <sup>2</sup>	26	39	1	Clin Com	11.5 <sup>a</sup>	Mexico	0.774	12.82	NA
4. Amr 2012 <sup>3</sup>	19	60	1	Clin Com	8.45	Egypt,Jordan,Arabia	0.761 <sup>b</sup>	38.3	66.8 <sup>c</sup>
5. Anckarsater 2006 <sup>4</sup>	47	113	1	Clin Com	39.5 <sup>a</sup>	Sweden	0.933	NA	NA
6. Bishop-Fitzpatrick & Rubenstein 2019 <sup>5</sup>	13	143	0	Pop Reg	52.4	USA	0.924	31.5	44.8
7. Bowers 2015 <sup>6</sup>	62	883	1	Clin Com	8.3	USA	0.924	17.4	36.8
8. Brookman-Frazee 2017 <sup>7</sup>	156	201	1	Clin Com	9.13	USA	0.924	16	13.19 <sup>c</sup>
9. Bryson 2008 <sup>8</sup>	232	586	1	Clin Com	9.18	USA	0.924	15.56	NA
10. Chen 2015 <sup>9</sup>	466	1191	0	Pop Reg	16.40	Taiwan	0.907	19.31	NA
11. Close 2012 <sup>10</sup>	25	154	0	Pop Reg	4.14	USA	0.924	17.5	NA
12. Close 2012 <sup>10</sup>	141	373	0	Pop Reg	8.38	USA	0.924	17.7	NA
13. Close 2012 <sup>10</sup>	156	386	0	Pop Reg	14.41	USA	0.924	19.2	NA
14. Croen 2015 <sup>11</sup>	167	1507	1	Clin Com	29	USA	0.924	26.9	19.2
15. Cummings 2016 <sup>12</sup>	616	3926	0	Pop Reg	6.2	USA	0.924	17.3	NA
16. Cummings 2016 <sup>12</sup>	1606	4399	0	Pop Reg	13.2	USA	0.924	18	NA
17. Davignon 2018 <sup>13</sup>	602	4123	1	Clin Com	18.39	USA	0.924	19.33	13
18. De Bruin 2007 <sup>14</sup>	42	94	1	Clin Com	8.5	Netherlands	0.931	11.7	11.17 <sup>c</sup>
19. Ghanizadeh 2012 <sup>15</sup>	37	68	1	Clin Com	7.3	Iran	0.798	27.94	NA
20. Ghaziuddin 1998 <sup>16</sup>	10	35	1	Clin Com	15.1	USA	0.924	17.14	4.01 <sup>c</sup>
21. Ghirardi 2018 <sup>17</sup>	13793	28468	0	Pop Reg	21.5 <sup>a</sup>	Sweden	0.933	30.68	NA
22. Gillberg 2016 <sup>18</sup>	13	39	1	Clin Com	30	Sweden	0.933	0	0
23. Gjevik 2011 <sup>19</sup>	22	71	1	Clin Com	11.8	Norway	0.953	18	57 <sup>c</sup>
24. Gjevik 2015 <sup>20</sup>	17	55	1	Clin Com	11.9	Norway	0.953	16.36	59 <sup>c</sup>
25. Goin-Kochel 2008 <sup>21</sup>	125	498	1	Clin Com	8.6	USA,Canada,UK,	0.927 <sup>b</sup>	19.9	9.24

						Australia, New Zealand			
26. Gordon-Lipkin 2018 <sup>22</sup>	973	2354	0	Pop Reg	8·5 <sup>a</sup>	USA	0·924	17 <sup>d</sup>	19·6 <sup>d</sup>
27. Gordon-Lipkin 2018 <sup>22</sup>	530	965	0	Pop Reg	14·5 <sup>a</sup>	USA	0·924	17 <sup>d</sup>	19·6 <sup>d</sup>
28. Hallerback 2014 <sup>23</sup>	16	54	1	Clin Com	27 <sup>a</sup>	Sweden	0·933	51·85	0
29. Hansen 2016 <sup>24</sup>	35	284	1	Clin Com	4·5	USA	0·924	15·1	26
30. Horowitz 2017 <sup>25</sup>	43	107	1	Clin Com	13·63	USA	0·924	23	10·76
31. Houghton 2017 <sup>26</sup>	692	6399	0	Pop Reg	3·5 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	9·34
32. Houghton 2017 <sup>26</sup>	16357	36947	0	Pop Reg	8 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	9·35
33. Houghton 2017 <sup>26</sup>	13818	28040	0	Pop Reg	14·5 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	12·01
34. Houghton 2017 <sup>26</sup>	4813	15086	0	Pop Reg	21 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	20·20
35. Houghton 2017 <sup>26</sup>	910	6529	0	Pop Reg	37 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	39·93
36. Houghton 2017 <sup>26</sup>	71	638	0	Pop Reg	64·5 <sup>a*</sup>	USA	0·924	20 <sup>d</sup>	45·14
37. Houghton 2018 <sup>27</sup>	0	110	0	Pop Reg	3·5 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	0
38. Houghton 2018 <sup>27</sup>	293	2813	0	Pop Reg	8 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	0·14 <sup>*</sup>
39. Houghton 2018 <sup>27</sup>	598	3371	0	Pop Reg	14·5 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	0·53 <sup>*</sup>
40. Houghton 2018 <sup>27</sup>	428	2467	0	Pop Reg	21 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	1·7
41. Houghton 2018 <sup>27</sup>	169	1667	0	Pop Reg	37 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	13·9
42. Houghton 2018 <sup>27</sup>	7	428	0	Pop Reg	65·5 <sup>a*</sup>	UK	0·922	19·3 <sup>d</sup>	26·2
43. Joshi 2010 <sup>28</sup>	181	217	1	Clin Com	9·7	USA	0·924	13·36	NA
44. Joshi 2013 <sup>29</sup>	26	63	1	Clin Com	29·2	USA	0·924	34·92	2·34
45. Kantzer 2018 <sup>30</sup>	18	79	1	Clin Com	5·22	Sweden	0·933	17·71	55·7
46. Keen & Ward 2004 <sup>31</sup>	27	196	1	Clin Com	8·5 <sup>a</sup>	UK	0·922	15·82	27·6
47. Knuppel 2018 <sup>32</sup>	275	1434	0	Pop Reg	21 <sup>a</sup>	Denmark	0·929	18·9	16·7
48. Kommu 2017 <sup>33</sup>	74	201	1	Clin Com	5·92	India	0·640	20·4	45·68
49. Levy 2010 <sup>34</sup>	547	2568	0	Pop Reg	8	USA	0·924	19·12	18·3
50. Levy 2019 <sup>35</sup>	52	668	1	Clin Com	4·94	USA	0·924	18·4	NA
51. Logan 2014 <sup>36</sup>	242	629	1	Clin Com	8	USA	0·924	19	62·96
52. LoVullo & Matson 2009 <sup>37</sup>	1	162	1	Clin Com	48·7	USA	0·924	42·6	100
53. Lugnegard 2011 <sup>38</sup>	16	54	1	Clin Com	27	Sweden	0·933	51·85	0
54. Manohar 2017 <sup>39</sup>	20	50	1	Clin Com	4 <sup>a</sup>	India	0·640	20	34
55. Mansour 2017 <sup>40</sup>	85	99	1	Clin Com	9·37	USA	0·924	21·2	24·71 <sup>c</sup>
56. Mathu-Muju 2016 <sup>41</sup>	42	303	1	Clin Com	9·46	Canada	0·926	23	39·6
57. Matilla 2010 <sup>42</sup>	19	50	1	Clin Com	12·7	Finland	0·920	24	0
58. Meguid 2018 <sup>43</sup>	55	80	1	Clin Com	3·77	Egypt	0·696	25	93·75 <sup>c</sup>
59. Meier 2015 <sup>44</sup>	3948	18184	0	Pop Reg	23·5 <sup>a</sup>	Denmark	0·929	NA	NA
60. Ming 2009 <sup>45</sup>	6	23	1	Clin Com	9 <sup>a</sup>	USA	0·924	17·39	NA
61. Moseley 2011 <sup>46</sup>	1	84	1	Clin Com	19·5	Australia	0·939	18	79
62. Mukaddes & Fatch 2010 <sup>47</sup>	17	37	1	Clin Com	10·9	Turkey	0·791	13·51	0
63. Mukaddes 2010 <sup>48</sup>	39	60	1	Clin Com	10·65	Turkey	0·791	0	0
64. Musser 2014 <sup>49</sup>	59	265	1	Clin Com	9 <sup>a</sup>	USA	0·924	19	NA
65. Nahar 2018 <sup>50</sup>	2	33	1	Clin Com	22·7	India	0·640	21·3	0
66. Neumeyer 2019 <sup>51</sup>	135	2114	0	Pop Reg	3·8	USA	0·924	18·45	NA
67. Neumeyer 2019 <sup>51</sup>	421	1221	0	Pop Reg	9·6	USA	0·924	16·46	NA
68. Orinstein 2015 <sup>52</sup>	14	42	1	Clin Com	13·9	USA, Canada	0·925 <sup>b</sup>	9·52	0
69. Rasmussen 2019 <sup>53</sup>	32	143	1	Clin Com	10·5 <sup>a</sup>	Australia	0·939	20	NA
70. Rasmussen 2019 <sup>53</sup>	18	93	1	Clin Com	14·5 <sup>a</sup>	Australia	0·939	23	NA
71. Romero 2016 <sup>54</sup>	71	123	1	Clin Com	10·62	Spain	0·891	18	NA

72. Rosa 2016 <sup>55</sup>	23	50	1	Clin Com	11·95	Spain	0·891	8	1·18 <sup>c</sup>
73. Rubenstein 2018 <sup>56</sup>	320	2352	0	Pop Reg	8	USA	0·924	18·3	3·8
74. Russell 2016 <sup>57</sup>	46	474	1	Clin Com	30·59	UK	0·922	21·6	0
75. Saqr 2018 <sup>58</sup>	62	126	1	Clin Com	21·2	USA	0·924	22·2	49·21
76. Simonoff 2008 <sup>59</sup>	32	112	0	Pop Reg	11·5	UK	0·922	12·5	45·03 <sup>c</sup>
77. Soke 2018 <sup>60</sup>	43	783	0	Pop Reg	4	USA	0·924	22·09	NA
78. Soke 2018 <sup>60</sup>	306	1091	0	Pop Reg	8	USA	0·924	18·97	NA
79. Stacy 2014 <sup>61</sup>	322	913	0	Pop Reg	10·23	USA	0·924	18·29	NA
80. Stadnick 2017 <sup>62</sup>	29	197	1	Clin Com	9·12	USA	0·924	16·24	13·44 <sup>c</sup>
81. Stevens 2016 <sup>63</sup>	717	1766	0	Pop Reg	11·53	USA	0·924	21·12	21·12
82. Supekar 2017 <sup>64</sup>	660	4790	0	Pop Reg	17·5	USA	0·924	NA	NA
83. Suren 2012 <sup>65</sup>	408	2352	0	Pop Reg	5·5 <sup>a</sup>	Norway	0·953	18·9	NA
84. Ung 2013 <sup>66</sup>	75	108	1	Clin Com	10·95	USA	0·924	20·37	0
85. Van Steensel 2013 <sup>67</sup>	9	40	1	Clin Com	11·1	Netherlands	0·931	10	5
86. Verheij 2015 <sup>68</sup>	29	74	1	Clin Com	16	Netherlands	0·931	12	8·75 <sup>c</sup>
87. Vohra 2017 <sup>69</sup>	146	1772	0	Pop Reg	31 <sup>a</sup>	USA	0·924	29	NA
88. Witwer 2010 <sup>70</sup>	55	61	1	Clin Com	11·2	USA	0·924	18·03	59·02
89. Wu 2016 <sup>71</sup>	1461	7773	0	Pop Reg	8	USA	0·924	17·35	NA

**2. Anxiety disorders in autism**

Case definition: anxiety disorders reported as the number of people in the autism sample with “any anxiety disorder”, “all anxiety disorders”, or “at least one anxiety disorder” using DSM-IV, DSM-5 or ICD-9/10 criteria.

Author Year	Cases	Total Autism	Design Code	Study Design	Age	Country	HDI	% Female	% ID
1. Bakken 2010 <sup>72</sup>	21	62	1	Clin Com	24·3	Norway	0·953	27·42	100
2. Bishop-Fitzpatrick & Rubenstein 2019 <sup>5</sup>	62	143	0	Pop Reg	52·4	USA	0·924	31·5	44·8
3. Bowers 2015 <sup>6</sup>	46	883	1	Clin Com	8·3	USA	0·924	17·4	36·8
4. Brookman-Frazee 2017 <sup>7</sup>	113	201	1	Clin Com	9·13	USA	0·924	16	13·19 <sup>c</sup>
5. Buck 2014 <sup>73</sup>	51	129	0	Pop Reg	25·4	USA	0·924	24·8	72·8
6. Bryson 2008 <sup>8</sup>	29	586	1	Clin Com	9·18	USA	0·924	15·56	NA
7. Chen 2015 <sup>9</sup>	134	1191	0	Pop Reg	16·4	Taiwan	0·907	19·31	NA
8. Close 2012 <sup>10</sup>	21	154	0	Pop Reg	4·14	USA	0·924	17·5	NA
9. Close 2012 <sup>10</sup>	122	373	0	Pop Reg	8·38	USA	0·924	17·7	NA
10. Close 2012 <sup>10</sup>	156	386	0	Pop Reg	14·41	USA	0·924	19·2	NA
11. Croen 2015 <sup>11</sup>	439	1507	1	Clin Com	29	USA	0·924	26·9	19·2
12. Cummings 2016 <sup>12</sup>	192	3926	0	Pop Reg	6·2	USA	0·924	17·3	NA
13. Cummings 2016 <sup>12</sup>	814	4399	0	Pop Reg	13·2	USA	0·924	18	NA
14. Davignon 2018 <sup>13</sup>	595	4123	1	Clin Com	18·39	USA	0·924	19·33	13
15. De Bruin 2007 <sup>14</sup>	52	94	1	Clin Com	8·5	Netherlands	0·931	11·7	11·17 <sup>c</sup>
16. Gillberg 2016 <sup>18</sup>	8	39	1	Clin Com	30	Sweden	0·933	0	0
17. Gjevik 2011 <sup>19</sup>	30	71	1	Clin Com	11·8	Norway	0·953	18	57 <sup>c</sup>
18. Gjevik 2015 <sup>20</sup>	24	55	1	Clin Com	11·9	Norway	0·953	16·36	59 <sup>c</sup>
19. Gordon-Lipkin 2018 <sup>22</sup>	605	2354	0	Pop Reg	8·5 <sup>a</sup>	USA	0·924	17 <sup>d</sup>	19·6 <sup>d</sup>
20. Gordon-Lipkin 2018 <sup>22</sup>	420	965	0	Pop Reg	14·5 <sup>a</sup>	USA	0·924	17 <sup>d</sup>	19·6 <sup>d</sup>
21. Hansen 2016 <sup>24</sup>	13	284	1	Clin Com	4·5	USA	0·924	15·1	26
22. Horowitz 2017 <sup>25</sup>	45	107	1	Clin Com	13·63	USA	0·924	23	10·76
23. Houghton 2017 <sup>26</sup>	197	6399	0	Pop Reg	3·5 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	9·34
24. Houghton 2017 <sup>26</sup>	5533	36947	0	Pop Reg	8 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	9·35
25. Houghton 2017 <sup>26</sup>	6897	28040	0	Pop Reg	14·5 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	12·01
26. Houghton 2017 <sup>26</sup>	3828	15086	0	Pop Reg	21 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	20·20
27. Houghton 2017 <sup>26</sup>	1488	6529	0	Pop Reg	37 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	39·93
28. Houghton 2017 <sup>26</sup>	198	638	0	Pop Reg	64·5 <sup>a*</sup>	USA	0·924	20 <sup>d</sup>	45·14
29. Houghton 2018 <sup>27</sup>	0	110	0	Pop Reg	3·5 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	0
30. Houghton 2018 <sup>27</sup>	48	2813	0	Pop Reg	8 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	0·14 <sup>*</sup>
31. Houghton 2018 <sup>27</sup>	162	3371	0	Pop Reg	14·5 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	0·53 <sup>*</sup>
32. Houghton 2018 <sup>27</sup>	244	2467	0	Pop Reg	21 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	1·7
33. Houghton 2018 <sup>27</sup>	292	1667	0	Pop Reg	37 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	13·9
34. Houghton 2018 <sup>27</sup>	80	428	0	Pop Reg	65·5 <sup>a*</sup>	UK	0·922	19·3 <sup>d</sup>	26·2
35. Kerns 2014 <sup>74</sup>	37	59	1	Clin Com	10·48	USA	0·924	22·03	3·43 <sup>c</sup>
36. Knuppel 2018 <sup>32</sup>	139	1434	0	Pop Reg	21 <sup>a</sup>	Denmark	0·929	18·9	16·7
37. Levy 2010 <sup>34</sup>	87	2568	0	Pop Reg	8	USA	0·924	19·12	18·3
38. Logan 2014 <sup>36</sup>	61	629	1	Clin Com	8	USA	0·924	19	62·96
39. LoVullo & Matson 2009 <sup>37</sup>	1	162	1	Clin Com	48·7	USA	0·924	42·6	100
40. Lugnegard 2011 <sup>38</sup>	30	54	1	Clin Com	27	Sweden	0·933	51·85	0
41. Maddox & White 2015 <sup>75</sup>	14	28	1	Clin Com	23·93	USA	0·924	46·43	0

42. Mattila 2010 <sup>42</sup>	21	50	1	Clin Com	12.7	Finland	0.920	24	0
43. Mathu-Muju 2016 <sup>41</sup>	28	303	1	Clin Com	9.46	Canada	0.926	23	39.6
44. McCarthy 2010 <sup>76</sup>	5	124	1	Clin Com	41.5 <sup>a</sup>	UK	0.922	30.65	100
45. Meier 2015 <sup>44</sup>	665	18184	0	Pop Reg	23.5 <sup>a</sup>	Denmark	0.929	NA	NA
46. Ming 2009 <sup>45</sup>	4	23	1	Clin Com	9 <sup>a</sup>	USA	0.924	17.39	NA
47. Moseley 2011 <sup>46</sup>	10	84	1	Clin Com	19.5	Australia	0.939	18	79
48. Mukaddes 2010 <sup>47</sup>	25	60	1	Clin Com	10.65	Turkey	0.791	0	0
49. Muris 1998 <sup>77</sup>	37	44	1	Clin Com	9.7	Netherlands	0.931	NA	24.87 <sup>c</sup>
50. Neumeyer 2019 <sup>51</sup>	59	2114	0	Pop Reg	3.8	USA	0.924	18.45	NA
51. Neumeyer 2019 <sup>51</sup>	241	1221	0	Pop Reg	9.6	USA	0.924	16.46	NA
52. Rosa 2016 <sup>55</sup>	9	50	1	Clin Com	11.95	Spain	0.891	8	1.18 <sup>c</sup>
53. Rubenstein 2018 <sup>56</sup>	86	2352	0	Pop Reg	8	USA	0.924	18.3	3.8
54. Russell 2016 <sup>57</sup>	186	474	1	Clin Com	30.59	UK	0.922	21.6	0
55. Saqr 2018 <sup>58</sup>	65	126	1	Clin Com	21.2	USA	0.924	22.2	49.21
56. Simonoff 2008 <sup>59</sup>	47	112	0	Pop Reg	11.5	UK	0.922	12.5	45.03 <sup>c</sup>
57. Soke 2018 <sup>60</sup>	37	783	0	Pop Reg	4	USA	0.924	22.09	NA
58. Soke 2018 <sup>60</sup>	122	1091	0	Pop Reg	8	USA	0.924	18.97	NA
59. Stacy 2014 <sup>61</sup>	299	913	0	Pop Reg	10.23	USA	0.924	18.29	NA
60. Stadnick 2017 <sup>62</sup>	18	197	1	Clin Com	9.12	USA	0.924	16.24	13.44 <sup>c</sup>
61. Sterling 2008 <sup>78</sup>	13	46	1	Clin Com	23.7	USA	0.924	8.7	10.99 <sup>c</sup>
62. Tsakanikos 2006 <sup>79</sup>	6	147	1	Clin Com	33.3	UK	0.922	32.65	100
63. Tsakanikos 2011 <sup>80</sup>	7	150	1	Clin Com	28.5	UK	0.922	33.33	100
64. Van Steensel 2013 <sup>67</sup>	11	40	1	Clin Com	11.1	Netherlands	0.931	10	5
65. Verheij 2015 <sup>68</sup>	23	74	1	Clin Com	16	Netherlands	0.931	12	8.75 <sup>c</sup>
66. Vohra 2017 <sup>69</sup>	216	1772	0	Pop Reg	31 <sup>a</sup>	USA	0.924	29	NA
67. Witwer 2010 <sup>70</sup>	41	61	1	Clin Com	11.2	USA	0.924	18.03	59.02
68. Wu 2016 <sup>71</sup>	317	7773	0	Pop Reg	8	USA	0.924	17.35	NA

### 3. Bipolar and related disorders in autism

Case definition: bipolar and related disorders reported as the number of people in the autism sample with “any bipolar disorder”, “all bipolar disorders”, or “at least one bipolar disorder”; and if these were not reported, the number of people in the autism sample with “bipolar I”, “bipolar II”, and/or “unspecified bipolar” were used, and added together if all were reported in the same study, defined using DSM-IV, DSM-5 or ICD-9/10 criteria.

Author Year	Cases	Total Autism	Design Code	Study Design	Age	Country	HDI	% Female	% ID
1. Bowers 2015 <sup>6</sup>	22	883	1	Clin Com	8·3	USA	0·924	17·4	36·8
2. Bishop-Fitzpatrick & Rubenstein 2019 <sup>5</sup>	52	143	0	Pop Reg	52·4	USA	0·924	31·5	44·8
3. Bryson 2008 <sup>8</sup>	48	586	1	Clin Com	9·18	USA	0·924	15·49	NA
4. Buck 2014 <sup>73</sup>	11	129	0	Pop Reg	25·4	USA	0·924	24·8	72·8
5. Chen 2015 <sup>9</sup>	45	1191	0	Pop Reg	16·40	Taiwan	0·907	19·31	NA
6. Croen 2015 <sup>11</sup>	159	1507	1	Clin Com	29	USA	0·924	26·9	19·2
7. Davignon 2018 <sup>13</sup>	264	4123	1	Clin Com	18·39	USA	0·924	19·33	13
8. Ghaziuddin 1998 <sup>16</sup>	1	35	1	Clin Com	15·1	USA	0·924	17·14	4·01 <sup>c</sup>
9. Houghton 2017 <sup>26</sup>	10	6399	0	Pop Reg	3·5 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	9·34
10. Houghton 2017 <sup>26</sup>	1016	36947	0	Pop Reg	8 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	9·35
11. Houghton 2017 <sup>26</sup>	2313	28040	0	Pop Reg	14·5 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	12·01
12. Houghton 2017 <sup>26</sup>	1832	15086	0	Pop Reg	21 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	20·20
13. Houghton 2017 <sup>26</sup>	770	6529	0	Pop Reg	37 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	39·93
14. Houghton 2017 <sup>26</sup>	75	638	0	Pop Reg	64·5 <sup>a*</sup>	USA	0·924	20 <sup>d</sup>	45·14
15. Houghton 2018 <sup>27</sup>	0	110	0	Pop Reg	3·5 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	0
16. Houghton 2018 <sup>27</sup>	0	2813	0	Pop Reg	8 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	0·14 <sup>*</sup>
17. Houghton 2018 <sup>27</sup>	4 <sup>*</sup>	3371	0	Pop Reg	14·5 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	0·53 <sup>*</sup>
18. Houghton 2018 <sup>27</sup>	15 <sup>*</sup>	2467	0	Pop Reg	21 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	1·7
19. Houghton 2018 <sup>27</sup>	37	1667	0	Pop Reg	37 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	13·9
20. Houghton 2018 <sup>27</sup>	27	428	0	Pop Reg	65·5 <sup>a*</sup>	UK	0·922	19·3 <sup>d</sup>	26·2
21. Joshi 2010 <sup>28</sup>	68	217	1	Clin Com	9·7	USA	0·924	13·36	NA
22. Joshi 2013 <sup>29</sup>	4	63	1	Clin Com	29·2	USA	0·924	34·92	2·34
23. Kommu 2017 <sup>33</sup>	1	201	1	Clin Com	5·92	India	0·640	20·4	45·68
24. Levy 2010 <sup>34</sup>	18	2568	0	Pop Reg	8	USA	0·924	19·12	18·3
25. LoVullo & Matson 2009 <sup>37</sup>	9	162	1	Clin Com	48·7	USA	0·924	42·6	100
26. Lugnegard 2011 <sup>38</sup>	5	54	1	Clin Com	27	Sweden	0·933	51·85	0
27. Moseley 2011 <sup>46</sup>	3	84	1	Clin Com	19·5	Australia	0·939	18	79
28. Mukaddes & Fatch 2010 <sup>47</sup>	3	37	1	Clin Com	10·9	Turkey	0·791	13·51	0
29. Mukaddes 2010 <sup>48</sup>	1	60	1	Clin Com	10·65	Turkey	0·791	0	0
30. Munesue 2008 <sup>81</sup>	12	44	1	Clin Com	20·27	Japan	0·909	36	0
31. Nahar 2018 <sup>50</sup>	3	33	1	Clin Com	22·7	India	0·640	21·3	0
32. Orinstein 2015 <sup>52</sup>	0	42	1	Clin Com	13·9	USA,Canada	0·925 <sup>b</sup>	9·52	0
33. Rubenstein 2018 <sup>56</sup>	6	2352	0	Pop Reg	8	USA	0·924	18·3	3·8
34. Ryden & Bejerot 2008 <sup>82</sup>	2	53	1	Clin Com	30	Sweden	0·933	46·43	0
35. Schalbroek 2018 <sup>83</sup>	116	17234	0	Pop Reg	23·15	Netherlands	0·931	23·93	10·51
36. Selten 2015 <sup>84</sup>	51	9062	0	Pop Reg	15·3	Sweden	0·933	27	NA
37. Witwer 2010 <sup>70</sup>	9	61	1	Clin Com	11·2	USA	0·924	18·03	59·02
38. Wu 2016 <sup>71</sup>	62	7773	0	Pop Reg	8	USA	0·924	17·35	NA



**4. Depressive disorders in autism**

Case definition: depressive disorders reported as the number of people in the autism sample with “any depressive disorder”, “all depressive disorders”, or “at least one depressive disorder”; and if these were not reported, the number of people in the autism sample with “major depressive disorder”, using DSM-IV, DSM-5 or ICD-9/10 criteria.

Author Year	Cases	Total Autism	Design Code	Study Design	Age	Country	HDI	% Female	% ID
1. Abdallah 2011 <sup>1</sup>	28	414	0	Pop Reg	16·28	Denmark	0·929	19·1	21·3
2. Amr 2012 <sup>3</sup>	8	60	1	Clin Com	8·45	Egypt,Jordan,Ara bia	0·761 <sup>b</sup>	38·3	66·8 <sup>c</sup>
3. Bakken 2010 <sup>72</sup>	23	62	1	Clin Com	24·3	Norway	0·953	27·42	100
4. Bishop-Fitzpatrick & Rubenstein 2019 <sup>5</sup>	40	143	0	Pop Reg	52·4	USA	0·924	31·5	44·8
5. Bitsika 2016 <sup>85</sup>	13	150	1	Clin Com	11·2	Australia	0·939	0	0
6. Bowers 2015 <sup>6</sup>	28	883	1	Clin Com	8·3	USA	0·924	17·4	36·8
7. Bryson 2008 <sup>8</sup>	56	586	1	Clin Com	9·18	USA	0·924	15·56	NA
8. Buck 2014 <sup>73</sup>	15	129	0	Pop Reg	25·4	USA	0·924	24·8	72·8
9. Chen 2015 <sup>9</sup>	86	1191	0	Pop Reg	16·40	Taiwan	0·907	19·31	NA
10. Close 2012 <sup>10</sup>	1	154	0	Pop Reg	4·14	USA	0·924	17·5	NA
11. Close 2012 <sup>10</sup>	30	373	0	Pop Reg	8·38	USA	0·924	17·7	NA
12. Close 2012 <sup>10</sup>	81	386	0	Pop Reg	14·41	USA	0·924	19·2	NA
13. Croen 2015 <sup>11</sup>	388	1507	1	Clin Com	29	USA	0·924	26·9	19·2
14. Cummings 2016 <sup>12</sup>	16	3926	0	Pop Reg	6·2	USA	0·924	17·3	NA
15. Cummings 2016 <sup>12</sup>	365	4399	0	Pop Reg	13·2	USA	0·924	18	NA
16. Davignon 2018 <sup>13</sup>	412	4123	1	Clin Com	18·39	USA	0·924	19·33	13
17. De Bruin 2007 <sup>14</sup>	10	94	1	Clin Com	8·5	Netherlands	0·931	11·7	11·17 <sup>c</sup>
18. Gillberg 2016 <sup>18</sup>	12	39	1	Clin Com	30	Sweden	0·933	0	0
19. Ghaziuddin 1998 <sup>16</sup>	12	35	1	Clin Com	15·1	USA	0·924	17·14	4·01 <sup>c</sup>
20. Gjevik 2011 <sup>19</sup>	1	71	1	Clin Com	11·8	Norway	0·953	18	57 <sup>c</sup>
21. Gjevik 2015 <sup>20</sup>	6	55	1	Clin Com	11·9	Norway	0·953	16·36	59 <sup>c</sup>
22. Gotham 2015 <sup>86</sup>	10	50	1	Clin Com	20·7	USA	0·924	10	0
23. Henry 2014 <sup>87</sup>	0	123	1	Clin Com	9·49	USA	0·924	17·07	NA
24. Houghton 2017 <sup>26</sup>	126	6399	0	Pop Reg	3·5 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	9·34
25. Houghton 2017 <sup>26</sup>	1414	36947	0	Pop Reg	8 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	9·35
26. Houghton 2017 <sup>26</sup>	3573	28040	0	Pop Reg	14·5 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	12·01
27. Houghton 2017 <sup>26</sup>	2655	15086	0	Pop Reg	21 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	20·20
28. Houghton 2017 <sup>26</sup>	1111	6529	0	Pop Reg	37 <sup>a</sup>	USA	0·924	20 <sup>d</sup>	39·93
29. Houghton 2017 <sup>26</sup>	176	638	0	Pop Reg	64·5 <sup>a*</sup>	USA	0·924	20 <sup>d</sup>	45·14
30. Houghton 2018 <sup>27</sup>	0	110	0	Pop Reg	3·5 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	0
31. Houghton 2018 <sup>27</sup>	4 <sup>*</sup>	2813	0	Pop Reg	8 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	0·14 <sup>*</sup>
32. Houghton 2018 <sup>27</sup>	50 <sup>*</sup>	3371	0	Pop Reg	14·5 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	0·53 <sup>*</sup>
33. Houghton 2018 <sup>27</sup>	255	2467	0	Pop Reg	21 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	1·7
34. Houghton 2018 <sup>27</sup>	460	1667	0	Pop Reg	37 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	13·9
35. Houghton 2018 <sup>27</sup>	150	428	0	Pop Reg	65·5 <sup>a*</sup>	UK	0·922	19·3 <sup>d</sup>	26·2
36. Joshi 2010 <sup>28</sup>	121	217	1	Clin Com	9·7	USA	0·924	13·36	NA
37. Joshi 2013 <sup>29</sup>	19	63	1	Clin Com	29·2	USA	0·924	34·92	2·34
38. Kerns 2014 <sup>74</sup>	12	59	1	Clin Com	10·48	USA	0·924	22·03	3·43 <sup>c</sup>
39. Knuppel 2018 <sup>32</sup>	125	1434	0	Pop Reg	21 <sup>a</sup>	Denmark	0·929	18·9	16·7
40. Levy 2010 <sup>34</sup>	28	2568	0	Pop Reg	8	USA	0·924	19·12	18·3

41. LoVullo & Matson 2009 <sup>37</sup>	3	162	1	Clin Com	48.7	USA	0.924	42.6	100
42. Lugnegard 2011 <sup>38</sup>	38	54	1	Clin Com	27	Sweden	0.933	51.85	0
43. McCarthy 2010 <sup>76</sup>	9	124	1	Clin Com	41.5 <sup>a</sup>	USA	0.924	30.65	100
44. Meier 2015 <sup>44</sup>	1568	18184	0	Pop Reg	23.5 <sup>a</sup>	Denmark	0.929	NA	NA
45. Moseley 2011 <sup>46</sup>	9	84	1	Clin Com	19.5	Australia	0.939	18	79
46. Mukaddes & Fateh 2010 <sup>47</sup>	11	37	1	Clin Com	10.9	Turkey	0.791	13.51	0
47. Mukaddes 2010 <sup>48</sup>	8	60	1	Clin Com	10.65	Turkey	0.791	0	0
48. Munesue 2008 <sup>81</sup>	4	44	1	Clin Com	20.27	Japan	0.909	36	4.68 <sup>c</sup>
49. Nahar 2018 <sup>50</sup>	1	33	1	Clin Com	22.7	India	0.640	21.3	0
50. Orinstein 2015 <sup>52</sup>	3	42	1	Clin Com	13.9	USA,Canada	0.925 <sup>b</sup>	9.52	0
51. Rai 2018 <sup>88</sup>	808	4073	0	Pop Reg	21.5	Sweden	0.933	34.12	28.14
52. Raja & Azzoni 2010 <sup>89</sup>	3	26	1	Clin Com	30.2	Italy	0.880	3.85	22.91 <sup>c</sup>
53. Rosa 2016 <sup>55</sup>	1	50	1	Clin Com	11.95	Spain	0.891	8	1.18 <sup>c</sup>
54. Rubenstein 2018 <sup>56</sup>	8	2352	0	Pop Reg	8	USA	0.924	18.3	3.8
55. Ryden & Bejerot 2008 <sup>82</sup>	2	53	1	Clin Com	30	Sweden	0.933	46.43	0
56. Saqr 2018 <sup>58</sup>	39	126	1	Clin Com	21.2	USA	0.924	22.2	49.21
57. Simonoff 2008 <sup>59</sup>	1	112	0	Pop Reg	11.5	UK	0.922	12.5	45.03 <sup>c</sup>
58. Stacy 2014 <sup>61</sup>	112	913	0	Pop Reg	10.23	USA	0.924	18.29	NA
59. Tsakanikos 2006 <sup>79</sup>	9	147	1	Clin Com	33.3	UK	0.922	32.65	100
60. Tsakanikos 2011 <sup>80</sup>	9	150	1	Clin Com	28.5	UK	0.922	33.33	100
61. Ung 2013 <sup>66</sup>	4	108	1	Clin Com	10.95	USA	0.924	20.37	0
62. Van Steensel 2013 <sup>67</sup>	1	40	1	Clin Com	11.1	Netherlands	0.931	10	5
63. Verheij 2015 <sup>68</sup>	8	74	1	Clin Com	16	Netherlands	0.931	12	8.75 <sup>c</sup>
64. Witwer 2010 <sup>70</sup>	9	61	1	Clin Com	11.2	USA	0.924	18.03	59.02
65. Wu 2016 <sup>71</sup>	47	7773	0	Pop Reg	8	USA	0.924	17.35	NA

**5. Disruptive, impulse-control and conduct disorders in autism**

Case definition: disruptive, impulse-control and conduct disorders reported as the number of people in the autism sample with “any disruptive, impulse-control or conduct disorder”, “all disruptive, impulse-control or conduct disorders”, or “at least one disruptive, impulse-control or conduct disorder”; and if these were not reported, the number of people in the autism sample with “conduct disorder” and/or “oppositional defiant disorder” were used, and added together if both were reported in the same study, using DSM-IV, DSM-5 or ICD-9/10 criteria.

Author Year	Cases	Total Autism	Design Code	Study Design	Age	Country	HDI	% Female	% ID
1. Albores-Gallo 2017 <sup>2</sup>	13	94	1	Clin Com	9 <sup>a</sup>	Mexico	0.774	18	NA
2. Amr 2012 <sup>3</sup>	14	60	1	Clin Com	8.45	Egypt, Jordan, Arabia	0.761 <sup>b</sup>	38.3	66.8 <sup>c</sup>
3. Bryson 2008 <sup>8</sup>	9	586	1	Clin Com	9.18	USA	0.924	15.56	NA
4. Chen 2015 <sup>9</sup>	53	1191	0	Pop Reg	16.4	Taiwan	0.907	19.31	NA
5. Close 2012 <sup>10</sup>	30	154	0	Pop Reg	4.14	USA	0.924	17.5	NA
6. Close 2012 <sup>10</sup>	100	373	0	Pop Reg	8.38	USA	0.924	17.7	NA
7. Close 2012 <sup>10</sup>	113	386	0	Pop Reg	14.41	USA	0.924	19.2	NA
8. Cummings 2016 <sup>12</sup>	165	3926	0	Pop Reg	6.2	USA	0.924	17.3	NA
9. Cummings 2016 <sup>12</sup>	321	4399	0	Pop Reg	13.2	USA	0.924	18	NA
10. Davignon 2018 <sup>13</sup>	143	4123	1	Clin Com	18.39	USA	0.924	19.33	13
11. De Bruin 2007 <sup>14</sup>	44	94	1	Clin Com	8.5	Netherlands	0.931	11.7	11.17 <sup>c</sup>
12. Gjevik 2011 <sup>19</sup>	5	71	1	Clin Com	11.8	Norway	0.953	18	57 <sup>c</sup>
13. Gjevik 2015 <sup>20</sup>	4	55	1	Clin Com	11.9	Norway	0.953	16.36	59 <sup>c</sup>
14. Houghton 2017 <sup>26</sup>	622	6399	0	Pop Reg	3.5 <sup>a</sup>	USA	0.924	20 <sup>d</sup>	9.34
15. Houghton 2017 <sup>26</sup>	5926	36947	0	Pop Reg	8 <sup>a</sup>	USA	0.924	20 <sup>d</sup>	9.35
16. Houghton 2017 <sup>26</sup>	5279	28040	0	Pop Reg	14.5 <sup>a</sup>	USA	0.924	20 <sup>d</sup>	12.01
17. Houghton 2017 <sup>26</sup>	1936	15086	0	Pop Reg	21 <sup>a</sup>	USA	0.924	20 <sup>d</sup>	20.20
18. Houghton 2017 <sup>26</sup>	761	6529	0	Pop Reg	37 <sup>a</sup>	USA	0.924	20 <sup>d</sup>	39.93
19. Houghton 2017 <sup>26</sup>	55	638	0	Pop Reg	64.5 <sup>a*</sup>	USA	0.924	20 <sup>d</sup>	45.14
20. Houghton 2018 <sup>27</sup>	0	110	0	Pop Reg	3.5 <sup>a</sup>	UK	0.922	19.3 <sup>d</sup>	0
21. Houghton 2018 <sup>27</sup>	0	2813	0	Pop Reg	8 <sup>a</sup>	UK	0.922	19.3 <sup>d</sup>	0.14 <sup>*</sup>
22. Houghton 2018 <sup>27</sup>	6	3371	0	Pop Reg	14.5 <sup>a</sup>	UK	0.922	19.3 <sup>d</sup>	0.53 <sup>*</sup>
23. Houghton 2018 <sup>27</sup>	14	2467	0	Pop Reg	21 <sup>a</sup>	UK	0.922	19.3 <sup>d</sup>	1.7
24. Houghton 2018 <sup>27</sup>	22 <sup>*</sup>	1667	0	Pop Reg	37 <sup>a</sup>	UK	0.922	19.3 <sup>d</sup>	13.9
25. Houghton 2018 <sup>27</sup>	4 <sup>*</sup>	428	0	Pop Reg	65.5 <sup>a*</sup>	UK	0.922	19.3 <sup>d</sup>	26.2
26. Joshi 2010 <sup>28</sup>	205	217	1	Clin Com	9.7	USA	0.924	13.36	NA
27. Joshi 2013 <sup>29</sup>	1	63	1	Clin Com	29.2	USA	0.924	34.92	2.34
28. Kommu 2017 <sup>33</sup>	6	201	1	Clin Com	5.92	India	0.640	20.4	45.68
29. Levy 2010 <sup>34</sup>	108	2568	0	Pop Reg	8	USA	0.924	19.12	18.3
30. Logan 2014 <sup>36</sup>	88	629	1	Clin Com	8	USA	0.924	19	62.96
31. Mansour 2017 <sup>40</sup>	23	99	1	Clin Com	9.37	USA	0.924	21.2	24.71 <sup>c</sup>
32. Mattila 2010 <sup>42</sup>	9	50	1	Clin Com	12.7	Finland	0.920	24	0
33. Moseley 2011 <sup>46</sup>	1	84	1	Clin Com	19.5	Australia	0.939	18	79
34. Mukaddes & Fateh 2010 <sup>47</sup>	19	37	1	Clin Com	10.9	Turkey	0.791	13.51	0
35. Mukaddes 2010 <sup>48</sup>	11	60	1	Clin Com	10.65	Turkey	0.791	0	0
36. Neumeyer 2019 <sup>51</sup>	50	2114	0	Pop Reg	3.8	USA	0.924	18.45	NA
37. Neumeyer 2019 <sup>51</sup>	74	1221	0	Pop Reg	9.6	USA	0.924	16.46	NA
38. Orinstein 2015 <sup>52</sup>	9	42	1	Clin Com	13.9	USA, Canada	0.925 <sup>b</sup>	9.52	0

39. Rosa 2016 <sup>55</sup>	1	50	1	Clin Com	11·95	Spain	0·891	8	1·18 °
40. Rubenstein 2018 <sup>56</sup>	16	2352	0	Pop Reg	8	USA	0·924	18·3	3·8
41. Simonoff 2008 <sup>59</sup>	35	112	0	Pop Reg	11·5	UK	0·922	12·5	45·03 °
42. Soke 2018 <sup>60</sup>	7	783	0	Pop Reg	4	USA	0·924	22·09	NA
43. Soke 2018 <sup>60</sup>	44	1091	0	Pop Reg	8	USA	0·924	18·97	NA
44. Stacy 2014 <sup>61</sup>	243	913	0	Pop Reg	10·23	USA	0·924	18·29	NA
45. Stadnick 2017 <sup>62</sup>	13	197	1	Clin Com	9·12	USA	0·924	16·24	13·44 °
46. Ung 2013 <sup>66</sup>	35	108	1	Clin Com	10·95	USA	0·924	20·37	0
47. Van Steensel 2013 <sup>67</sup>	10	40	1	Clin Com	11·1	Netherlands	0·931	10	5
48. Verheij 2015 <sup>68</sup>	22	74	1	Clin Com	16	Netherlands	0·931	12	8·75 °
49. Witwer 2010 <sup>70</sup>	46	61	1	Clin Com	11·2	USA	0·924	18·03	59·02
50. Wu 2016 <sup>71</sup>	243	7773	0	Pop Reg	8	USA	0·924	17·35	NA

**6. Obsessive-compulsive disorder in autism**

Case definition: obsessive-compulsive disorder (OCD) reported as the number of people in the autism sample with OCD using DSM-IV, DSM-5 or ICD-9/10 criteria.

Author Year	Cases	Total Autism	Design Code	Study Design	Age	Country	HDI	% Female	% ID
1. Amr 2012 <sup>3</sup>	33	60	1	Clin Com	8·45	Egypt,Jordan,Ara bia	0·761 <sup>b</sup>	38·3	66·8 <sup>c</sup>
2. Anckarsater 2006 <sup>4</sup>	28	113	1	Clin Com	39·5 <sup>a</sup>	Sweden	0·933	NA	NA
3. Bishop-Fitzpatrick & Rubenstein 2019 <sup>5</sup>	18	143	0	Pop Reg	52·4	USA	0·924	31·5	44·8
4. Bakken 2010 <sup>72</sup>	8	62	1	Clin Com	24·3	Norway	0·953	27·42	100
5. Bitsika & Sharpley 2015 <sup>90</sup>	14	140	1	Clin Com	11·16	Australia	0·939	0	0
6. Bowers 2015 <sup>6</sup>	17	883	1	Clin Com	8·3	USA	0·924	17·4	36·8
7. Brookman-Frazee 2017 <sup>7</sup>	19	201	1	Clin Com	9·13	USA	0·924	16	13·19 <sup>c</sup>
8. Bryson 2008 <sup>8</sup>	20	586	1	Clin Com	9·18	USA	0·924	15·56	NA
9. Buck 2014 <sup>73</sup>	43	129	0	Pop Reg	25·4	USA	0·924	24·8	72·8
10. Croen 2015 <sup>11</sup>	115	1507	1	Clin Com	29	USA	0·924	26·9	19·2
11. Davignon 2018 <sup>13</sup>	94	4123	1	Clin Com	18·39	USA	0·924	19·33	13
12. De Bruin 2007 <sup>14</sup>	6	94	1	Clin Com	8·5	Netherlands	0·931	11·7	11·17 <sup>c</sup>
13. Gillberg 2016 <sup>18</sup>	4	39	1	Clin Com	30	Sweden	0·933	0	0
14. Ghaiziuddin 1998	1	35	1	Clin Com	15·1	USA	0·924	17·14	4·01 <sup>c</sup>
15. Gjevik 2011 <sup>19</sup>	7	71	1	Clin Com	11·8	Norway	0·953	18	57 <sup>c</sup>
16. Gjevik 2015 <sup>20</sup>	5	55	1	Clin Com	11·9	Norway	0·953	16·36	59 <sup>c</sup>
17. Houghton 2018 <sup>27</sup>	0	110	0	Pop Reg	3·5 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	0
18. Houghton 2018 <sup>27</sup>	10	2813	0	Pop Reg	8 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	0·14 <sup>*</sup>
19. Houghton 2018 <sup>27</sup>	52	3371	0	Pop Reg	14·5 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	0·53 <sup>*</sup>
20. Houghton 2018 <sup>27</sup>	84	2467	0	Pop Reg	21 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	1·7
21. Houghton 2018 <sup>27</sup>	100	1667	0	Pop Reg	37 <sup>a</sup>	UK	0·922	19·3 <sup>d</sup>	13·9
22. Houghton 2018 <sup>27</sup>	21	428	0	Pop Reg	65·5 <sup>a*</sup>	UK	0·922	19·3 <sup>d</sup>	26·2
23. Joshi 2010 <sup>28</sup>	53	217	1	Clin Com	9·7	USA	0·924	13·36	NA
24. Joshi 2013 <sup>29</sup>	10	63	1	Clin Com	29·2	USA	0·924	34·92	2·34
25. Kerns 2014 <sup>74</sup>	1	59	1	Clin Com	10·48	USA	0·924	22·03	3·43
26. Knuppel 2018 <sup>32</sup>	82	1434	0	Pop Reg	21 <sup>a</sup>	Denmark	0·929	18·9	16·7
27. Levy 2010 <sup>34</sup>	51	2568	0	Pop Reg	8	USA	0·924	19·12	18·3
28. Lugnegard 2011 <sup>38</sup>	4	54	1	Clin Com	27	Sweden	0·933	51·85	0
29. Mansour 2017 <sup>40</sup>	15	99	1	Clin Com	9·37	USA	0·924	21·2	24·71 <sup>c</sup>
30. Mattila 2010 <sup>42</sup>	11	50	1	Clin Com	12·7	Finland	0·920	24	0
31. Meier 2015 <sup>44</sup>	458	18184	0	Pop Reg	23·5 <sup>a</sup>	Denmark	0·929	NA	NA
32. Mukaddes & Fateh 2010 <sup>47</sup>	11	37	1	Clin Com	10·9	Turkey	0·791	13·51	0
33. Mukaddes 2010 <sup>48</sup>	22	60	1	Clin Com	10·65	Turkey	0·791	0	0
34. Nahar 2018 <sup>50</sup>	15	33	1	Clin Com	22·7	India	0·640	21·3	0
35. Orinstein 2015 <sup>52</sup>	4	42	1	Clin Com	13·9	USA,Canada	0·925 <sup>b</sup>	9·52	0
36. Raja & Azzoni 2010 <sup>89</sup>	2	26	1	Clin Com	30·2	Italy	0·880	3·85	22·91 <sup>c</sup>
37. Romero 2016 <sup>54</sup>	50	123	1	Clin Com	10·62	Spain	0·891	18	NA
38. Rosa 2016 <sup>55</sup>	2	50	1	Clin Com	11·95	Spain	0·891	8	1·18 <sup>c</sup>
39. Rubenstein 2018 <sup>56</sup>	9	2352	0	Pop Reg	8	USA	0·924	18·3	3·8
40. Russell 2016 <sup>57</sup>	85	474	1	Clin Com	30·59	UK	0·922	21·6	0
41. Ryden & Bejerot 2008 <sup>82</sup>	12	53	1	Clin Com	30	Sweden	0·933	46·42	0

42. Simonoff 2008 <sup>59</sup>	9	112	0	Pop Reg	11·5	UK	0·922	12·5	45·03 °
43. Ung 2013 <sup>66</sup>	5	108	1	Clin Com	10·95	USA	0·924	20·37	0
44. Van Steensel 2013 <sup>67</sup>	3	40	1	Clin Com	11·1	Netherlands	0·931	10	5
45. Verheij 2015 <sup>68</sup>	6	74	1	Clin Com	16	Netherlands	0·931	12	8·75 °
46. Witwer 2010 <sup>70</sup>	3	61	1	Clin Com	11·2	USA	0·924	18·03	59·02
47. Wu 2016 <sup>71</sup>	131	7773	0	Pop Reg	8	USA	0·924	17·35	NA

**7. Schizophrenia spectrum and psychotic disorders in autism**

Case definition: schizophrenia spectrum and psychotic disorders, reported as the number of people in the autism sample, with “any schizophrenia spectrum disorder”, “all schizophrenia spectrum disorders” or “at least one schizophrenia spectrum disorder”; and if these were not reported, “any psychotic disorder”, “psychosis”, and “schizophrenia” were used and added together if reported in the same study, using DSM-IV, DSM-5 or ICD-9/10 criteria.

Author Year	Cases	Total Autism	Design Code	Study Design	Age	Country	HDI	% Female	% ID
1. Abdallah 2011 <sup>1</sup>	12	414	0	Pop Reg	16-28	Denmark	0.929	19.1	21.3
2. Bakken 2010 <sup>72</sup>	16	62	1	Clin Com	24.3	Norway	0.953	27.42	100
3. Bishop-Fitzpatrick & Rubenstein 2019 <sup>5</sup>	15	143	0	Pop Reg	52.4	USA	0.924	31.5	44.8
4. Bowers 2015 <sup>6</sup>	3	883	1	Clin Com	8.3	USA	0.924	17.4	36.8
5. Buck 2014 <sup>73</sup>	6	129	0	Pop Reg	25.4	USA	0.924	24.8	72.8
6. Chen 2015 <sup>9</sup>	95	1191	0	Pop Reg	16.4	Taiwan	0.907	19.31	NA
7. Croen 2015 <sup>11</sup>	118	1507	1	Clin Com	29	USA	0.924	26.9	19.2
8. Davignon 2018 <sup>13</sup>	70	4123	1	Clin Com	18.39	USA	0.924	19.33	13
9. De Bruin 2007 <sup>14</sup>	0	94	1	Clin Com	8.5	Netherlands	0.931	11.7	11.17 <sup>c</sup>
10. Houghton 2017 <sup>26</sup>	1	6399	0	Pop Reg	3.5 <sup>a</sup>	USA	0.924	20 <sup>d</sup>	9.34
11. Houghton 2017 <sup>26</sup>	80	36947	0	Pop Reg	8 <sup>a</sup>	USA	0.924	20 <sup>d</sup>	9.35
12. Houghton 2017 <sup>26</sup>	325	28040	0	Pop Reg	14.5 <sup>a</sup>	USA	0.924	20 <sup>d</sup>	12.01
13. Houghton 2017 <sup>26</sup>	635	15086	0	Pop Reg	21 <sup>a</sup>	USA	0.924	20 <sup>d</sup>	20.20
14. Houghton 2017 <sup>26</sup>	486	6529	0	Pop Reg	37 <sup>a</sup>	USA	0.924	20 <sup>d</sup>	39.93
15. Houghton 2017 <sup>26</sup>	57	638	0	Pop Reg	64.5 <sup>a*</sup>	USA	0.924	20 <sup>d</sup>	45.14
16. Houghton 2018 <sup>27</sup>	0	110	0	Pop Reg	3.5 <sup>a</sup>	UK	0.922	19.3 <sup>d</sup>	0
17. Houghton 2018 <sup>27</sup>	0	2813	0	Pop Reg	8 <sup>a</sup>	UK	0.922	19.3 <sup>d</sup>	0.14 <sup>*</sup>
18. Houghton 2018 <sup>27</sup>	0	3371	0	Pop Reg	14.5 <sup>a</sup>	UK	0.922	19.3 <sup>d</sup>	0.53 <sup>*</sup>
19. Houghton 2018 <sup>27</sup>	5	2467	0	Pop Reg	21 <sup>a</sup>	UK	0.922	19.3 <sup>d</sup>	1.7
20. Houghton 2018 <sup>27</sup>	31	1667	0	Pop Reg	37 <sup>a</sup>	UK	0.922	19.3 <sup>d</sup>	13.9
21. Houghton 2018 <sup>27</sup>	21	428	0	Pop Reg	65.5 <sup>a*</sup>	UK	0.922	19.3 <sup>d</sup>	26.2
22. Joshi 2010 <sup>28</sup>	42	217	1	Clin Com	9.7	USA	0.924	13.36	NA
23. Joshi 2013 <sup>29</sup>	5	63	1	Clin Com	29.2	USA	0.924	34.92	2.34
24. Kohane 2012 <sup>91</sup>	350	14381	1	Clin Com	17.5 <sup>a</sup>	USA	0.924	20.67	NA
25. Knuppel 2018 <sup>32</sup>	27	1434	0	Pop Reg	21 <sup>a</sup>	Denmark	0.929	18.9	16.7
26. Levy 2010 <sup>34</sup>	3	2568	0	Pop Reg	8	USA	0.924	19.12	18.3
27. Logan 2014 <sup>36</sup>	1	629	1	Clin Com	8	USA	0.924	19	62.96
28. LoVullo & Matson 2009 <sup>37</sup>	2	162	1	Clin Com	48.7	USA	0.924	42.6	100
29. McCarthy 2010 <sup>76</sup>	7	124	1	Clin Com	41.5 <sup>a</sup>	USA	0.924	30.65	100
30. Mouridsen 2008a <sup>92</sup>	31	89	1	Clin Com	45.3	Denmark	0.929	34.83	39
31. Mouridsen 2008b <sup>93</sup>	8	118	1	Clin Com	40.6	Denmark	0.929	27.97	71
32. Mukaddes 2010 <sup>48</sup>	1	60	1	Clin Com	10.65	Turkey	0.791	0	0
33. Nahar 2018 <sup>50</sup>	0	33	1	Clin Com	22.7	India	0.640	21.3	0
34. Raja & Azzoni 2010 <sup>89</sup>	16	26	1	Clin Com	30.2	Italy	0.880	3.85	22.91 <sup>c</sup>
35. Russell 2016 <sup>57</sup>	6	474	1	Clin Com	30.59	UK	0.922	21.6	0
36. Ryden & Bejerot 2008 <sup>82</sup>	5	53	1	Clin Com	30	Sweden	0.933	46.42	0
37. Schalbroek 2018 <sup>83</sup>	845	17234	0	Pop Reg	23.14	Netherlands	0.931	23.93	10.51
38. Selten 2015 <sup>84</sup>	57	9062	0	Pop Reg	15.3	Sweden	0.933	27	NA
39. Supekar 2017 <sup>64</sup>	95	4790	0	Pop Reg	17.5	USA	0.924	NA	NA
40. Tsakanikos 2006 <sup>79</sup>	23	147	1	Clin Com	33.3	UK	0.922	32.65	100

41. Tsakanikos 2011 <sup>80</sup>	25	150	1	Clin Com	28.5	UK	0.922	33.33	100
42. Vohra 2017 <sup>69</sup>	294	1772	0	Pop Reg	31 <sup>a</sup>	USA	0.924	29	NA



**8. Sleep-wake disorders in autism**

Case definition: sleep-wake disorders reported as the number of people in the autism sample with “any sleep disorder”, “all sleep disorders”, or “at least one sleep disorder” using DSM-IV, DSM-5 or ICD-9/10 criteria.

Author Year	Cases	Total Autism	Design Code	Study Design	Age	Country	HDI	% Female	% ID
1. Croen 2015 <sup>11</sup>	265	1507	1	Clin Com	29	USA	0.924	26.9	19.2
2. Cummings 2016 <sup>12</sup>	149	3926	0	Pop Reg	6.2	USA	0.924	17.3	NA
3. Cummings 2016 <sup>12</sup>	264	4399	0	Pop Reg	13.2	USA	0.924	18	NA
4. Davignon 2018 <sup>13</sup>	256	4123	1	Clin Com	18.39	USA	0.924	19.33	13
5. Elrod 2016 <sup>94</sup>	14951	48762	0	Pop Reg	3 <sup>a</sup>	USA	0.924	20	NA
6. Jones 2015 <sup>95</sup>	38	92	1	Clin Com	36	USA	0.924	25	NA
7. Hansen 2016 <sup>24</sup>	38	284	1	Clin Com	4.5	USA	0.924	15.1	26
8. Houghton 2017 <sup>26</sup>	629	6399	0	Pop Reg	3.5 <sup>a</sup>	USA	0.924	20 <sup>d</sup>	9.34
9. Houghton 2017 <sup>26</sup>	3019	36947	0	Pop Reg	8 <sup>a</sup>	USA	0.924	20 <sup>d</sup>	9.35
10. Houghton 2017 <sup>26</sup>	1921	28040	0	Pop Reg	14.5 <sup>a</sup>	USA	0.924	20 <sup>d</sup>	12.01
11. Houghton 2017 <sup>26</sup>	1006	15086	0	Pop Reg	21 <sup>a</sup>	USA	0.924	20 <sup>d</sup>	20.20
12. Houghton 2017 <sup>26</sup>	451	6529	0	Pop Reg	37 <sup>a</sup>	USA	0.924	20 <sup>d</sup>	39.93
13. Houghton 2017 <sup>26</sup>	64	638	0	Pop Reg	64.5 <sup>a*</sup>	USA	0.924	20 <sup>d</sup>	45.14
14. Houghton 2018 <sup>27</sup>	7	110	0	Pop Reg	3.5 <sup>a</sup>	UK	0.922	19.3 <sup>d</sup>	0
15. Houghton 2018 <sup>27</sup>	372	2813	0	Pop Reg	8 <sup>a</sup>	UK	0.922	19.3 <sup>d</sup>	0.14 <sup>*</sup>
16. Houghton 2018 <sup>27</sup>	485	3371	0	Pop Reg	14.5 <sup>a</sup>	UK	0.922	19.3 <sup>d</sup>	0.53 <sup>*</sup>
17. Houghton 2018 <sup>27</sup>	389	2467	0	Pop Reg	21 <sup>a</sup>	UK	0.922	19.3 <sup>d</sup>	1.7
18. Houghton 2018 <sup>27</sup>	285	1667	0	Pop Reg	37 <sup>a</sup>	UK	0.922	19.3 <sup>d</sup>	13.9
19. Houghton 2018 <sup>27</sup>	82	428	0	Pop Reg	65.5 <sup>a*</sup>	UK	0.922	19.3 <sup>d</sup>	26.2
20. Kohane 2012 <sup>91</sup>	161	14381	1	Clin Com	17.5 <sup>a</sup>	USA	0.924	20.67	NA
21. Logan 2014 <sup>36</sup>	15	629	1	Clin Com	8	USA	0.924	19	62.96
22. Meguid 2018 <sup>43</sup>	19	80	1	Clin Com	3.77	Egypt	0.696	25	93.75 <sup>c</sup>
23. Ming 2008 <sup>96</sup>	83	160	1	Clin Com	9 <sup>a</sup>	USA	0.924	18.13	NA
24. Neumeyer 2019 <sup>51</sup>	567	2114	0	Pop Reg	3.8	USA	0.924	18.45	NA
25. Neumeyer 2019 <sup>51</sup>	297	1221	0	Pop Reg	9.6	USA	0.924	16.46	NA
26. Supekar 2017 <sup>64</sup>	40	4790	0	Pop Reg	17.5	USA	0.924	NA	NA

## 9. Studies not meta-analysed and only descriptively synthesised

Trauma, stress related disorders in autism were reported in 14 studies.<sup>8,14,68,74,82,97,18,28,29,34,40,52,66,67</sup> Post traumatic stress disorder was most commonly reported, with prevalence estimates ranging from 0 to 3.6%. Substance related and addictive disorders in autism were reported in 14 studies.<sup>1,11,92,98-100,18,23,28,29,47,57,69,89</sup> The most commonly reported on substance related sub-conditions was alcohol abuse and/or alcohol dependence, which ranged from 0 to 11%. Gender dysphoria in autism was reported in 0 studies. Due to the diverse ways in which these conditions and sub-conditions were presented in the included studies, it was not possible to combine the information reported into an acceptable case definition for meta-analyses with more than 15 data points for meta-analysis.

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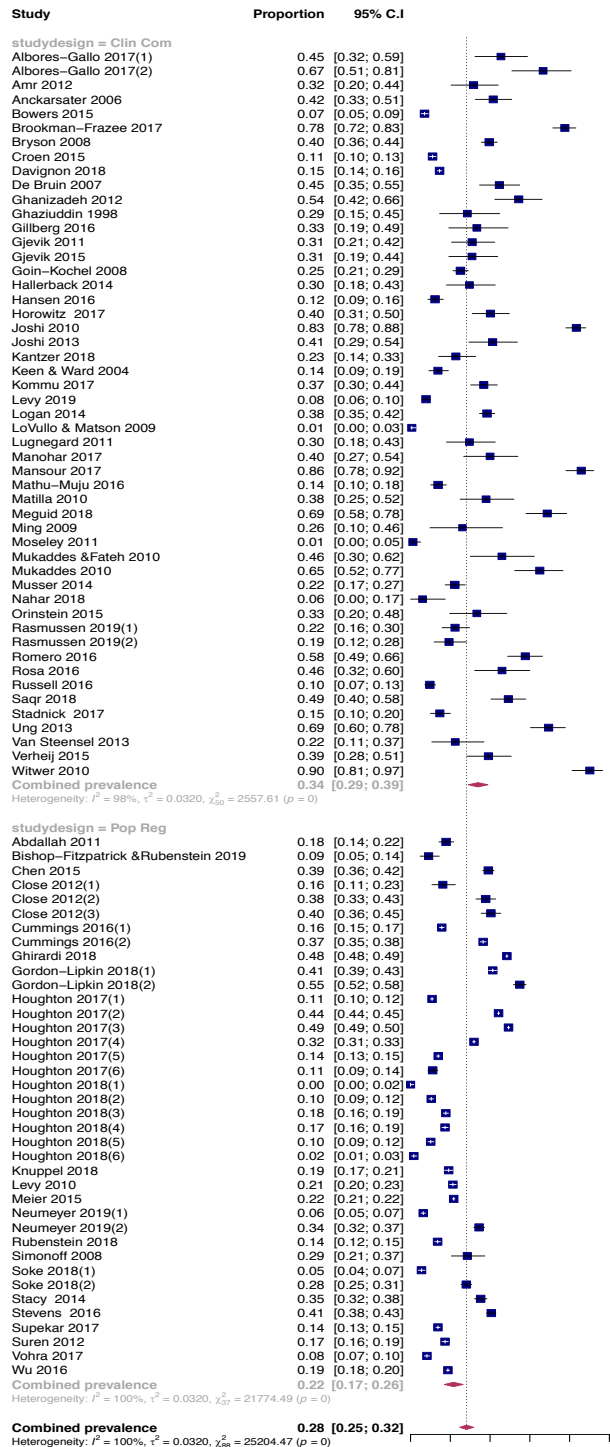
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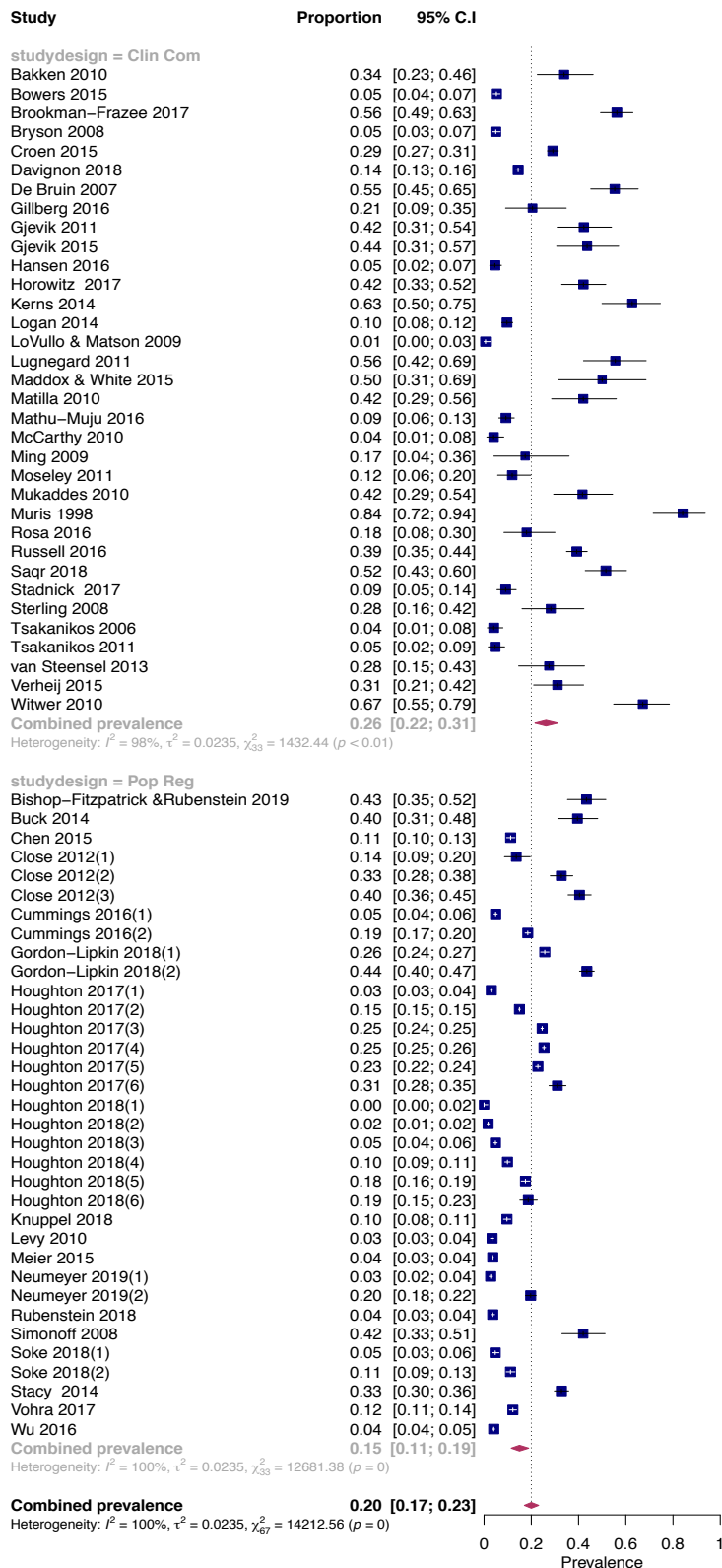
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93. Mouridsen SE, Rich B, Isager T, Nedergaard NJ. Psychiatric disorders in individuals diagnosed with infantile autism as children: a case control study. *J Psychiatr Pract*. 2008;14(1):5-12. doi:10.1097/01.pra.0000308490.47262.e0.
94. Elrod MG, Nylund CM, Susi AL, et al. Prevalence of Diagnosed Sleep Disorders and Related Diagnostic and Surgical Procedures in Children with Autism Spectrum Disorders. *J Dev Behav Pediatr*. 2016;37(5):377-384. doi:10.1097/DBP.0000000000000248.
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98. Butwicka A, Langstrom N, Larsson H, et al. Increased Risk for Substance Use-Related Problems in Autism Spectrum Disorders: A Population-Based Cohort Study. *J Autism Dev Disord*. 2017;47(1):80-89. doi:10.1007/s10803-016-2914-2.
99. Santosh PJ, Mijovic A. Does pervasive developmental disorder protect children and adolescents against drug and alcohol use? *Eur Child Adolesc Psychiatry*. 2006;15(4):183-188. doi:10.1007/s00787-005-0517-0.
100. Sizoo B, van den Brink W, Koeter M, Gorissen van Eenige M, van Wijngaarden-Cremers P, van der Gaag RJ. Treatment seeking adults with autism or ADHD and co-morbid substance use disorder: prevalence, risk factors and functional disability. *Drug Alcohol Depend*. 2010;107(1):44-50. doi:10.1016/j.drugalcdep.2009.09.003.

**Appendix3: Forest Plots by Study Design Subgroups (Main Analyses)**

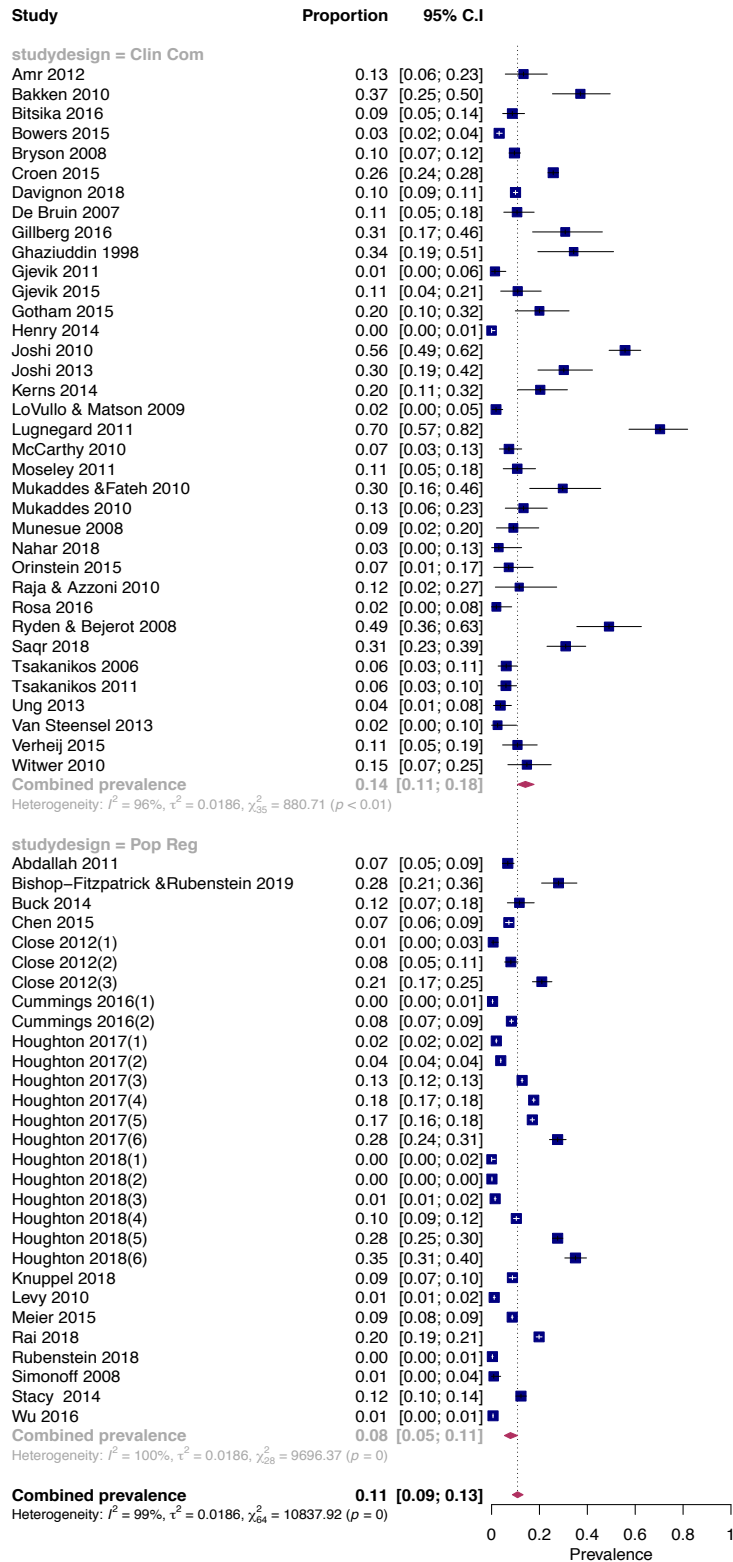
Legend: Pop Reg = Population-based/Registry-based studies; Clin Com = Clinical studies from community samples  
C.I = Confidence Interval

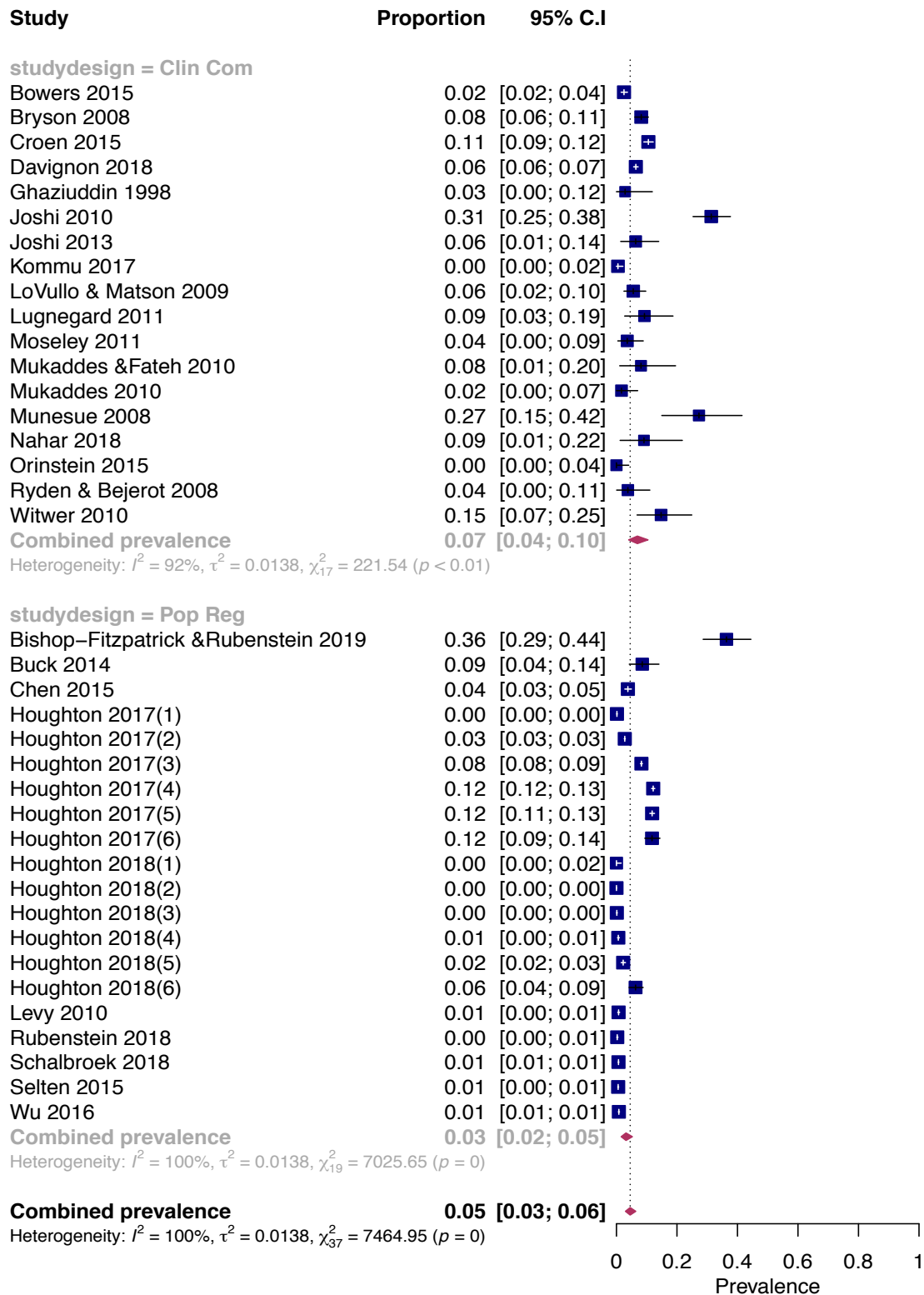
**a. ADHD**



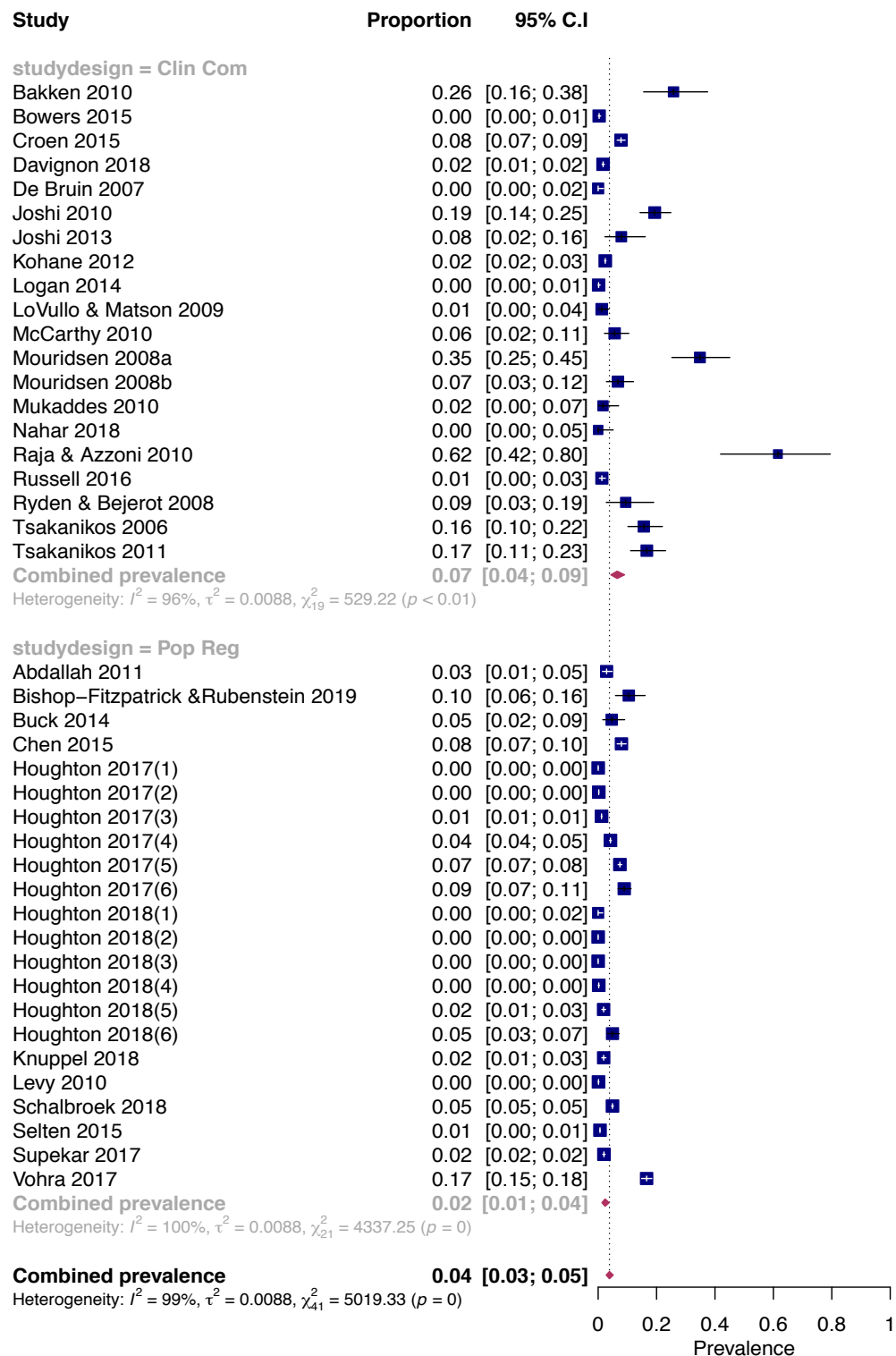
**b. Anxiety Disorders**

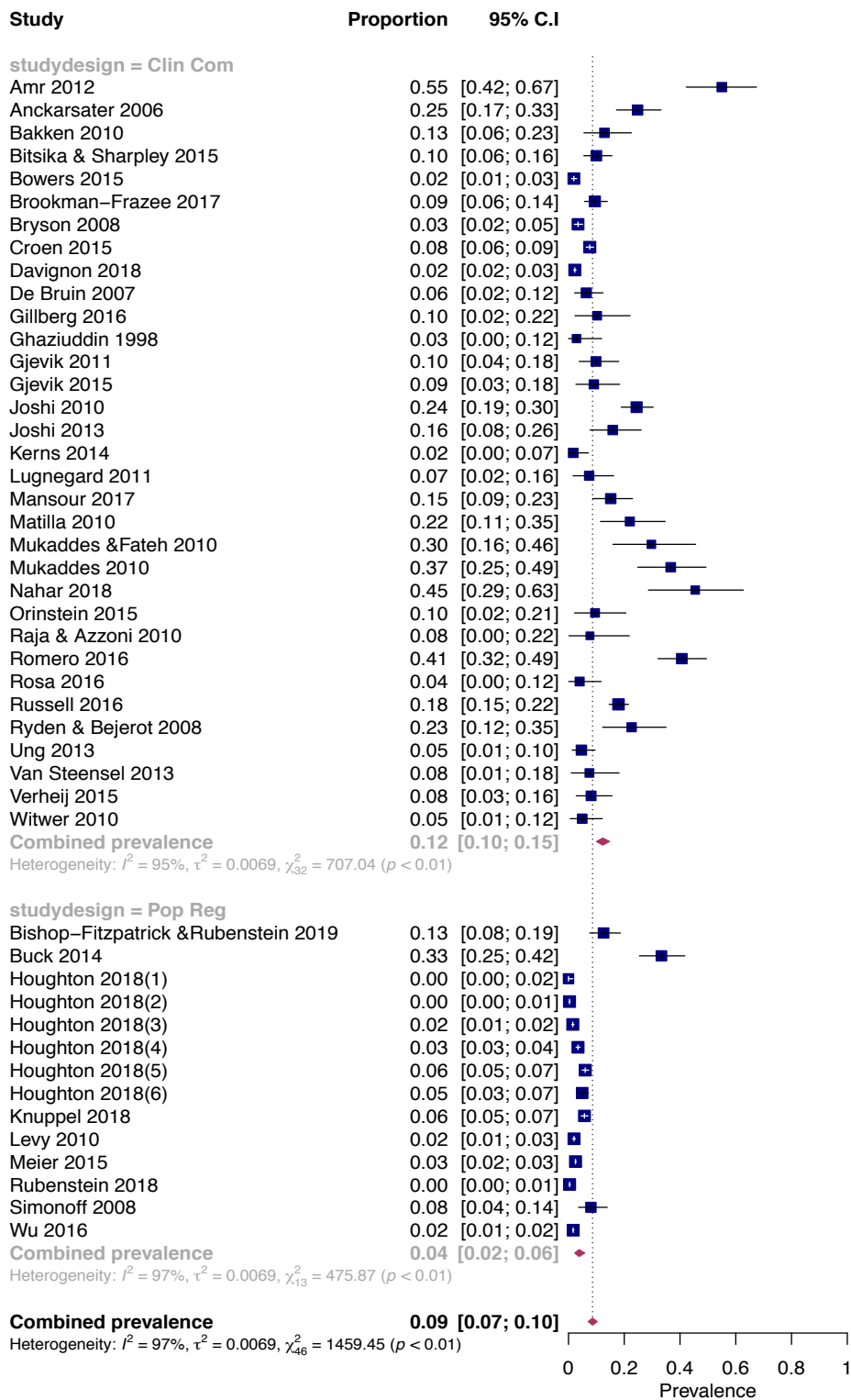
## c. Depressive Disorders

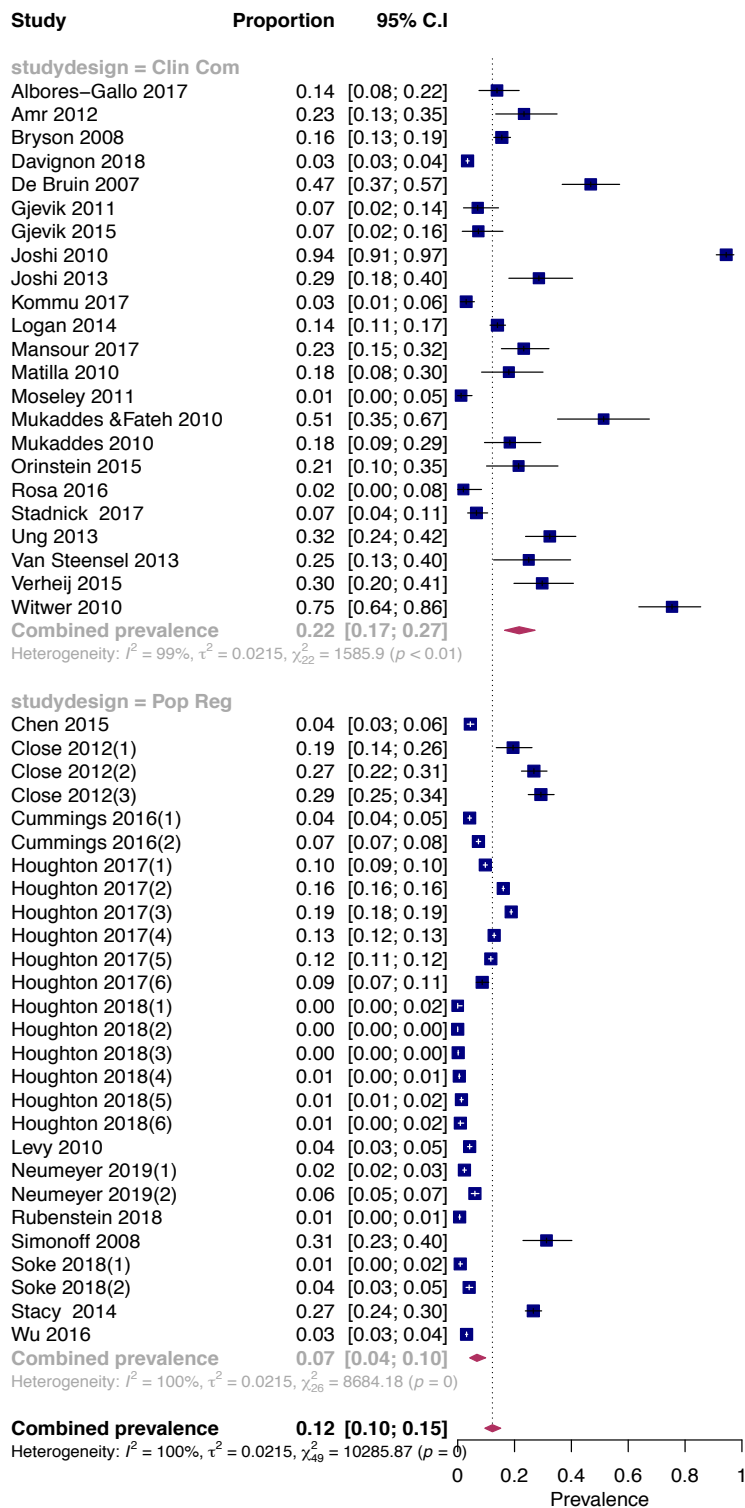


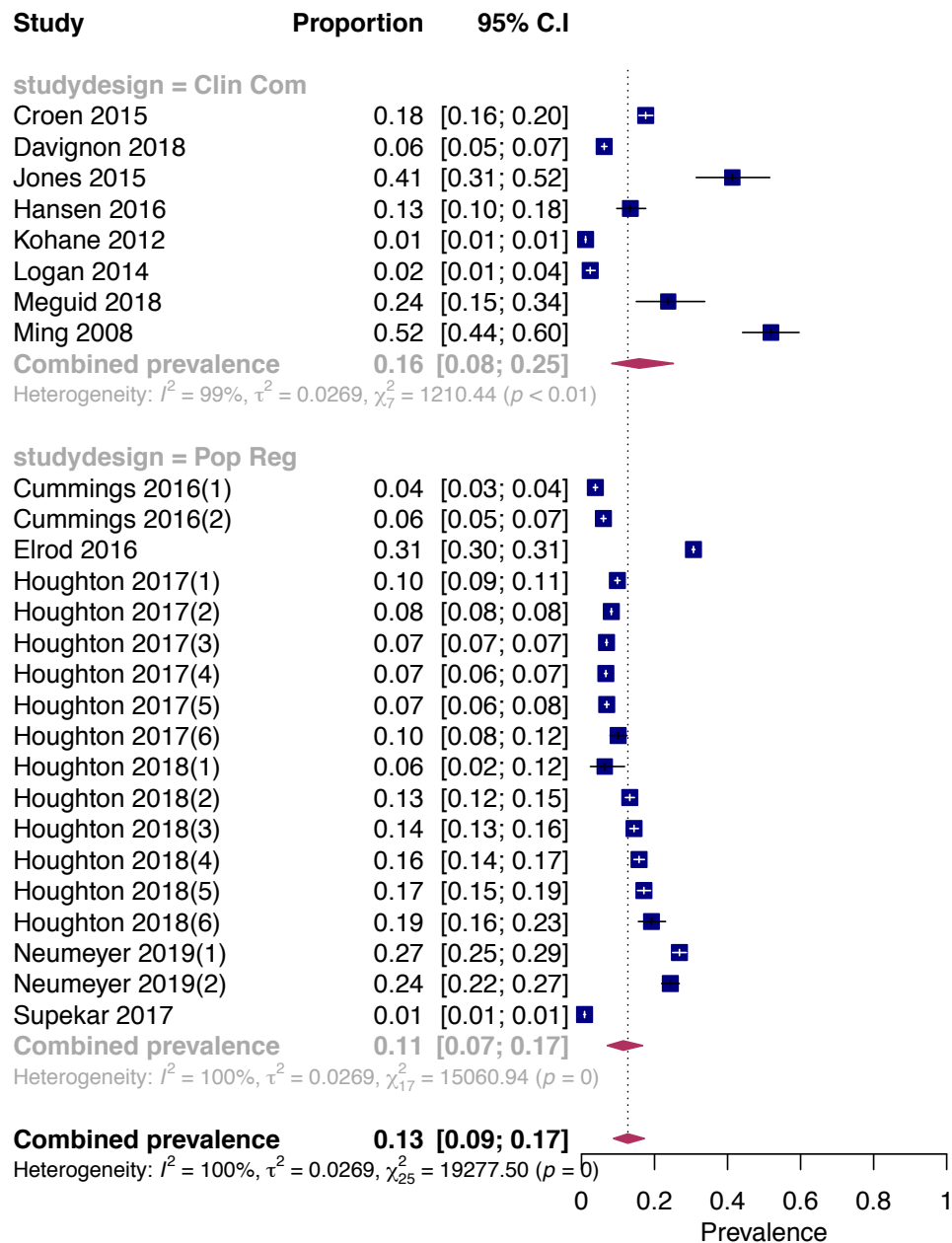
**d. Bipolar and Related Disorders**

## e. Schizophrenia Spectrum and Psychotic Disorders



**f. Obsessive-Compulsive Disorder**

**g. Disruptive, Impulse-Control and Conduct Disorders**

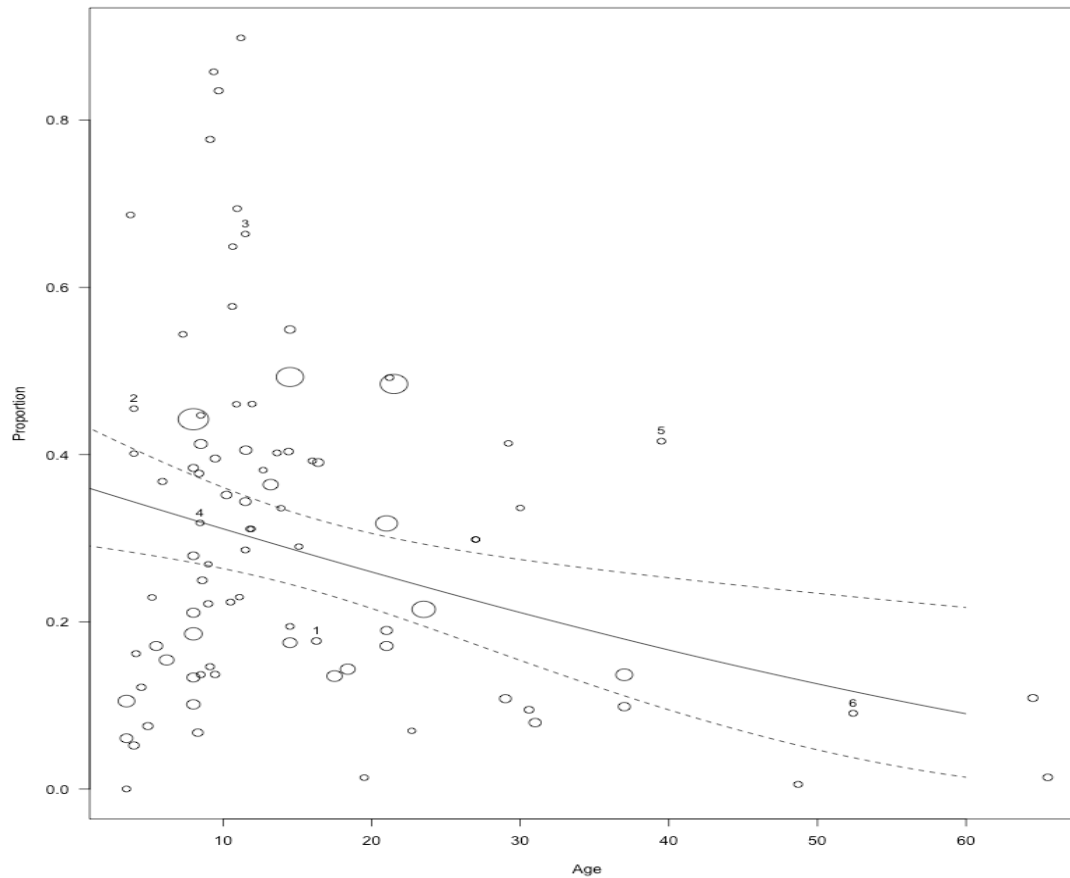
**h. Sleep-Wake Disorders**

#### Appendix4: Univariable scatter-plots and box-and-whisker plots (\* indicates QM $p < 0.05$ )

X-axis indicates the univariable meta-regression moderator modeled, and y-axis indicates reported proportion of each CMHC in the autism sample, based on the moderator. Solid line indicates estimated regression line, and dotted line indicates 95% confidence intervals. For the subgroup analysis, box-and-whisker plot shows the distribution of the sample by study design, the solid horizontal line represents the sample median, and the whiskers display the 95% confidence intervals. Circle size represents size of a study's influence on the regression line.

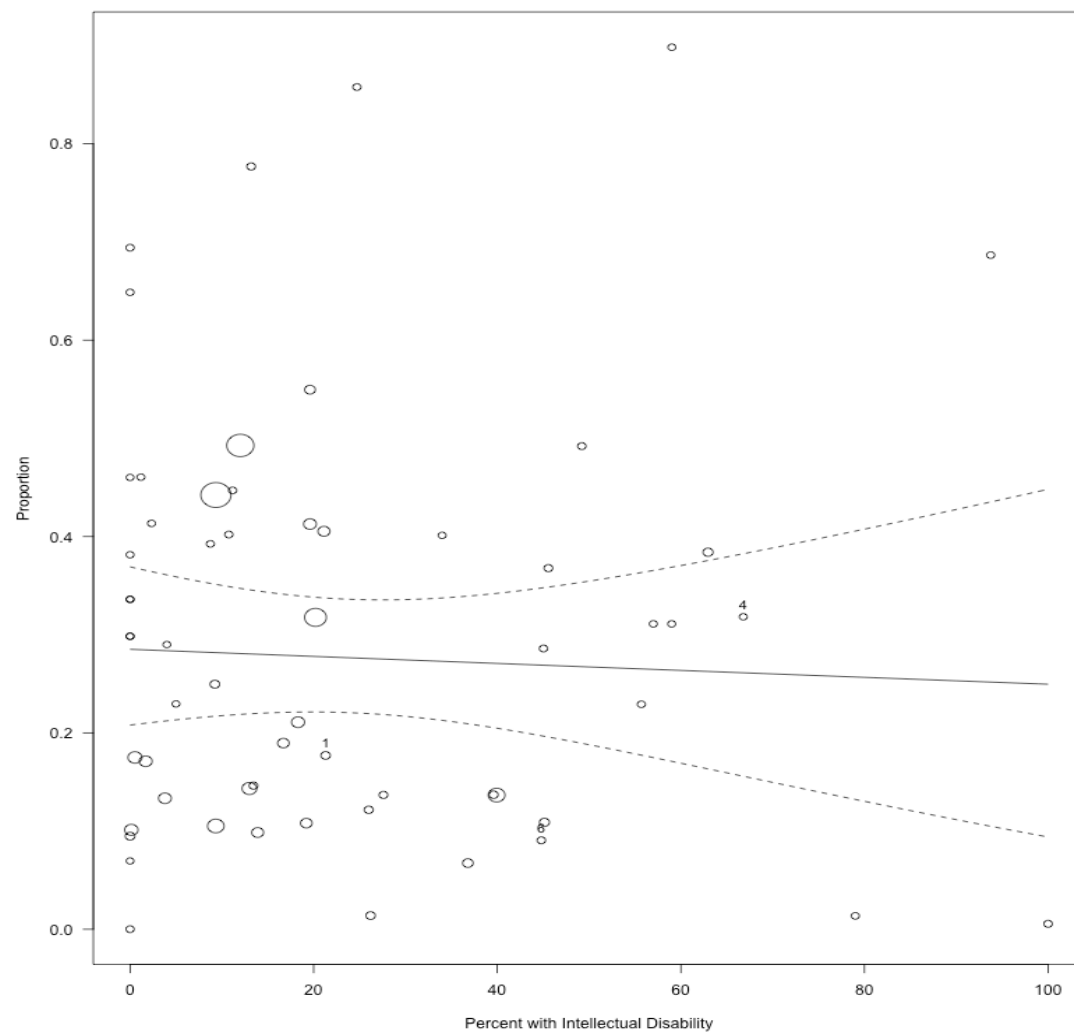
##### a. ADHD

\*Age

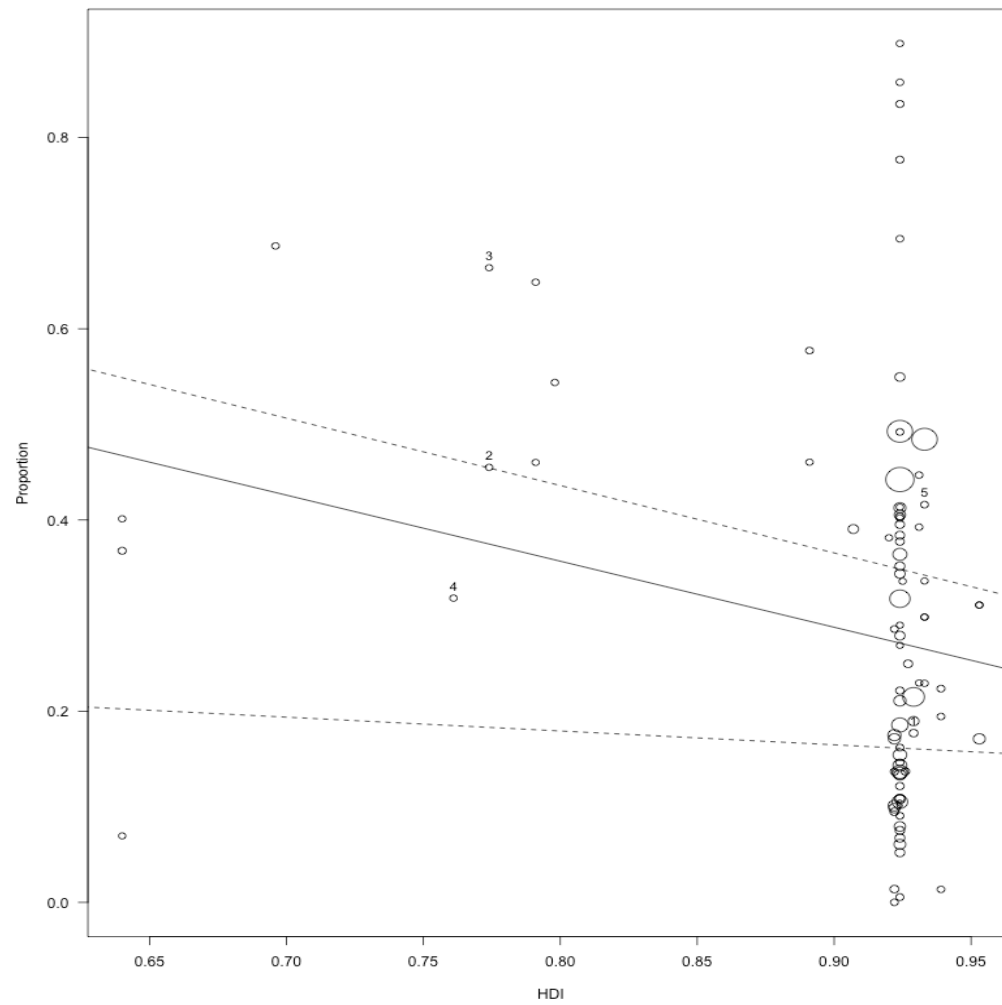




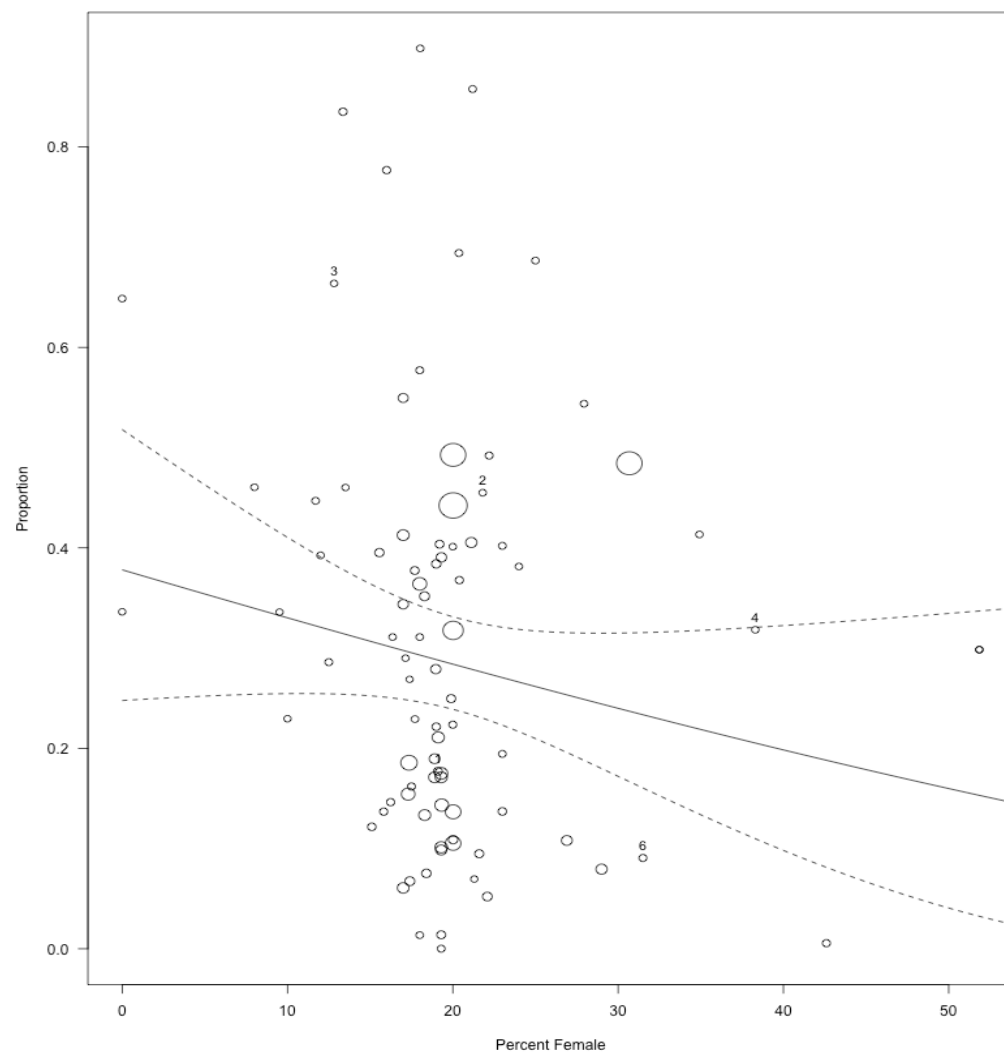
Percent ID



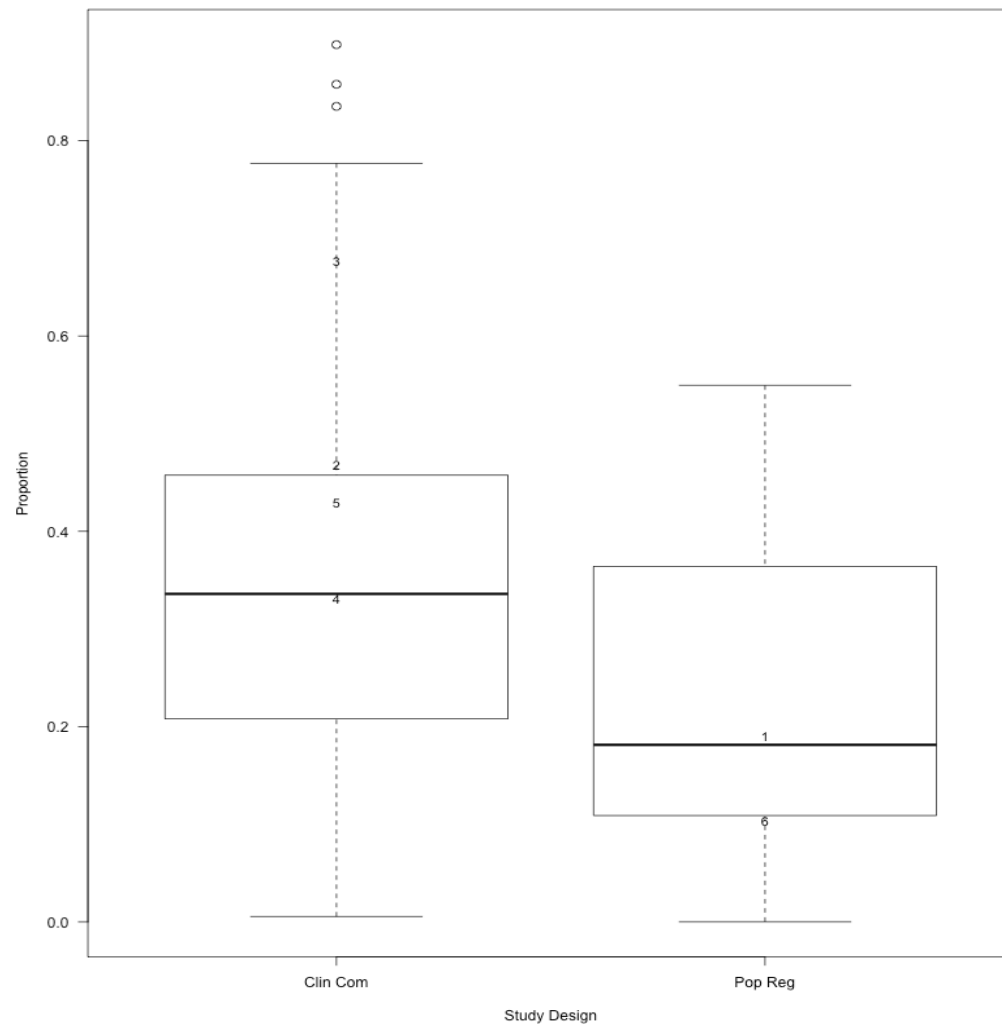
HDI



Percent Female

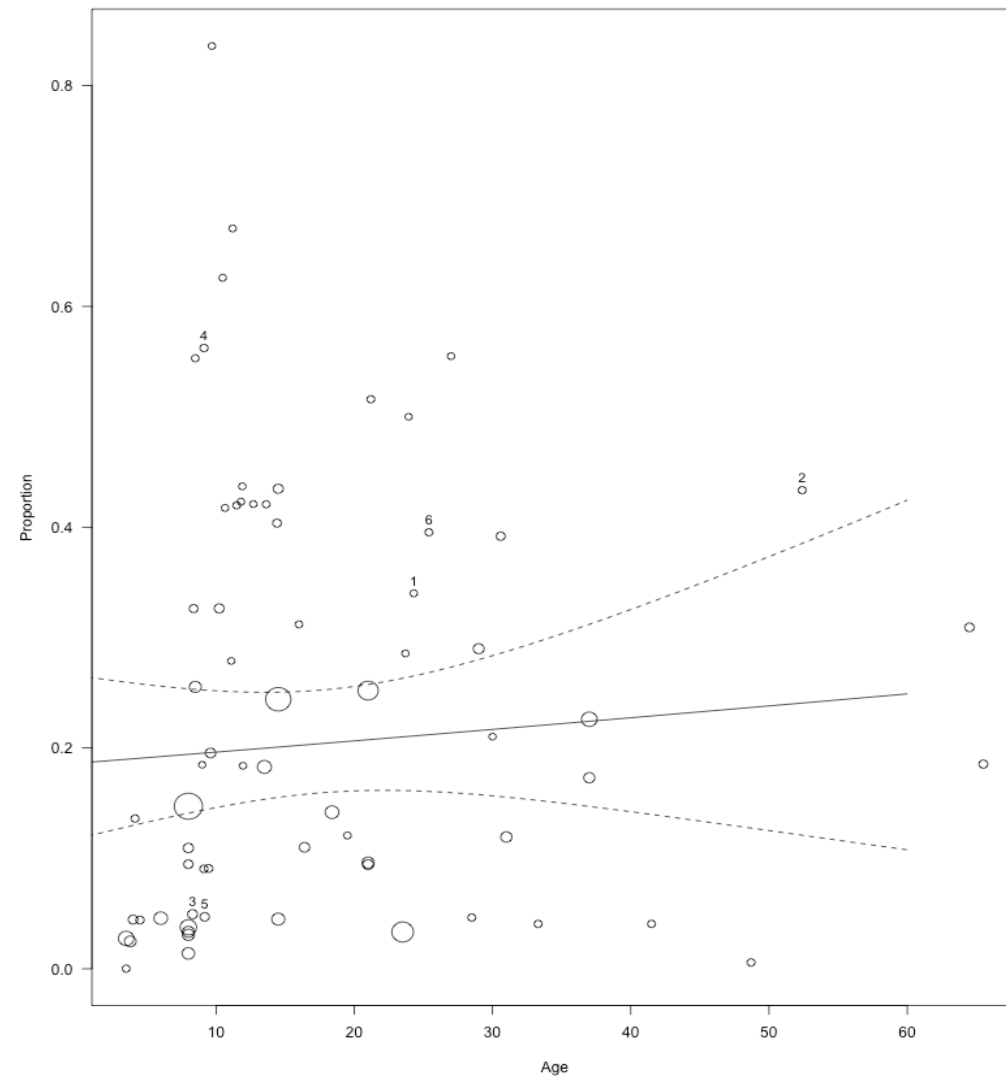


\*Study Design

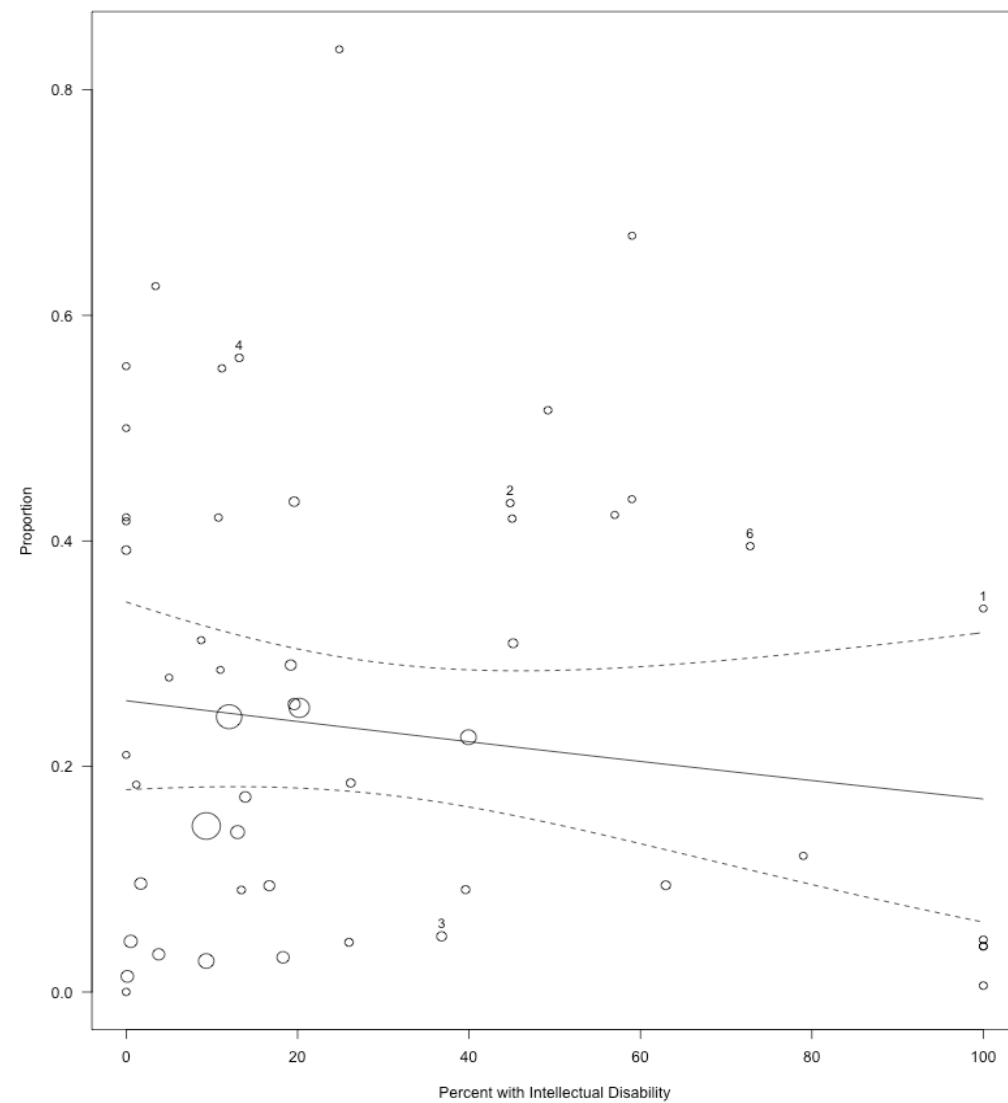


**b. Anxiety disorders**

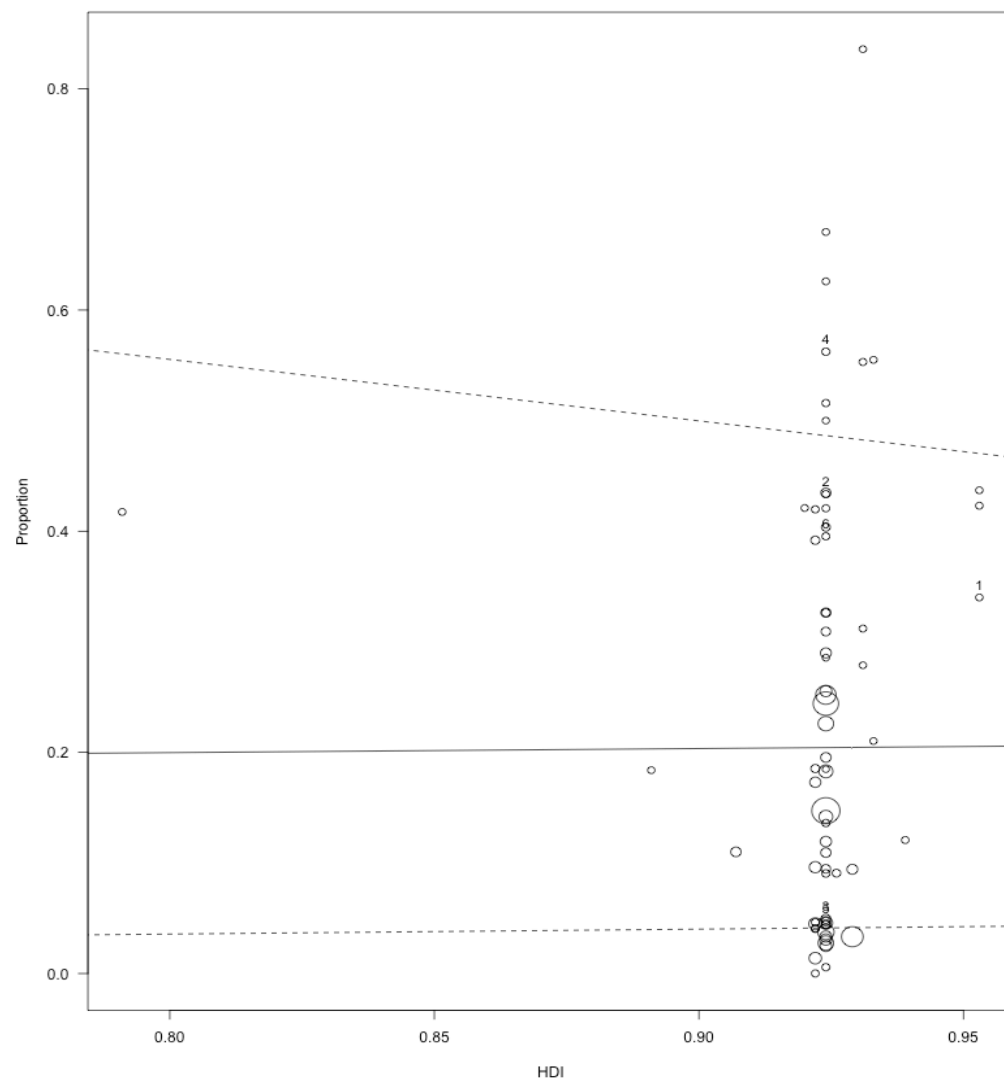
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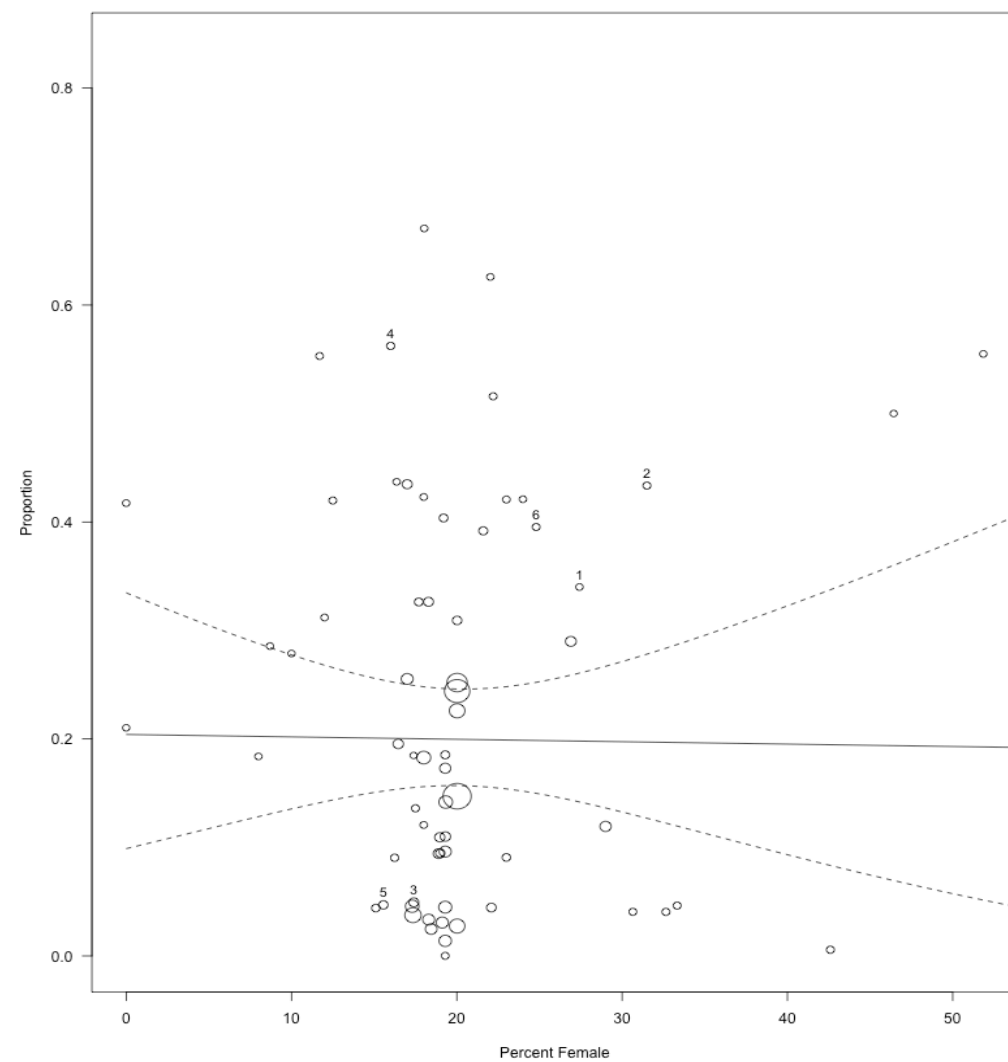
Percent ID



HDI

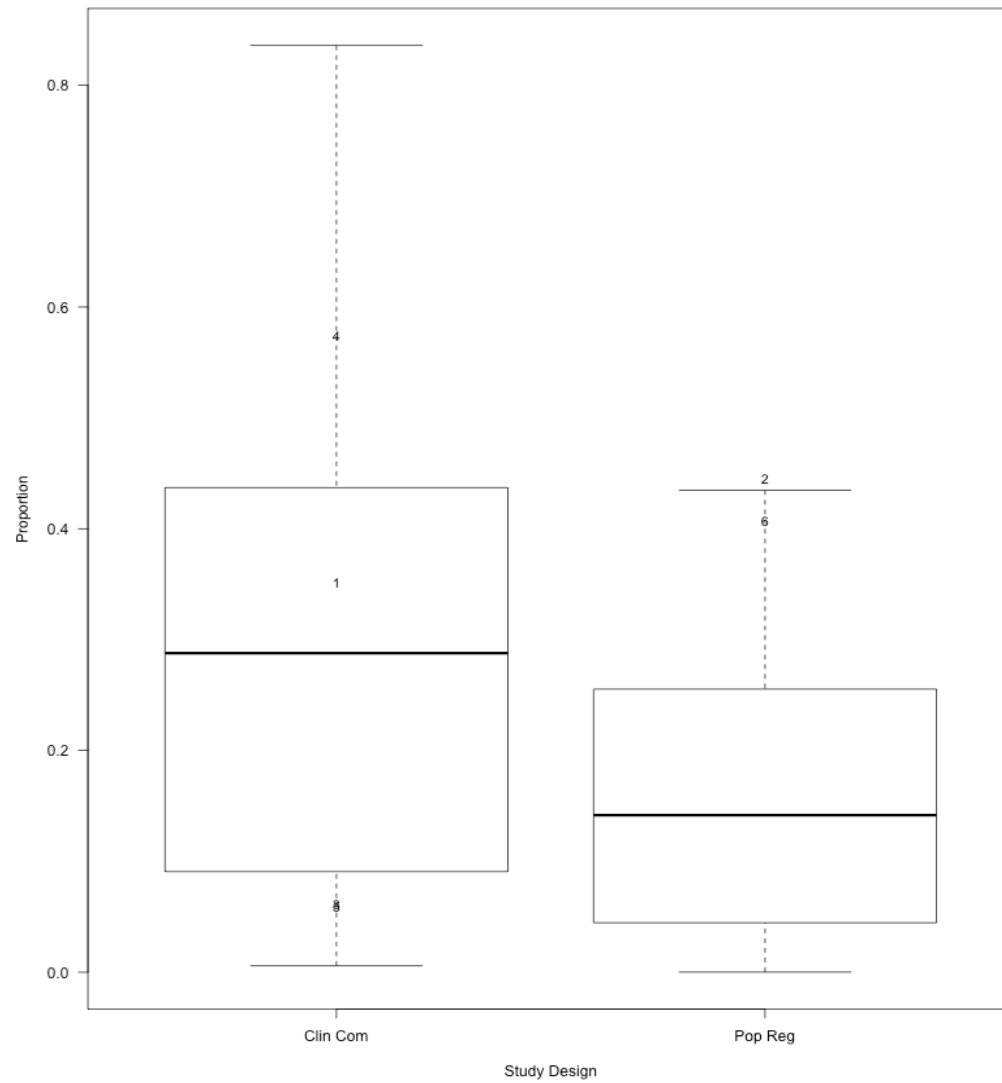


Percent Female



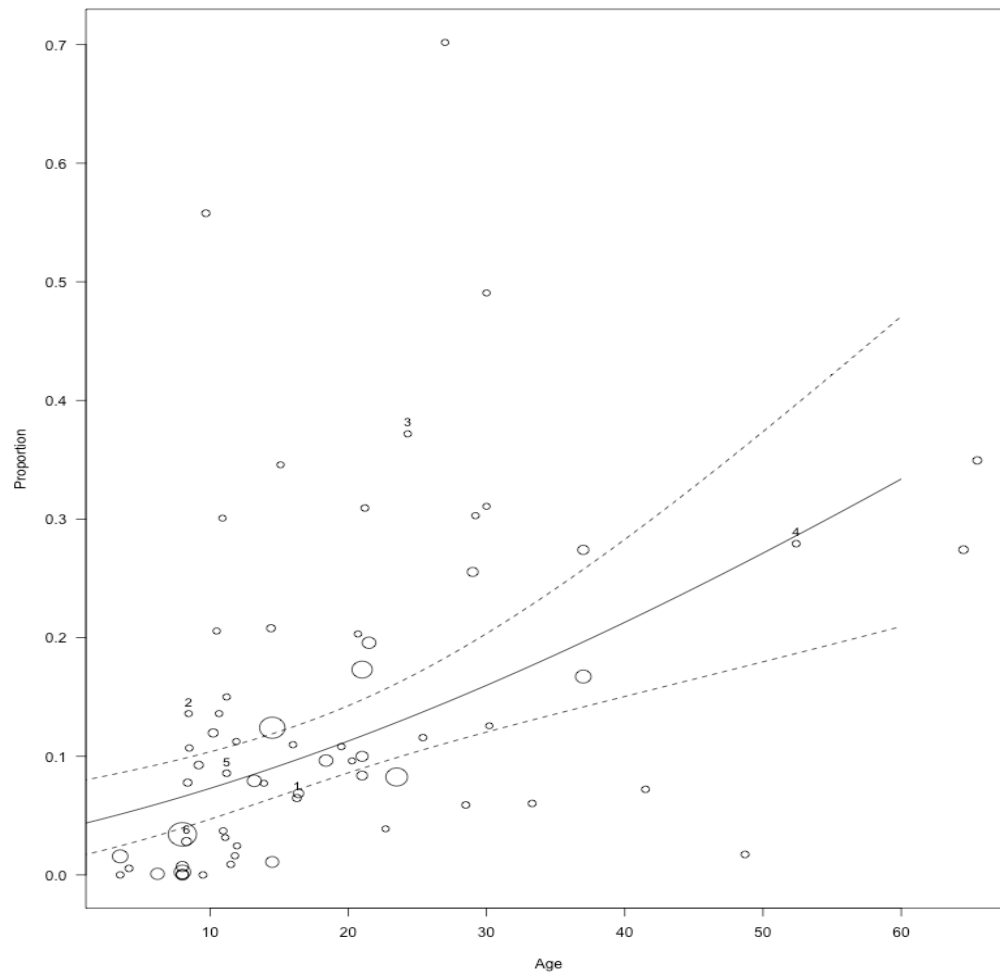


\*Study Design

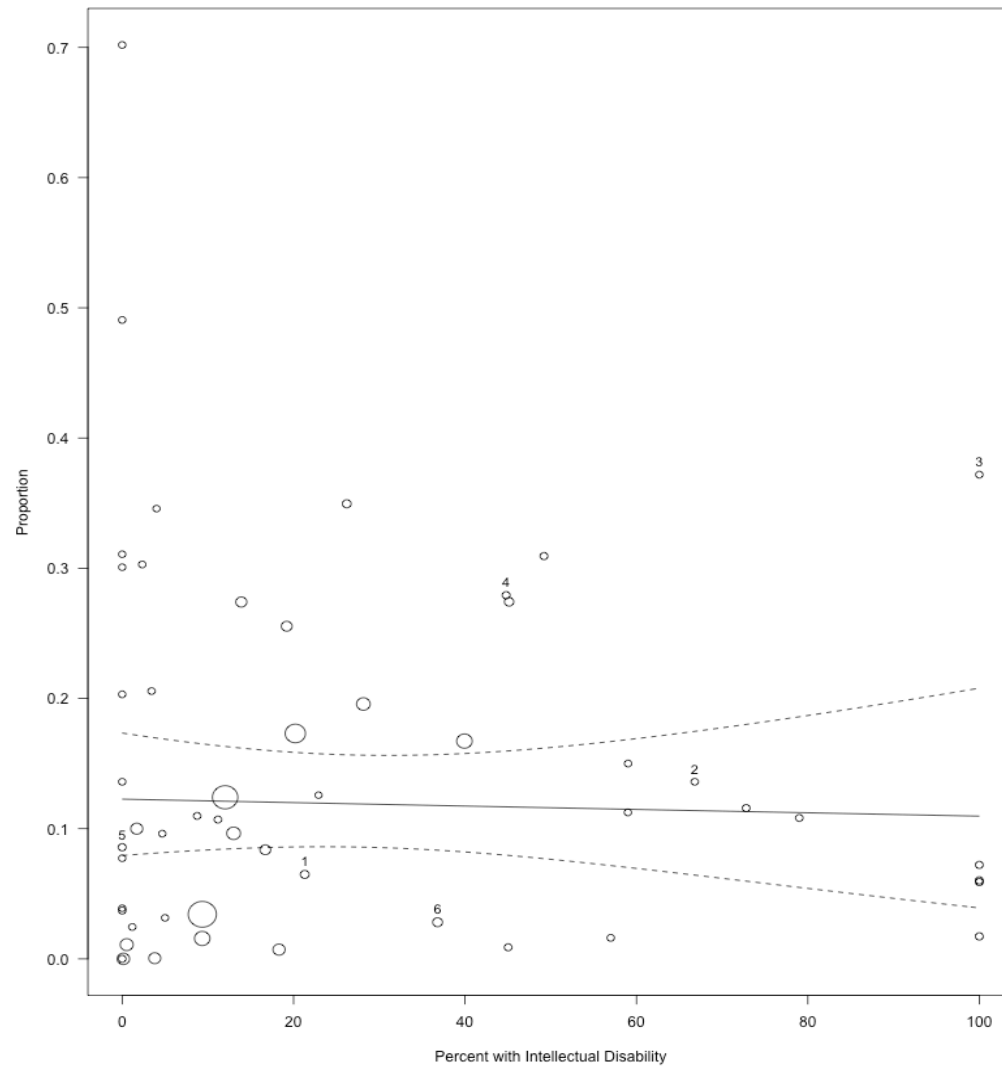


**c. Depressive disorders**

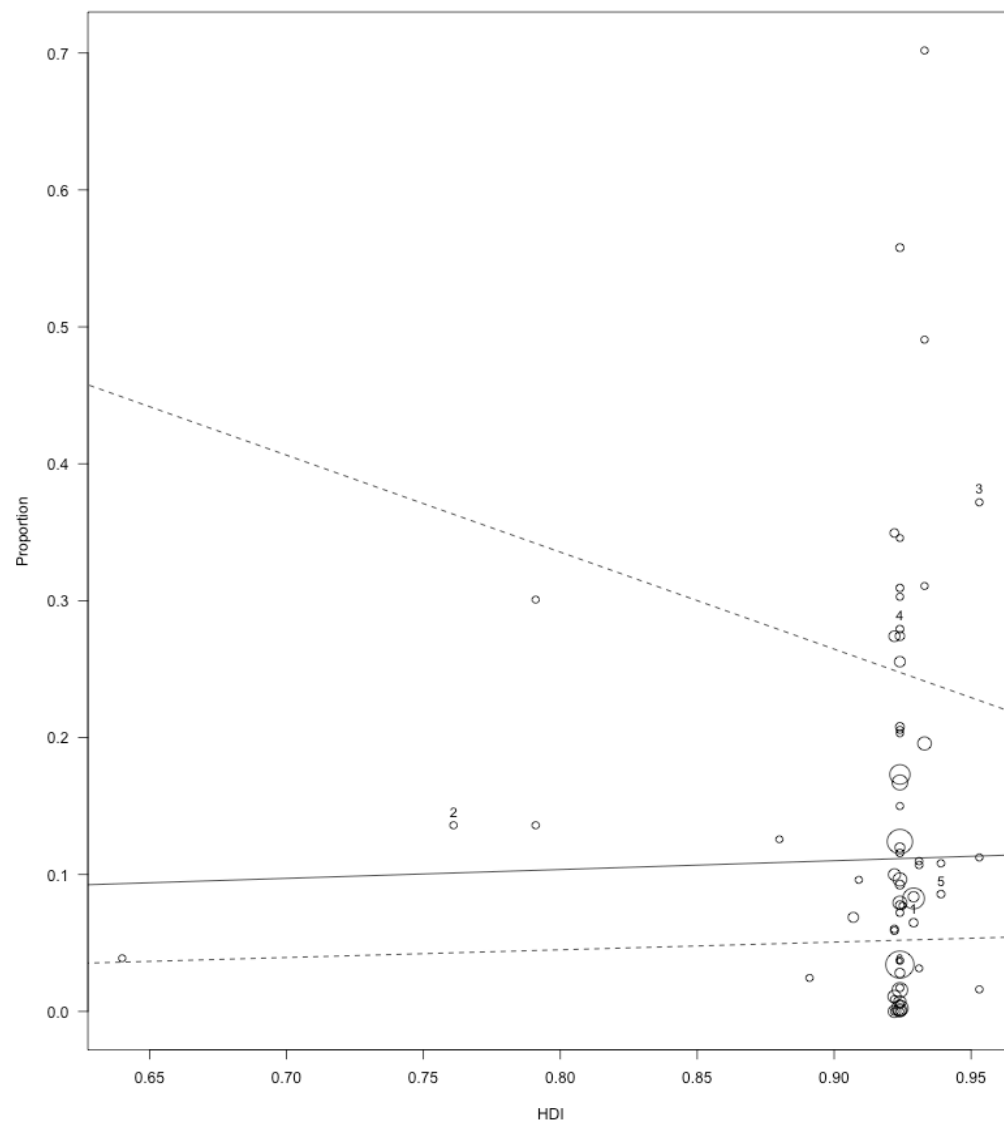
\*Age



Percent ID

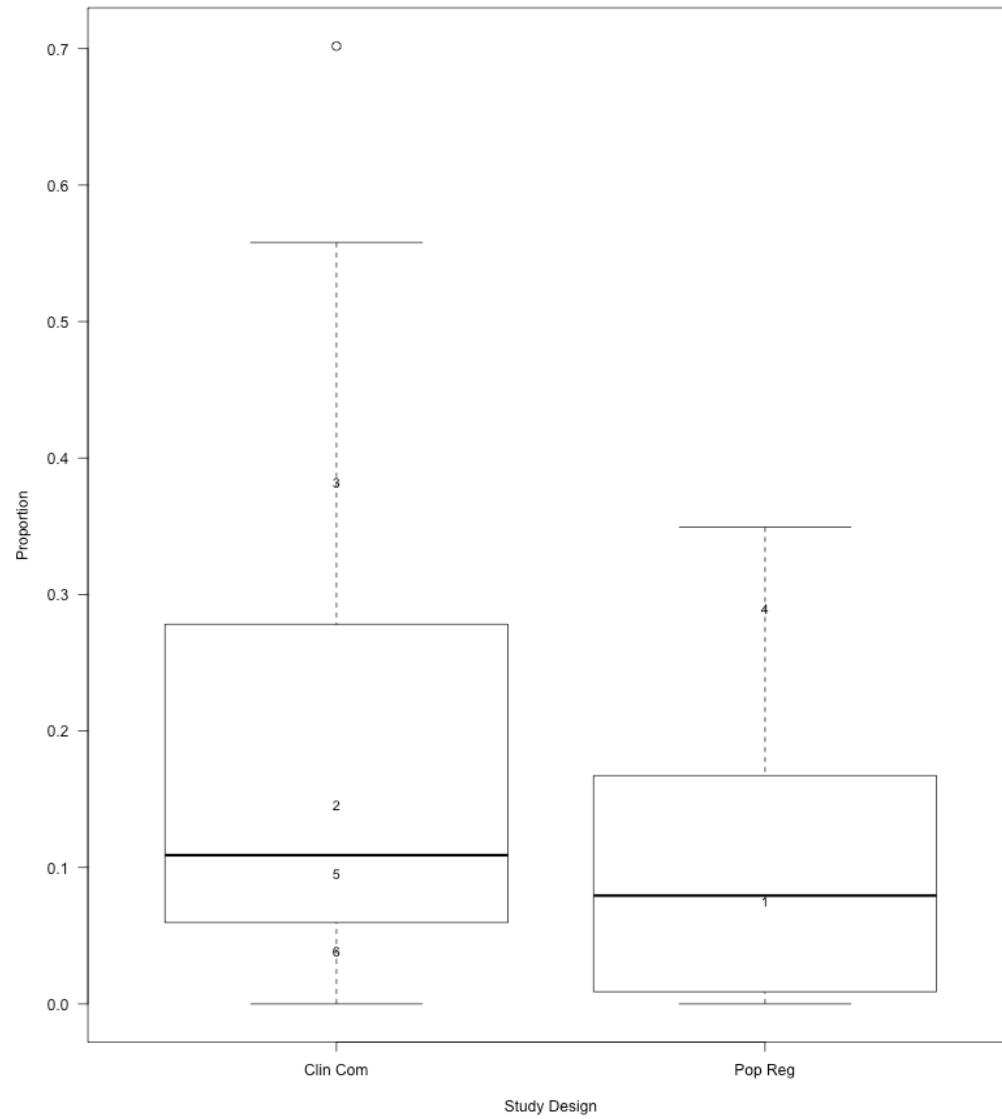


HDI



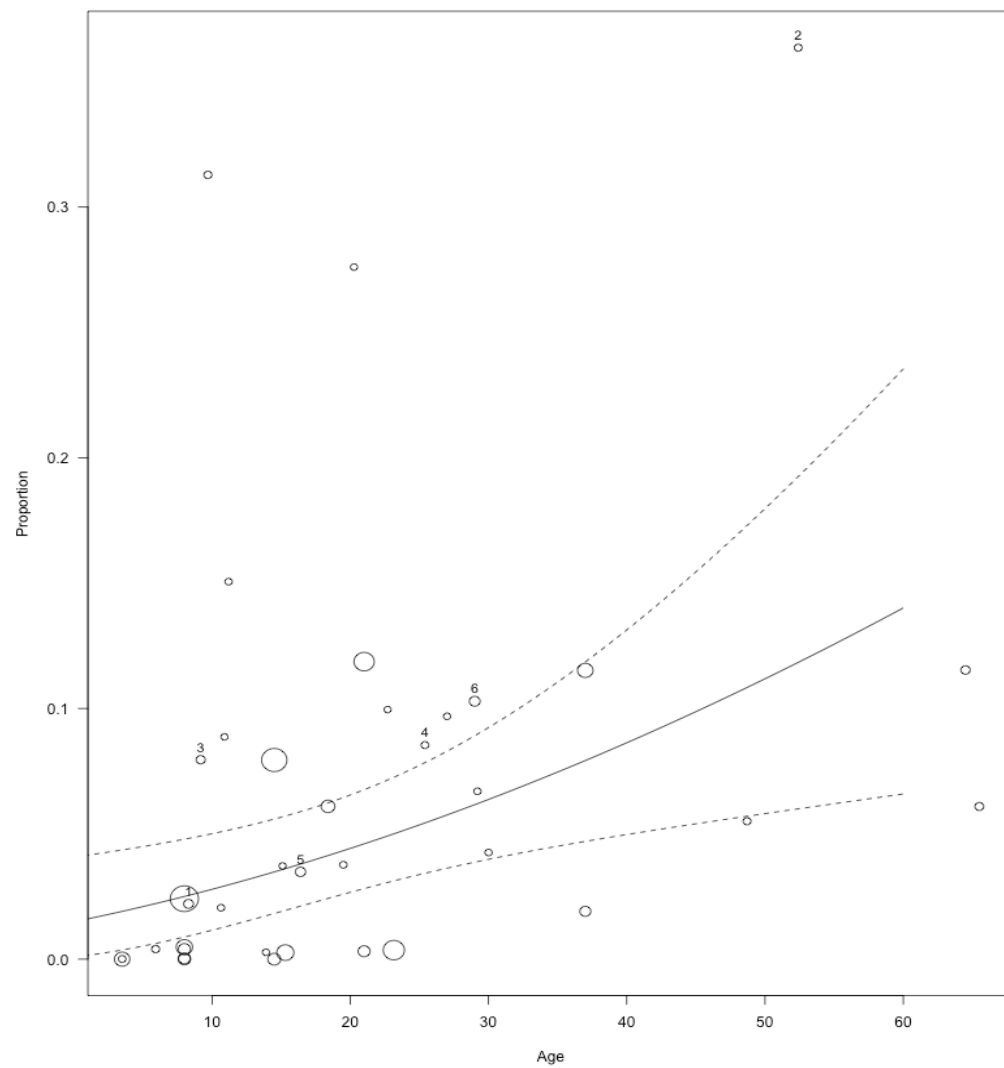


\*Study Design

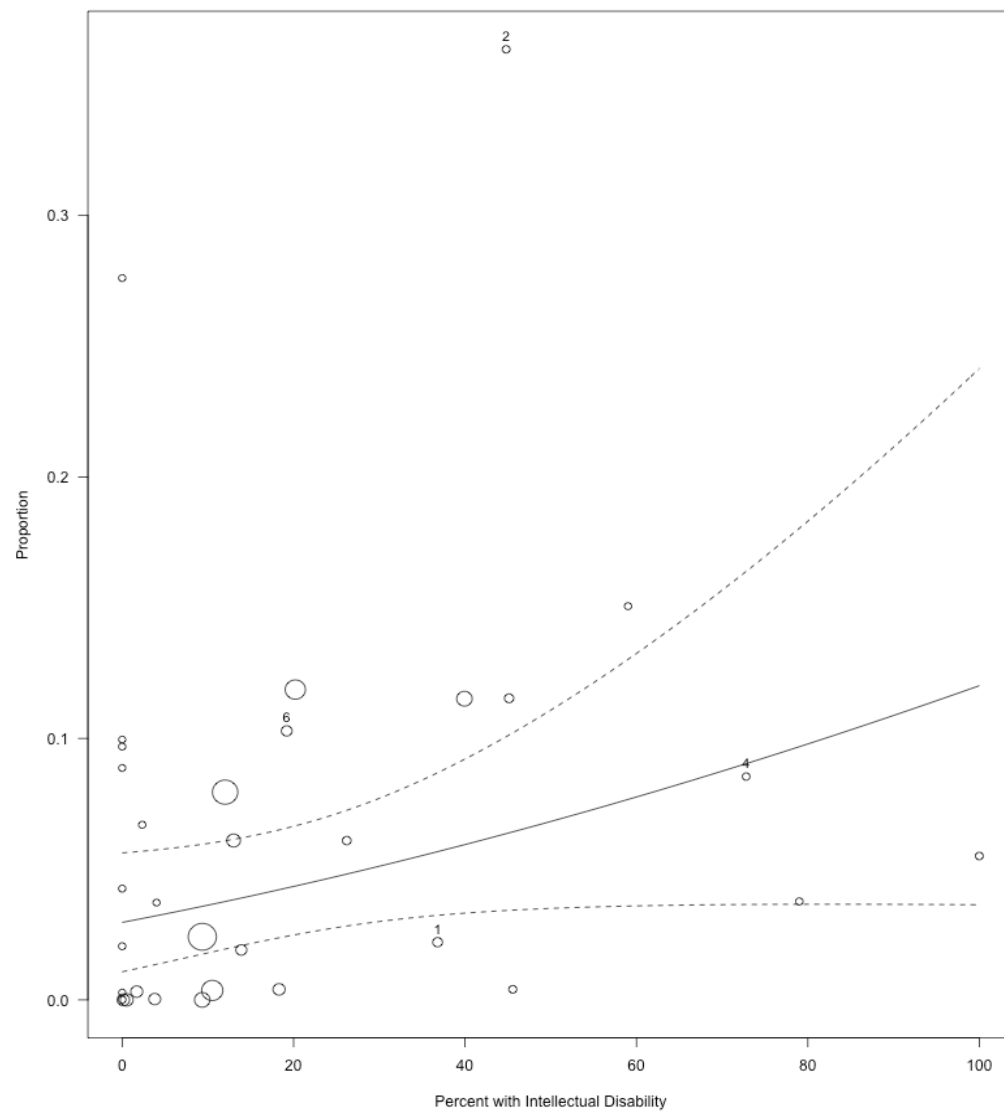


#### d. Bipolar and related disorders

\*Age

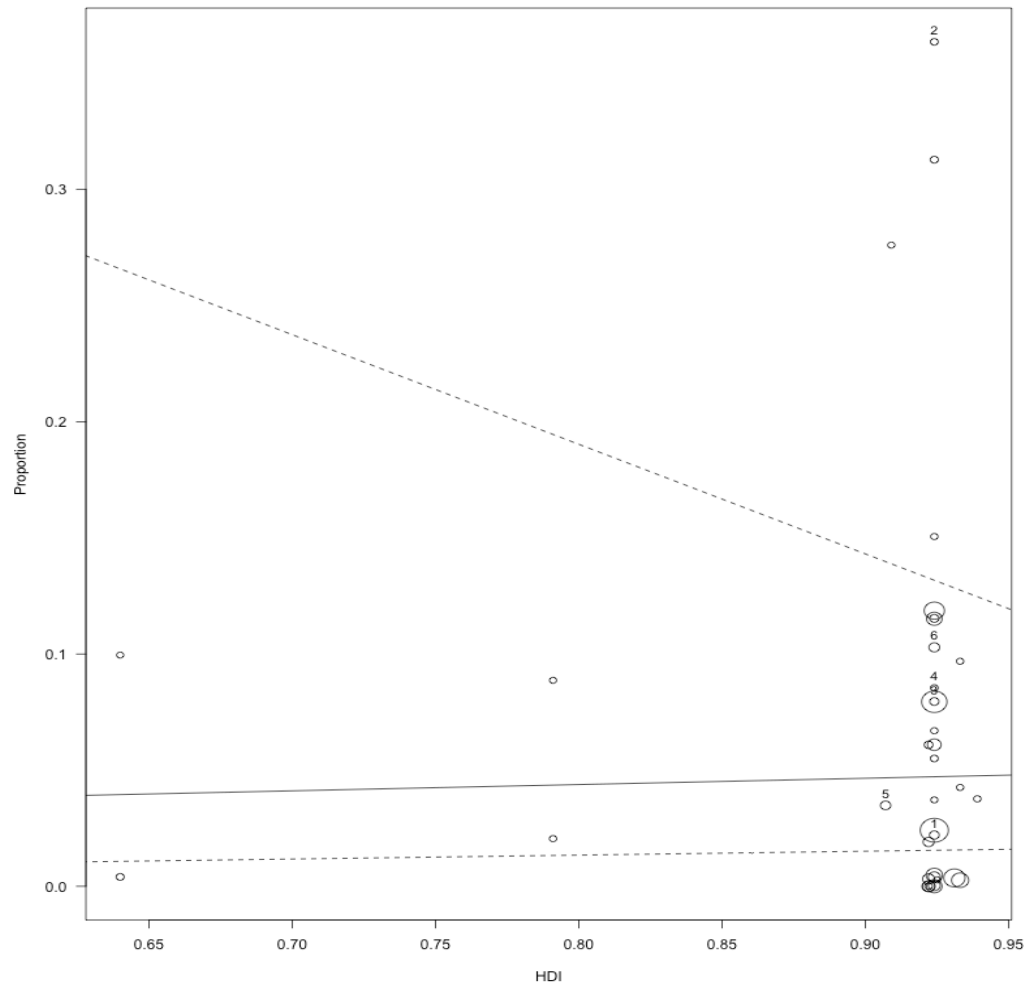


Percent ID

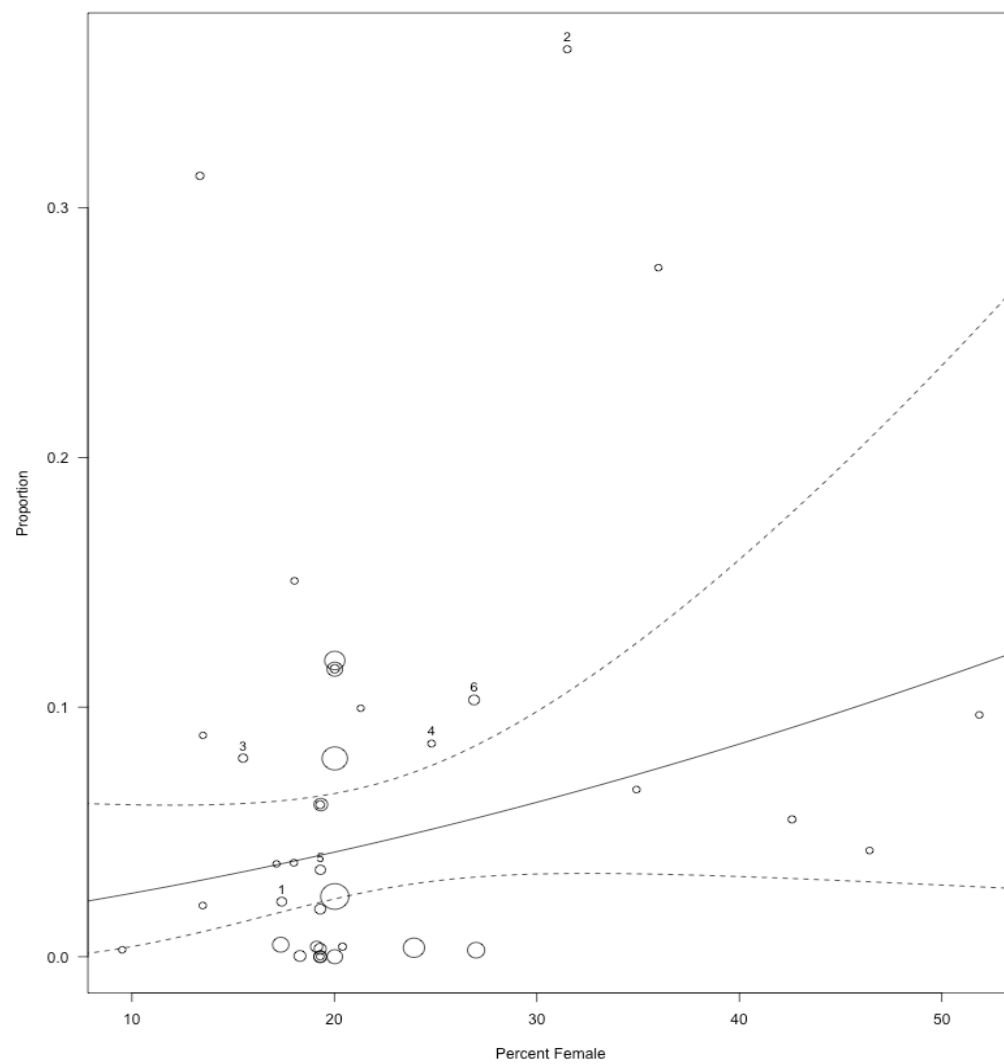




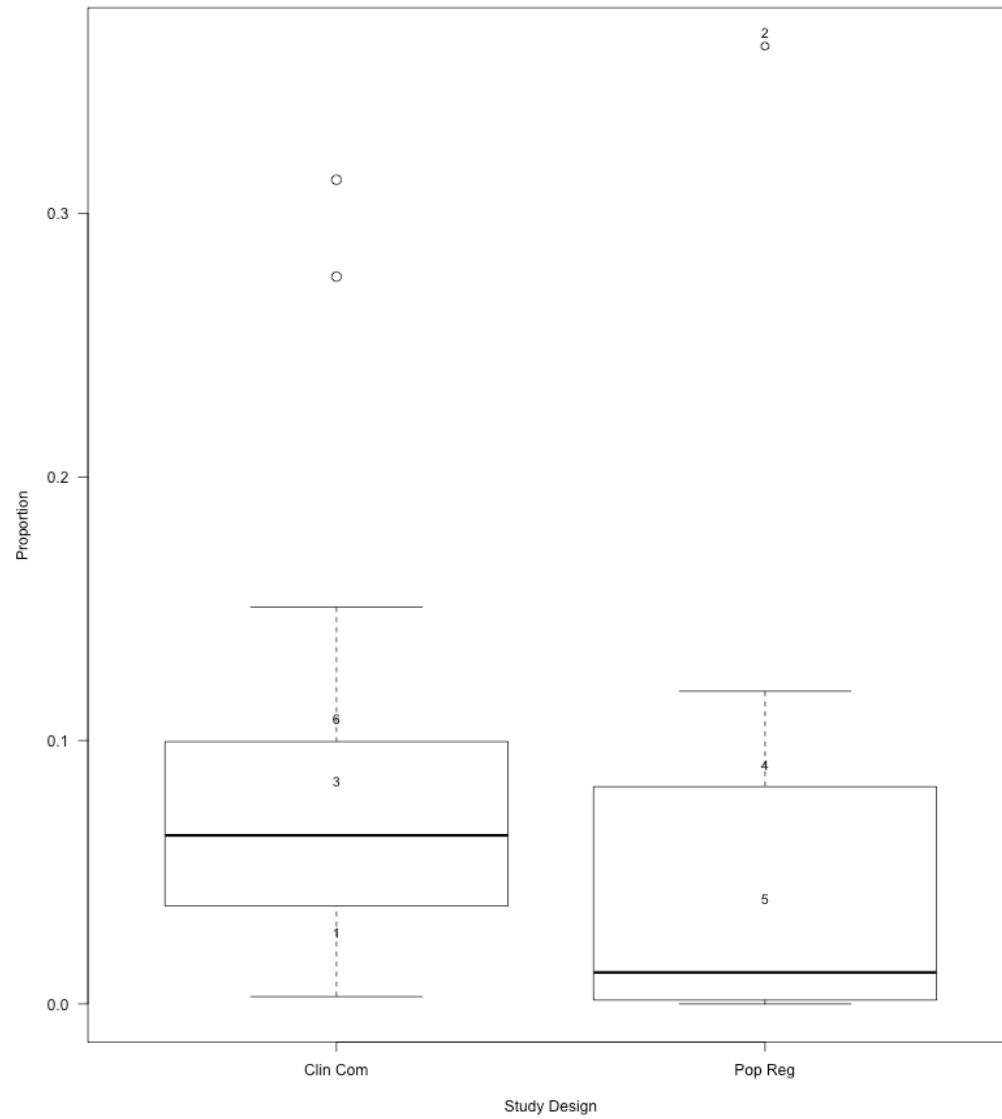
HDI



Percent Female

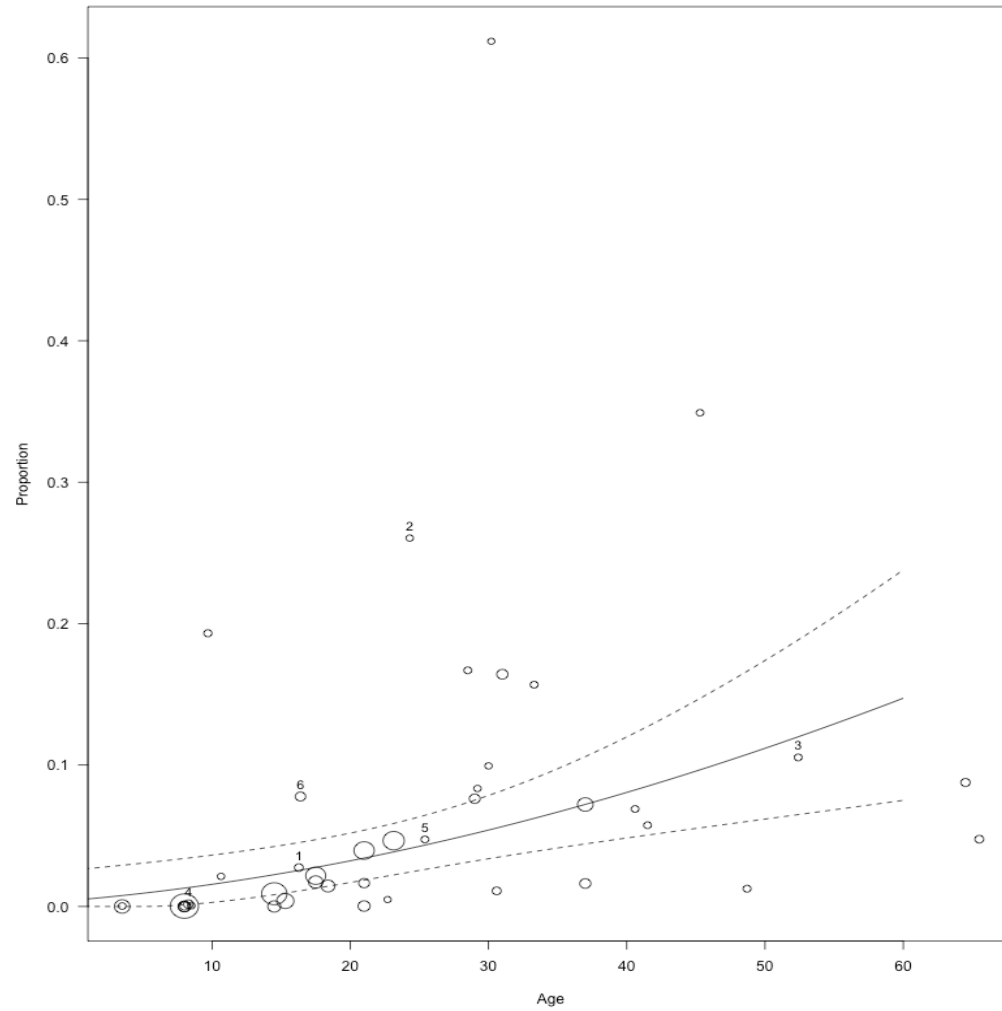


\*Study Design

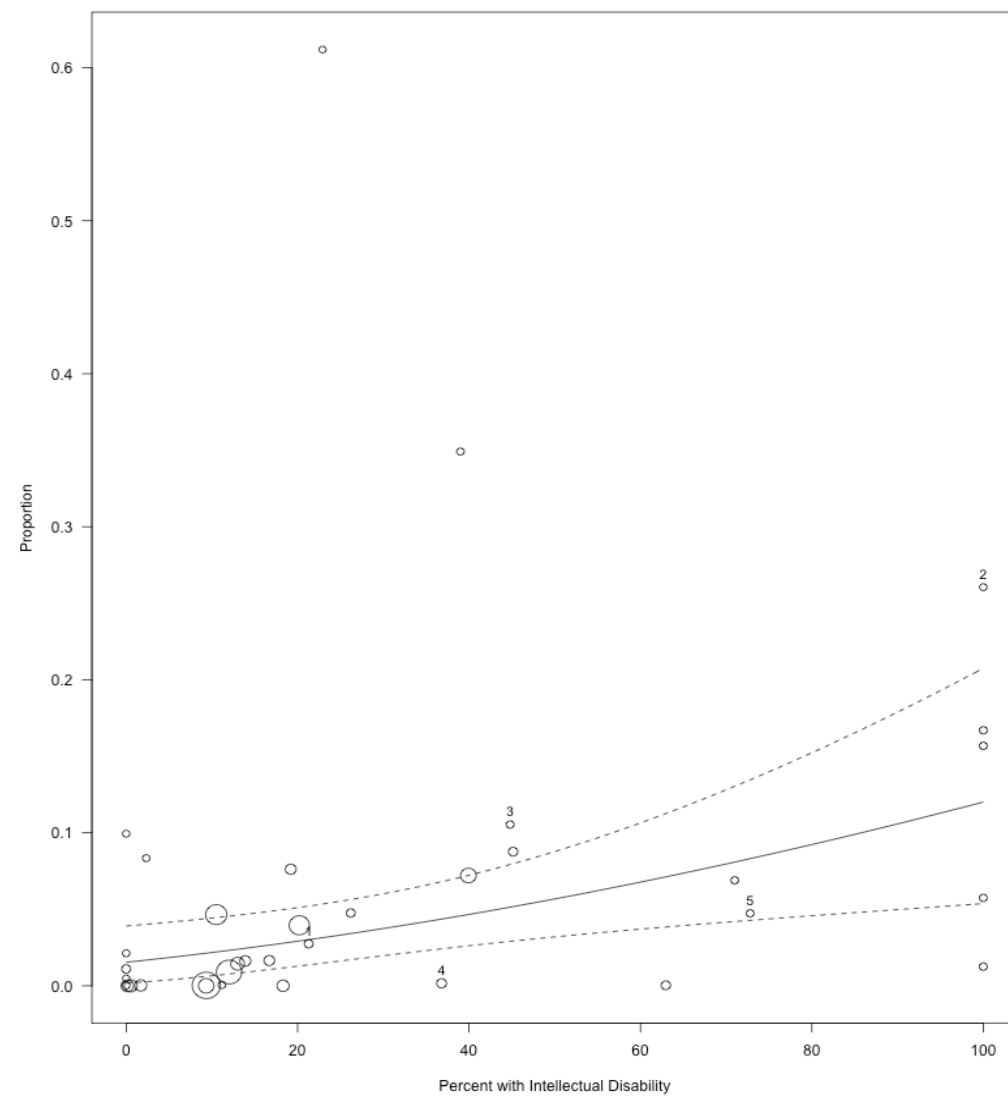


**e. Schizophrenia spectrum and psychotic disorders**

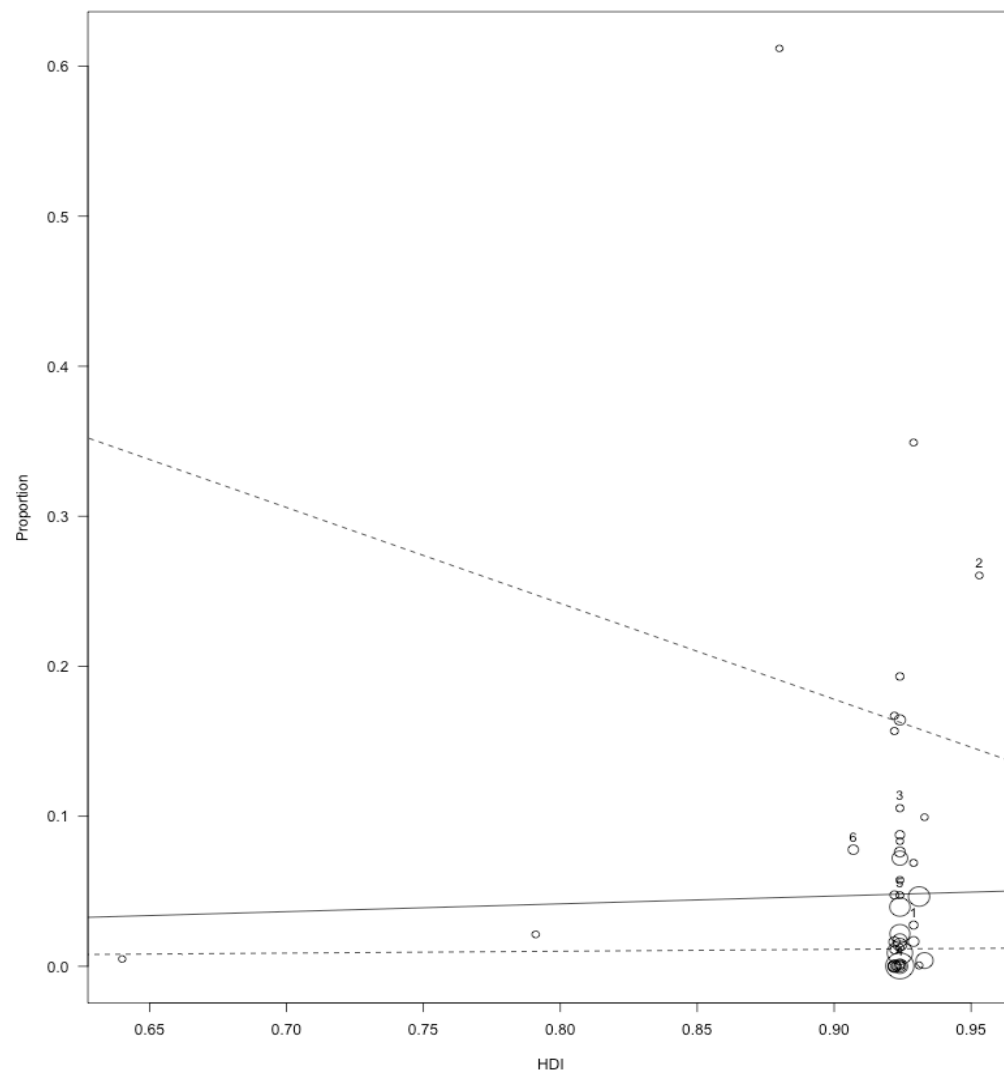
\*Age



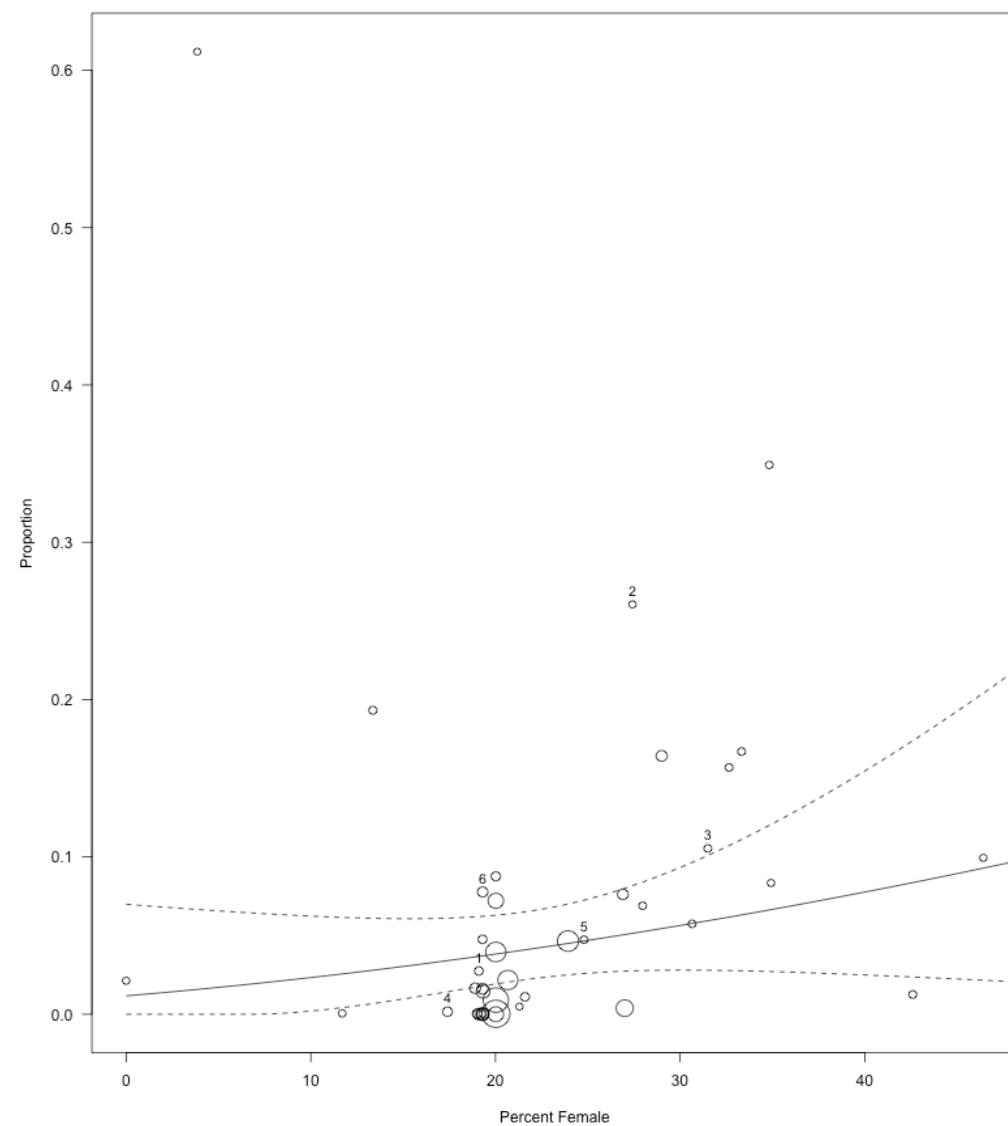
\*Percent ID



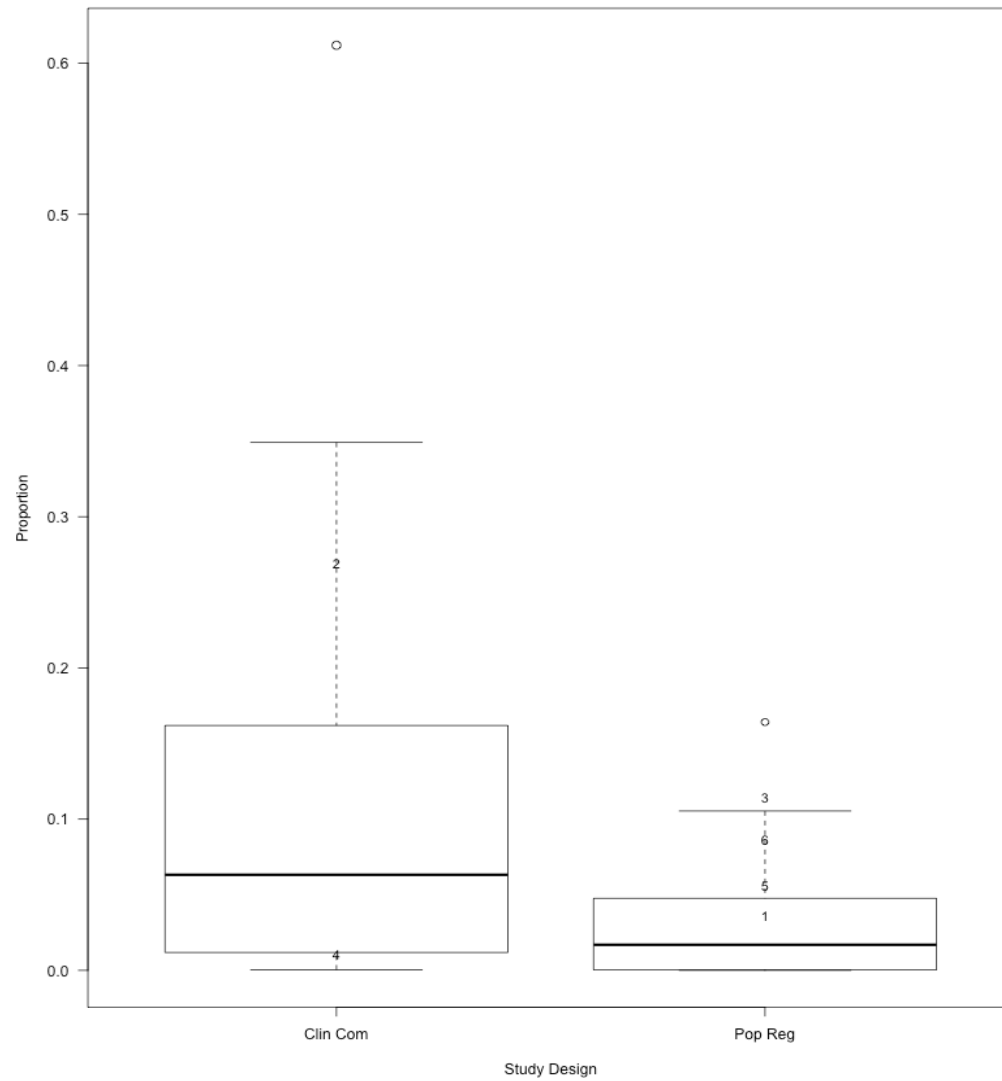
HDI



Percent Female



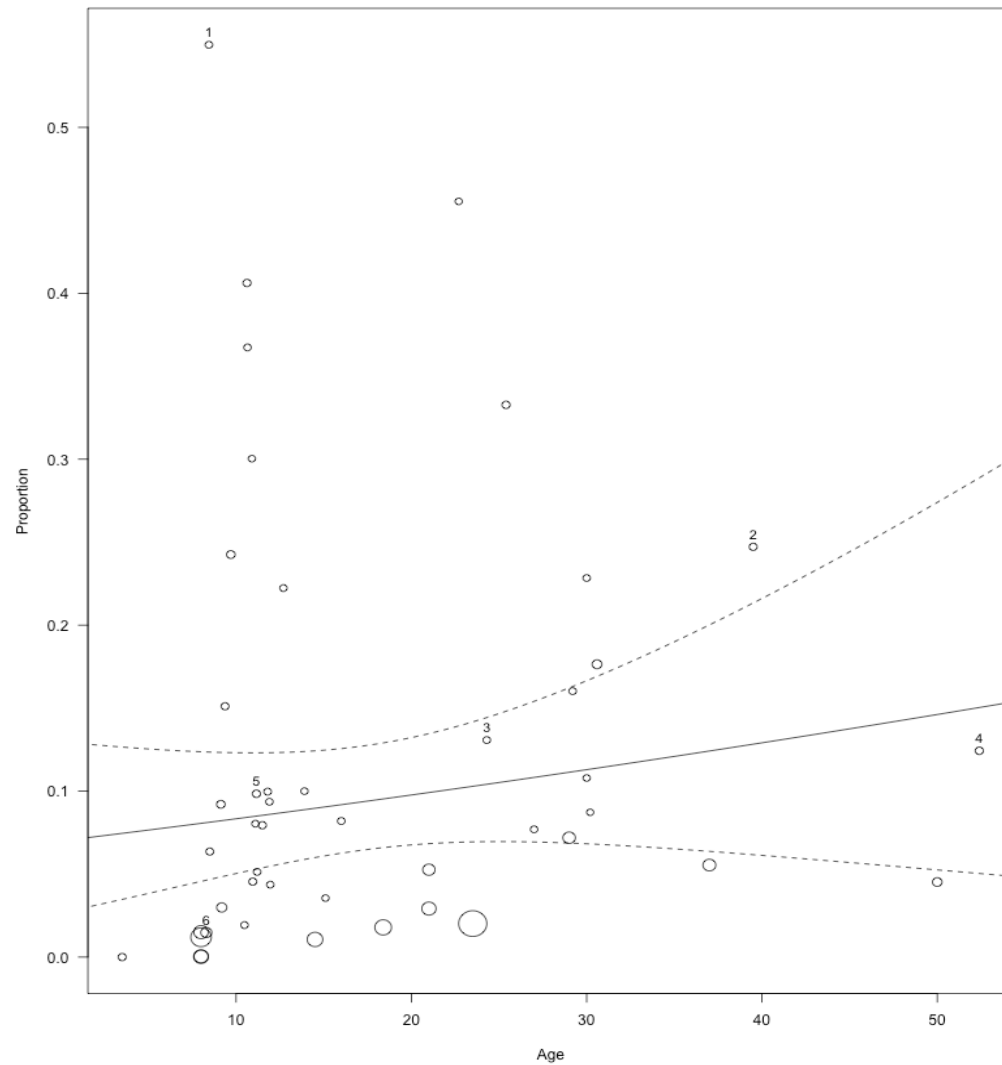
\*Study Design



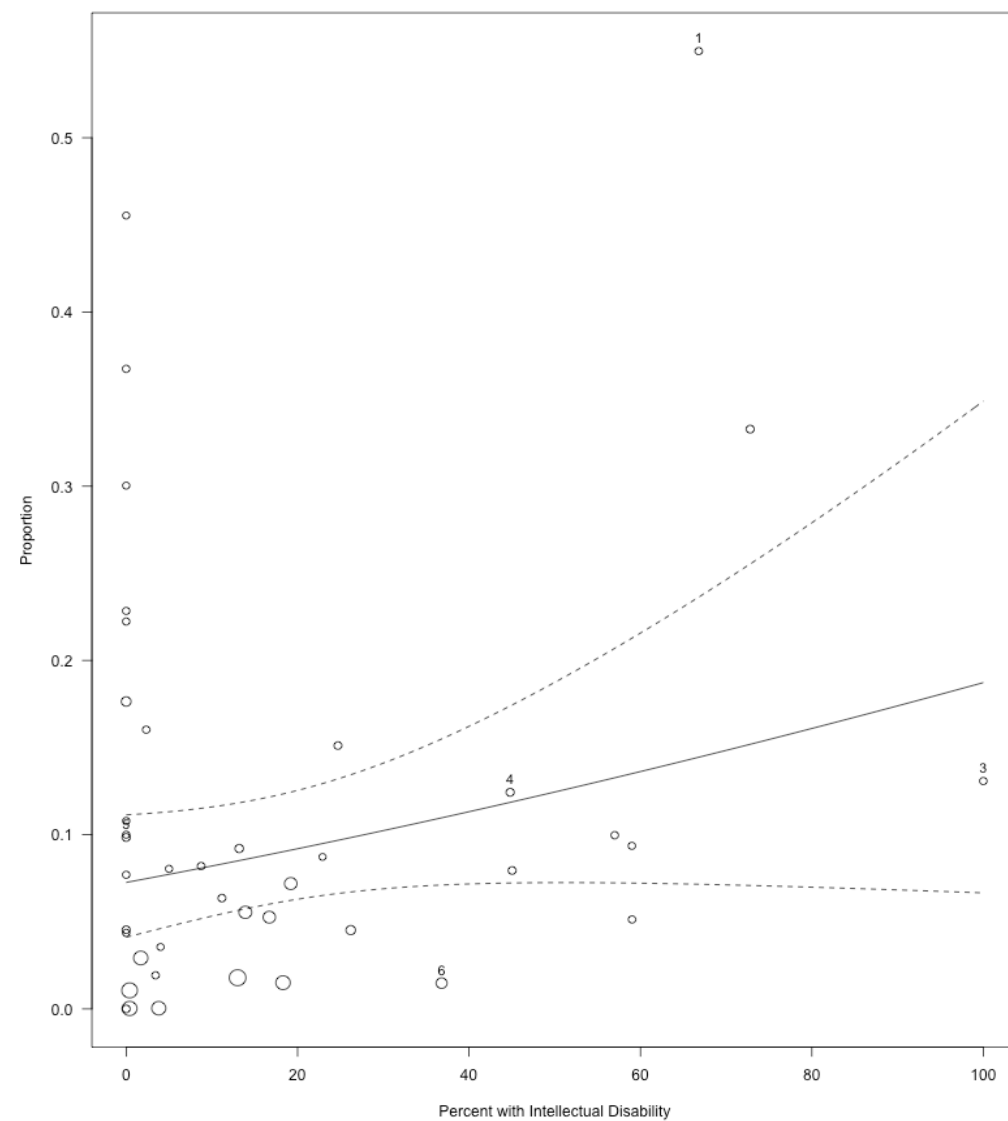


## f. Obsessive-compulsive disorder

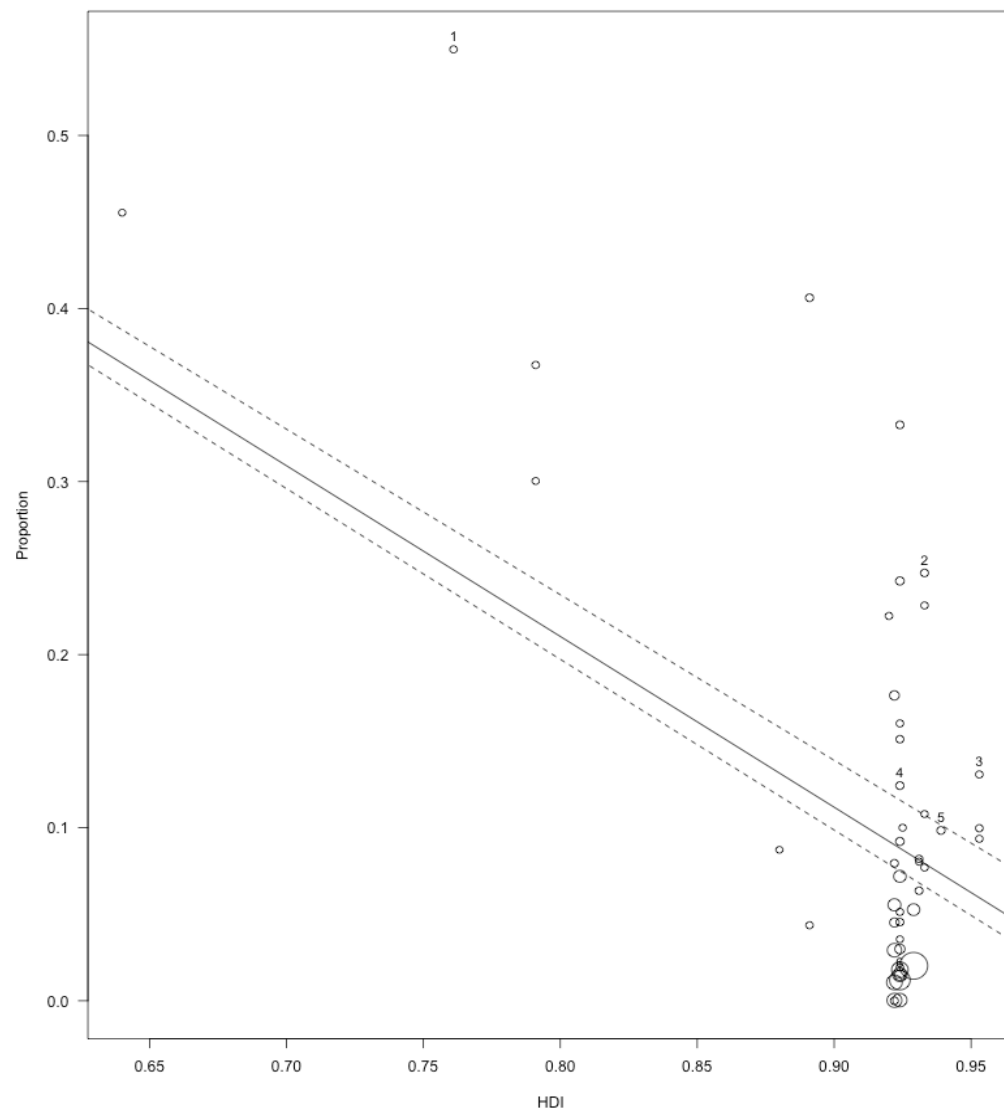
Age



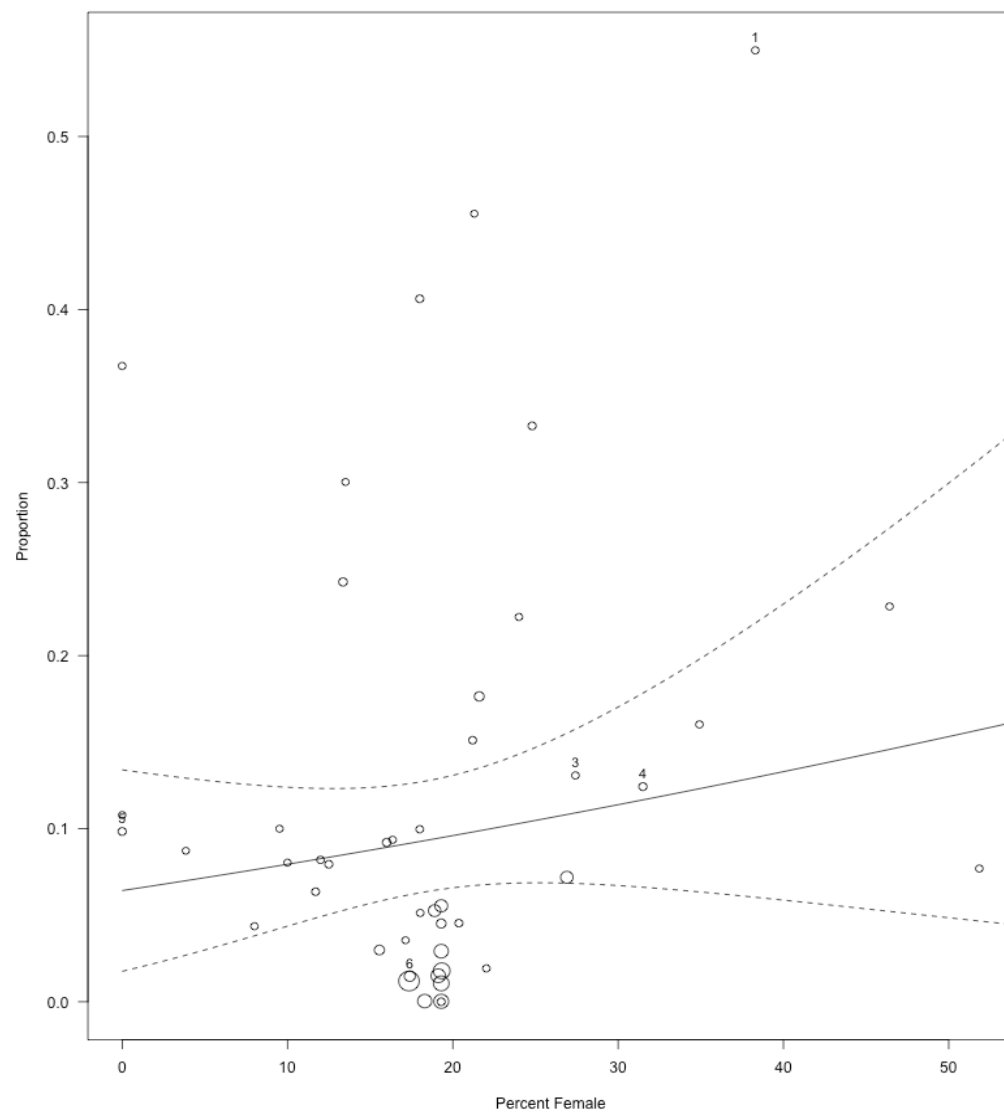
Percent ID



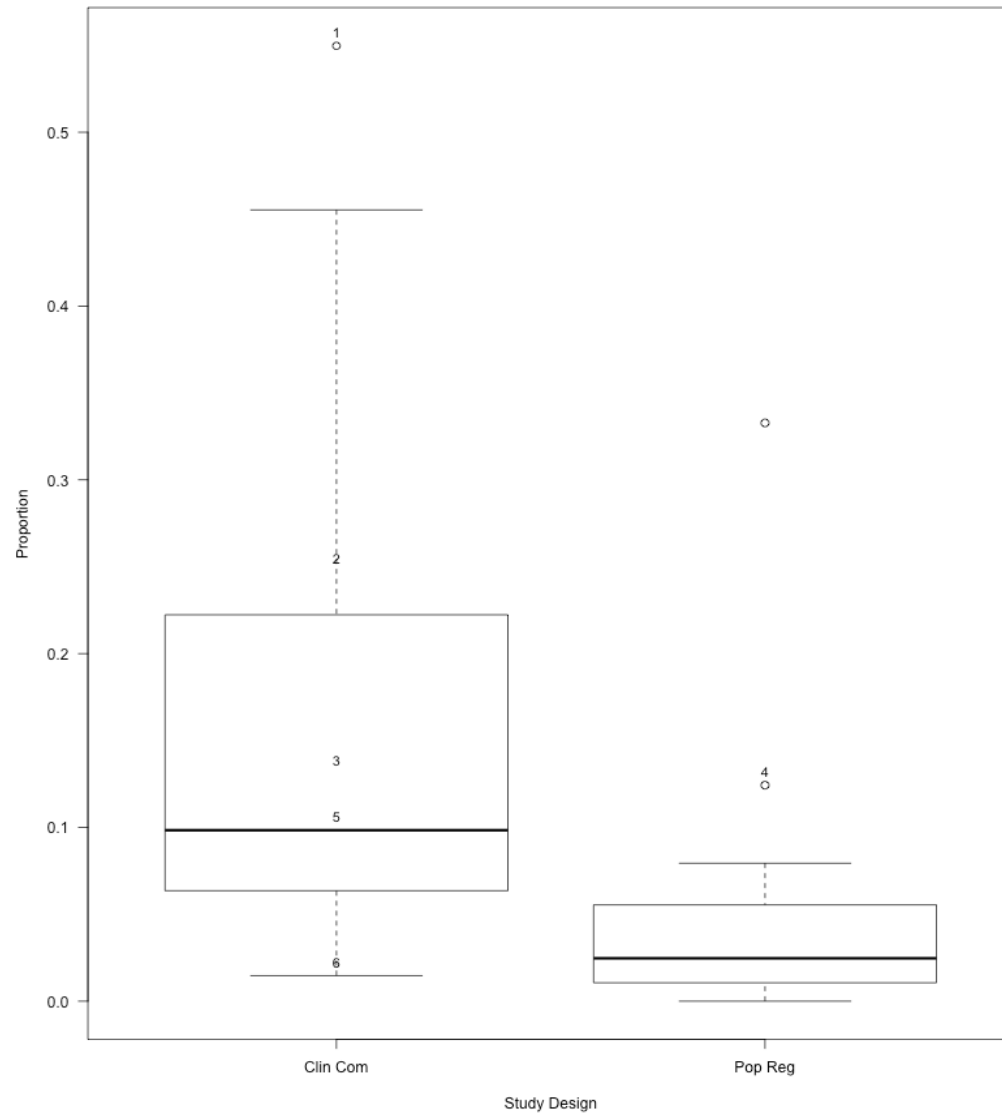
\*HDI



Percent Female

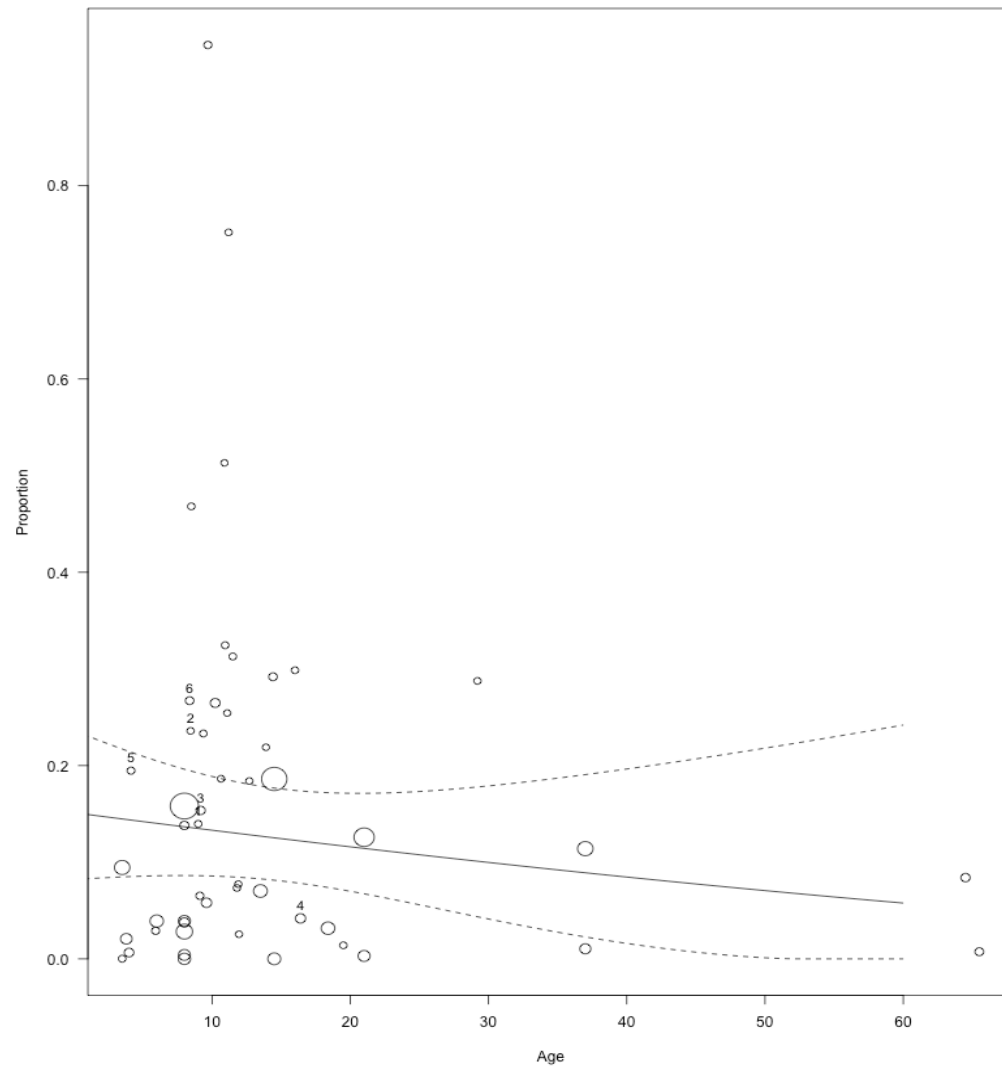


\*Study Design

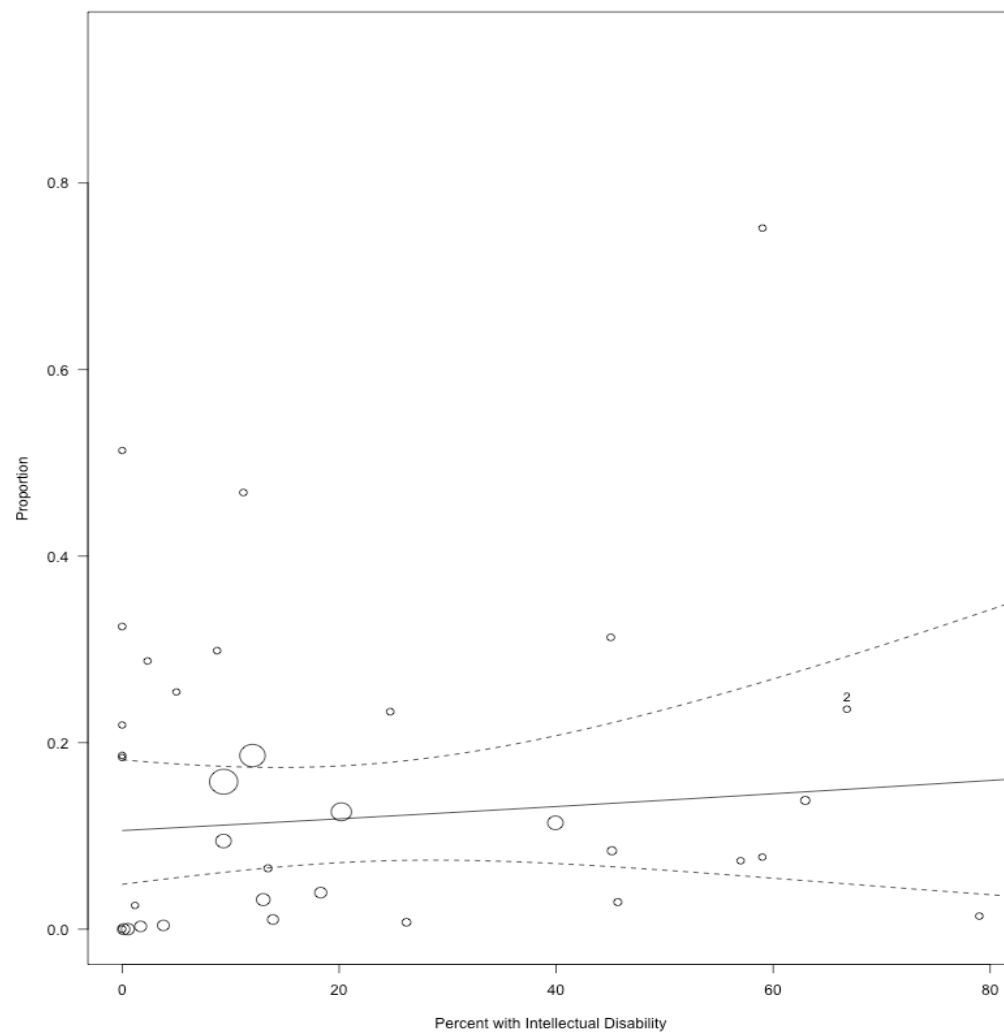


**g. Disruptive, impulse-control and conduct disorders**

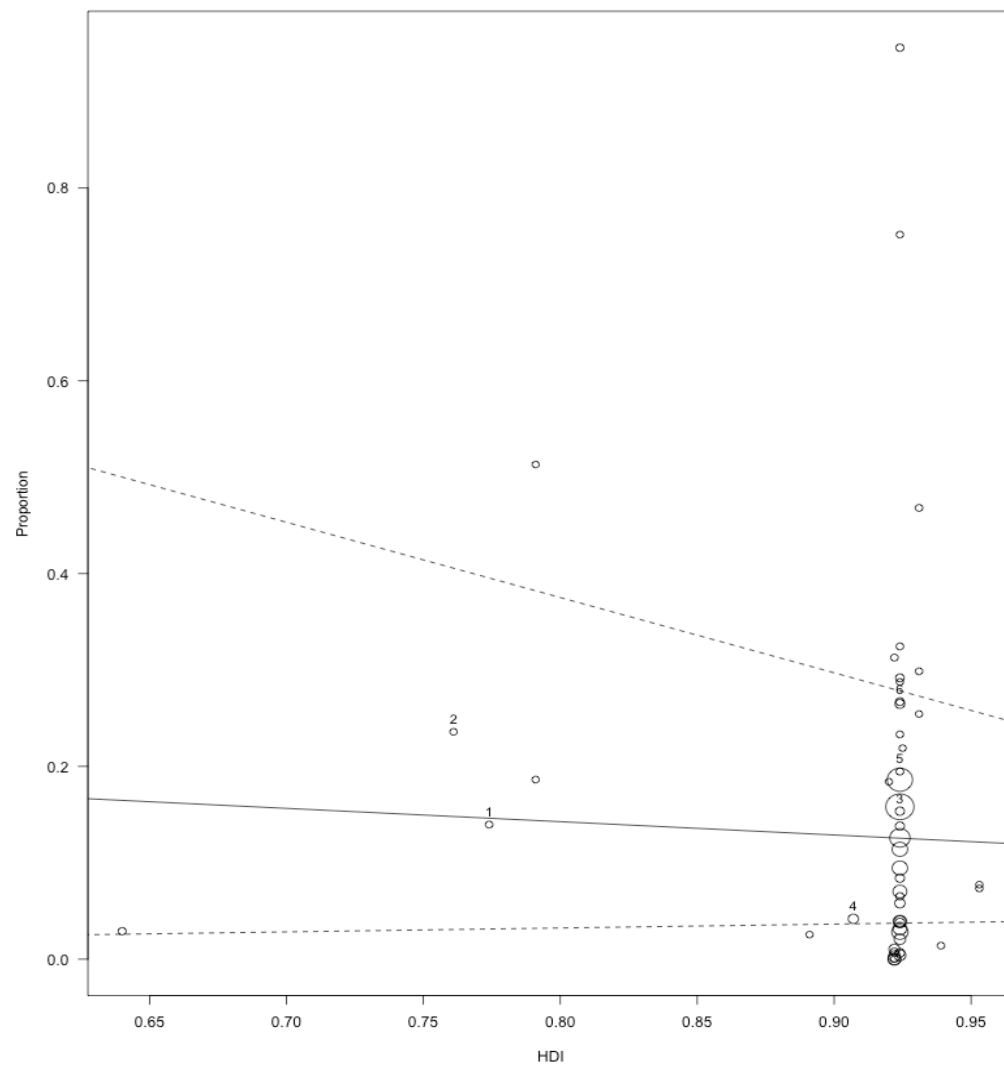
Age



Percent ID

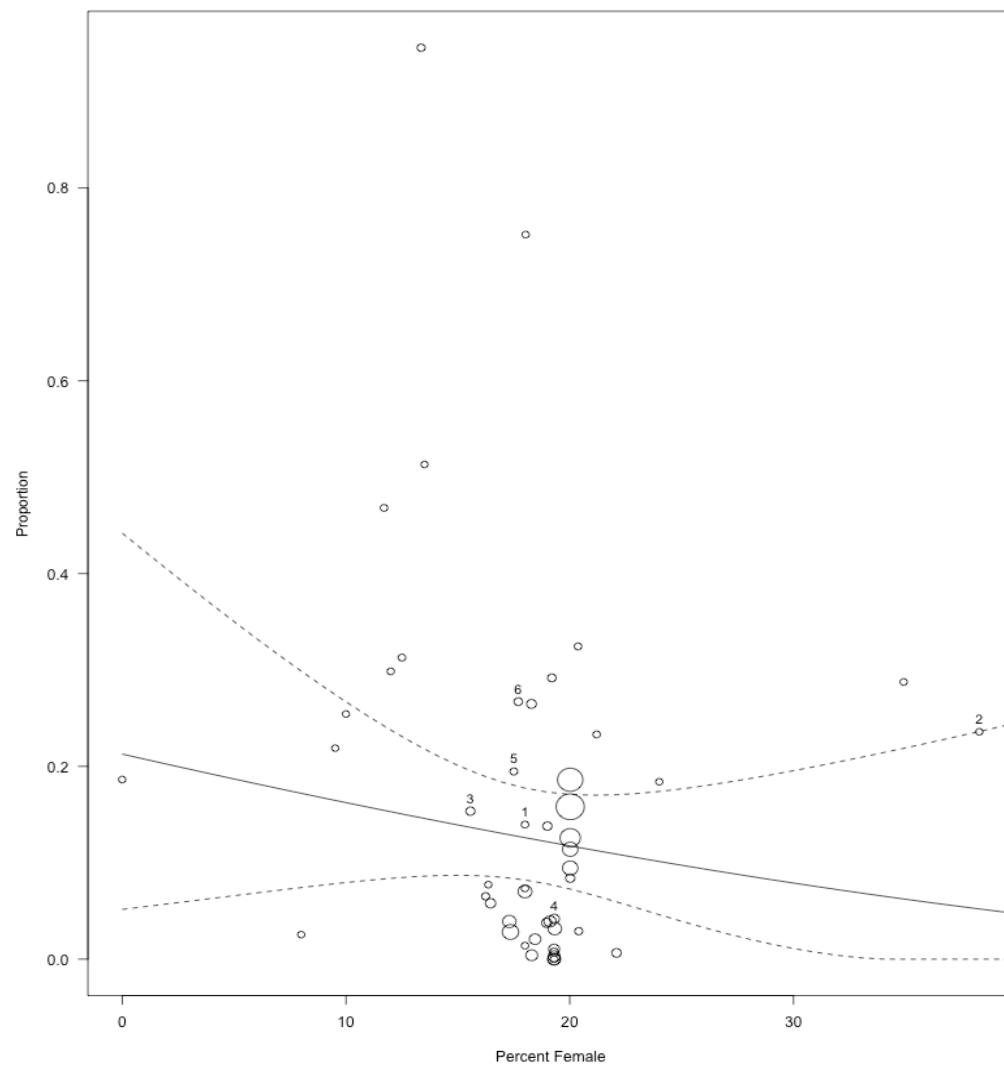


HDI

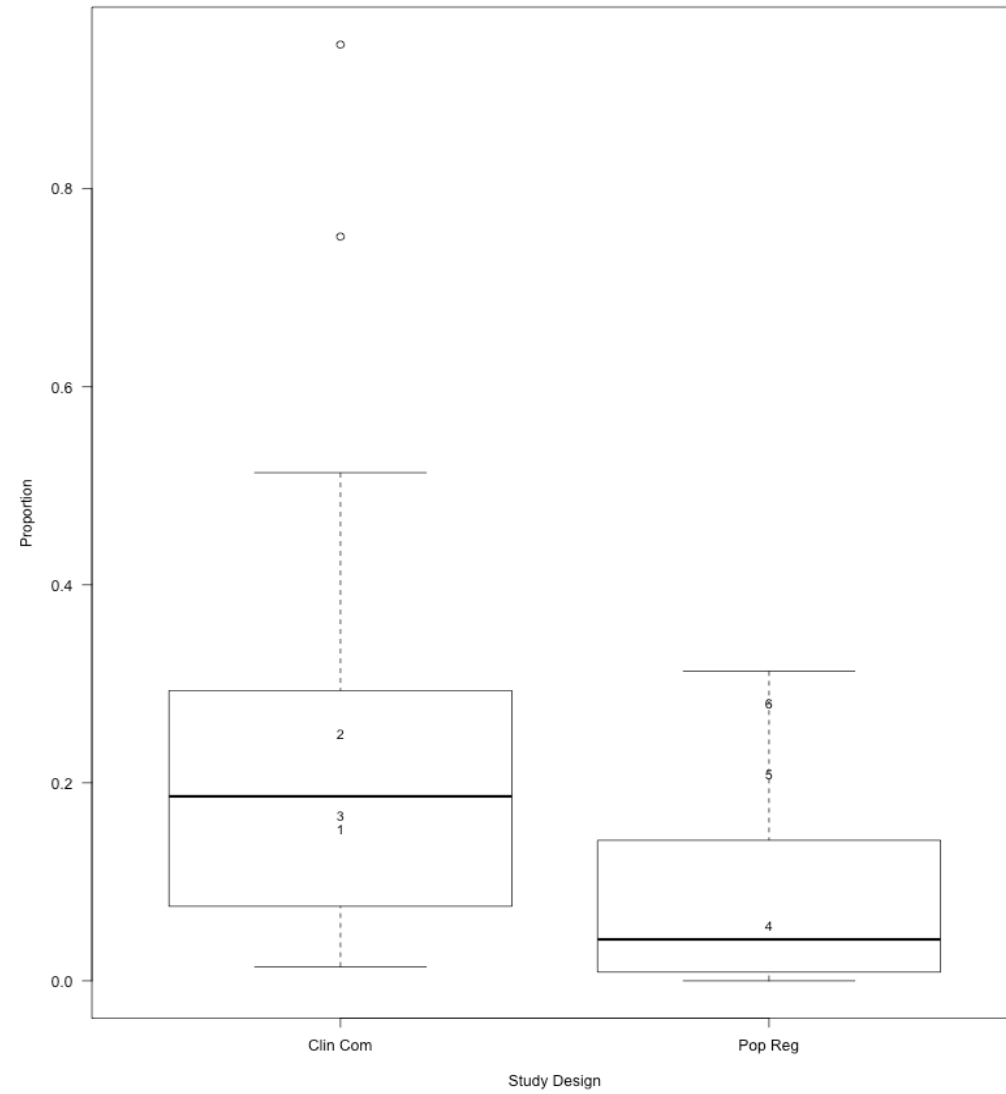




Percent Female

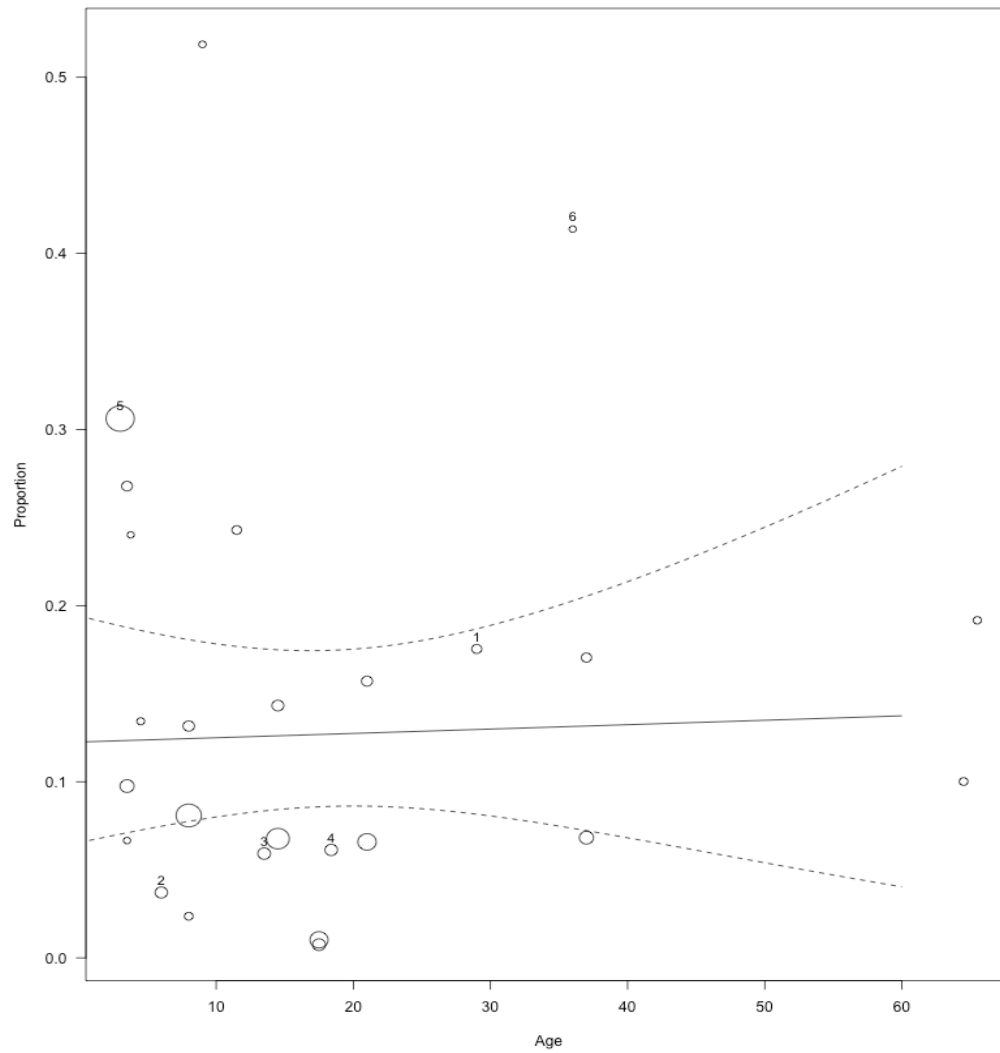


\*Study Design

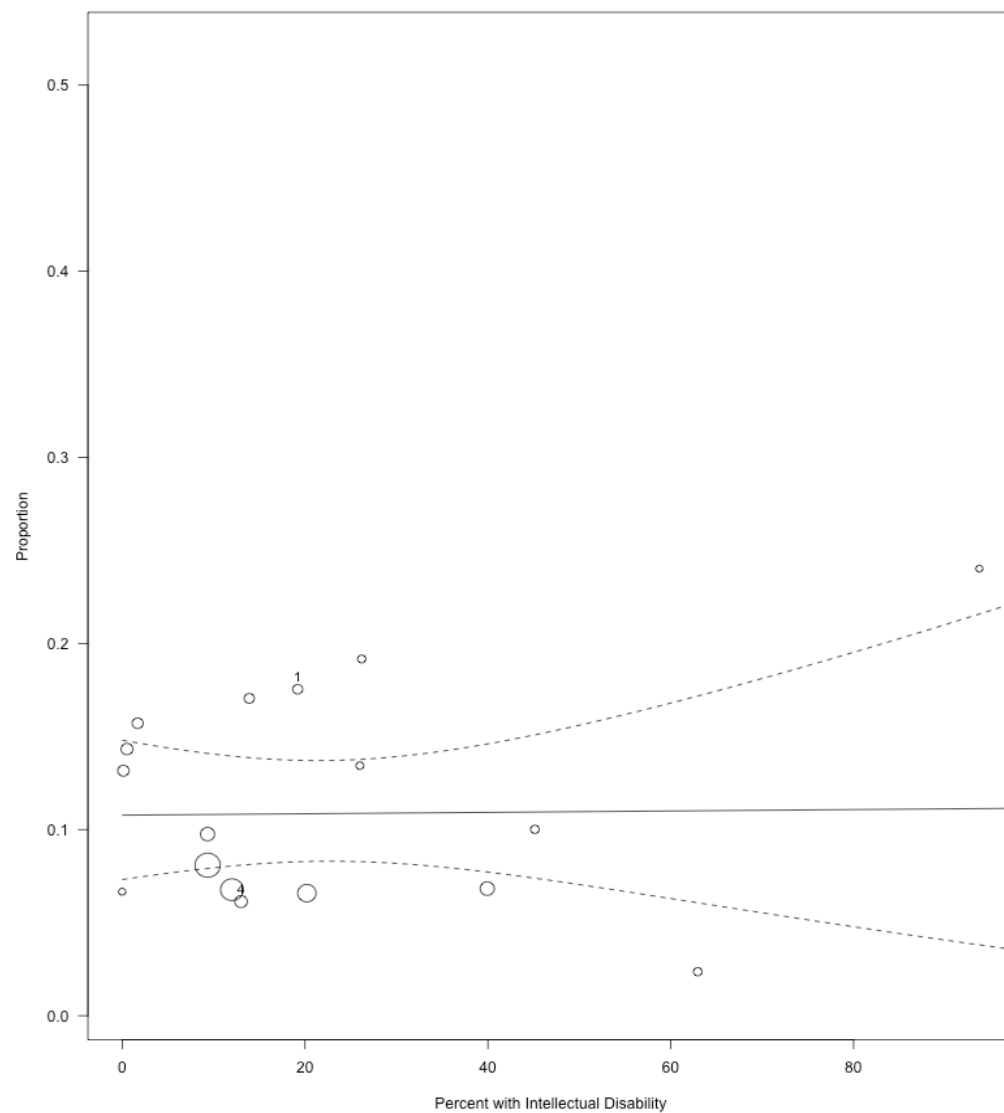


## h. Sleep-wake disorders

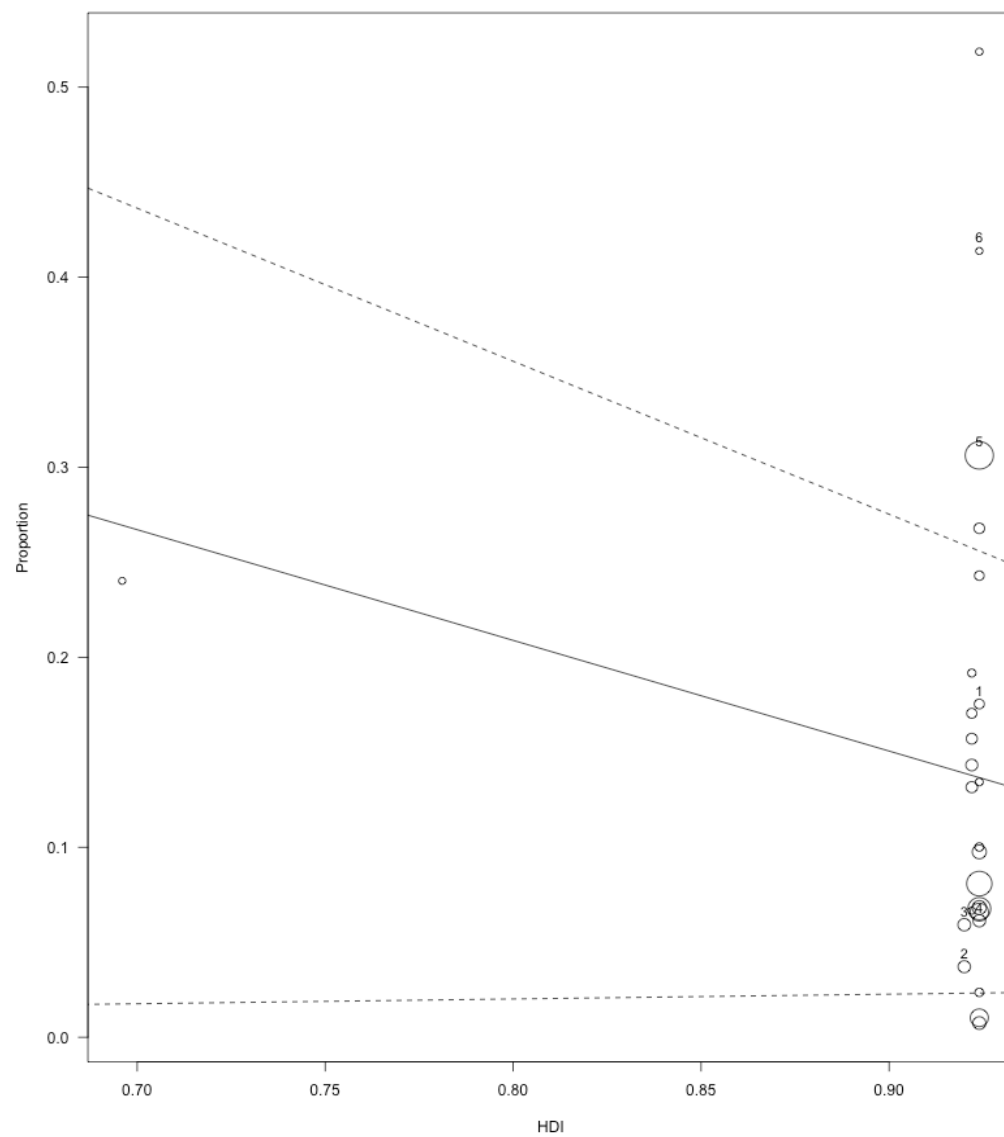
Age



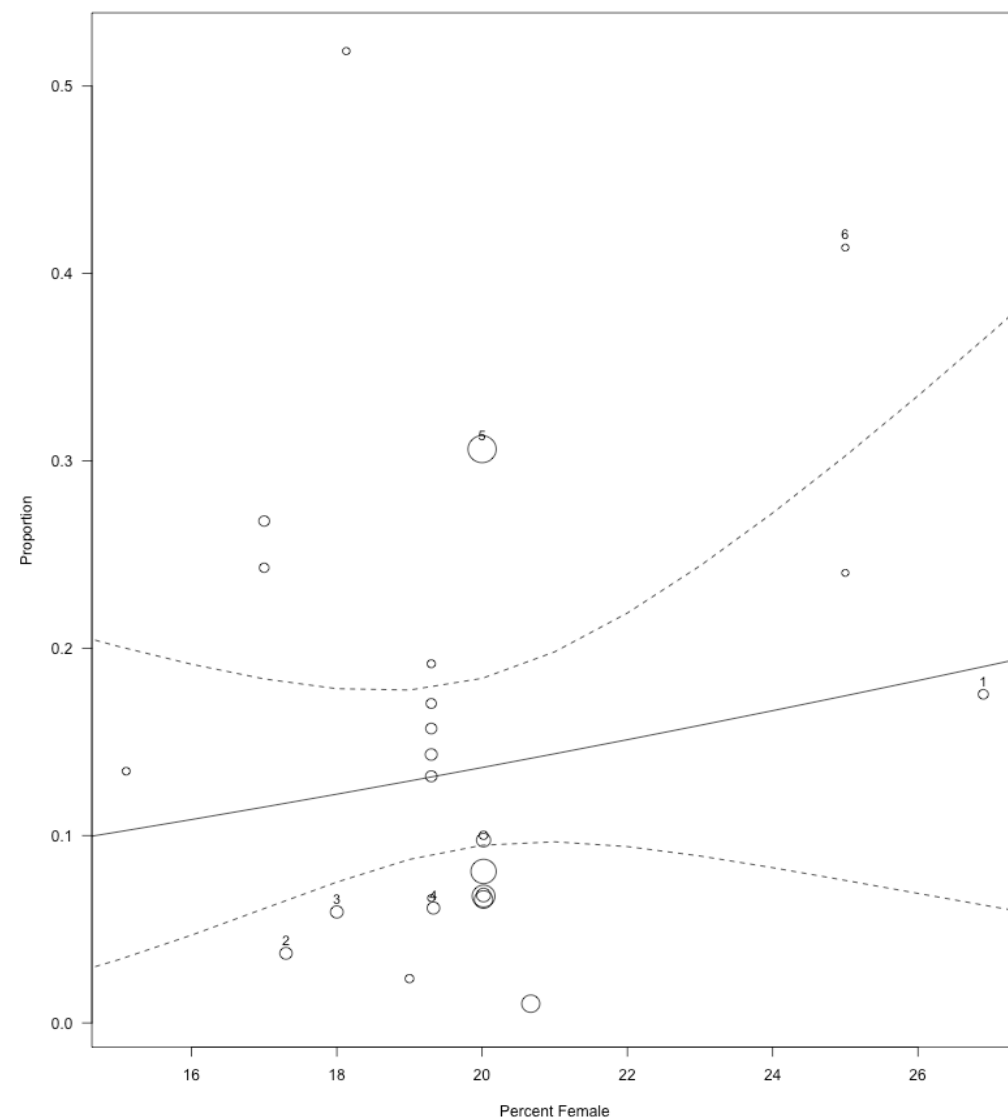
Percent ID



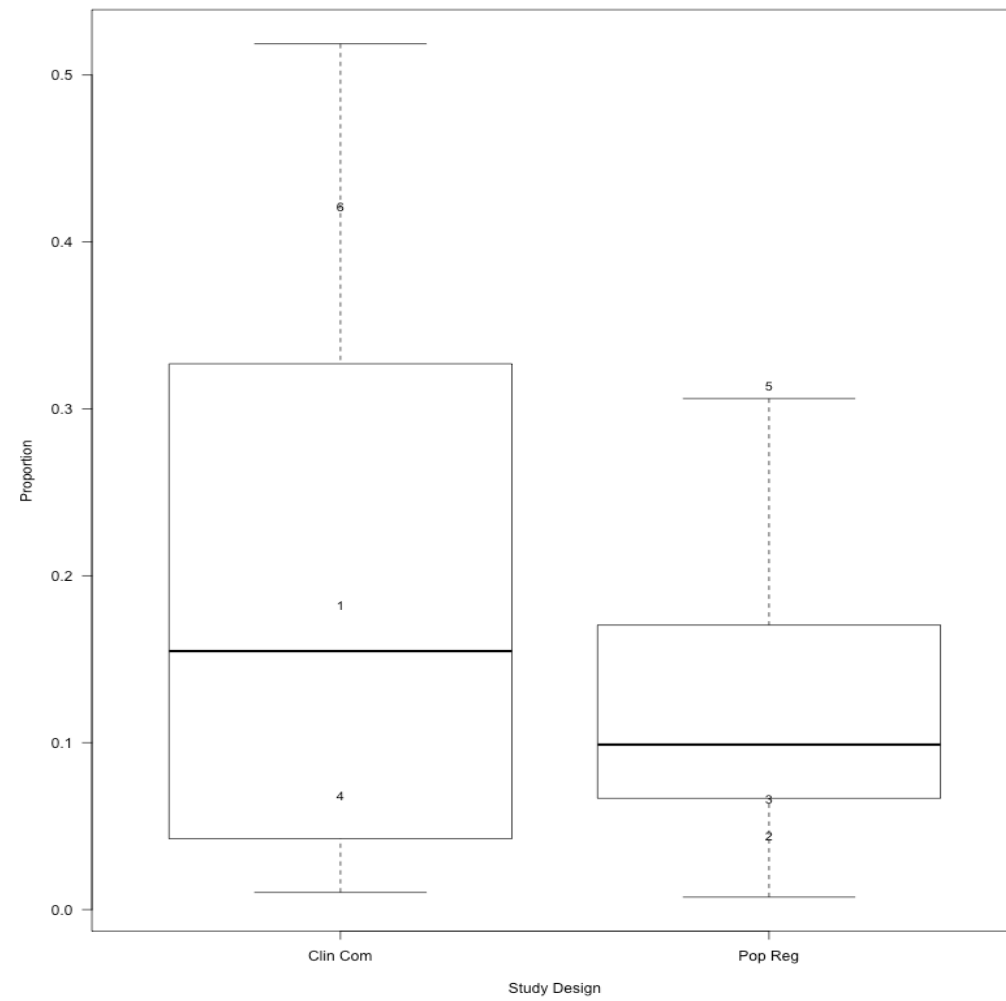
HDI



Percent Female



Study Design



**Sensitivity analysis for publication year****Appendix5: Summary of univariable meta-analysis for ‘Publication Year’**

<sup>a</sup> Co-occurring mental health condition	<sup>b</sup> R <sup>2</sup> %	I <sup>2</sup> % (95%CI)	QM p-value
<b>ADHD</b> (N = 89) (n = 210,249)	1.77	99.79 (99.76-99.85)	0.117
<b>Anxiety Disorders</b> (N = 68) (n = 169,829)	7.72	99.78 (99.70-99.85)	0.009
<b>Depressive Disorders</b> (N = 65) (n = 162,671)	0.98	99.71 (99.59-99.80)	0.174
<b>Bipolar and Related Disorders</b> (N = 38) (n = 153,192)	3.94	99.68 (99.51-99.82)	0.134
<b>Schizophrenia Spectrum and Psychotic Disorders</b> (N = 42) (n = 166,627)	17.74	99.69 (99.55-99.83)	0.023
<b>Obsessive-Compulsive Disorder</b> (N = 47) (n = 53,243)	4.02	99.11 (98.66-99.46)	0.127
<b>Disruptive, Impulse-Control and Conduct Disorders</b> (N = 50) (n = 140,946)	42.48	99.73 (99.61-99.83)	<0.0001
<b>Sleep-Wake Disorders</b> (N = 26) (n = 190,963)	0.00	99.86 (99.77-99.93)	0.376

a. N = number of data-points in meta-analyses; n = sample size for individuals with autism included across studies

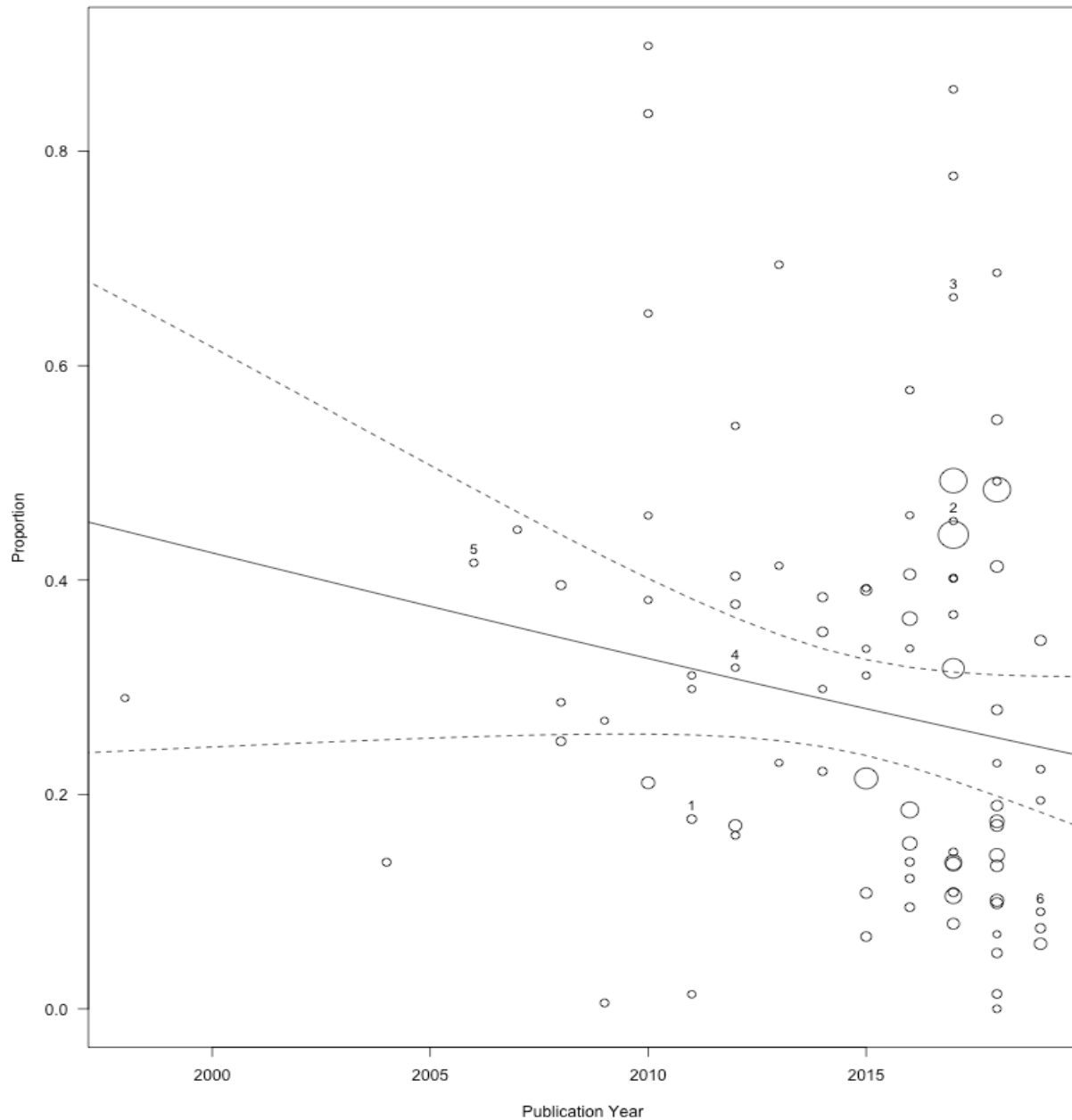
b. QE test of residual heterogeneity for R<sup>2</sup> is statistically significant for all CMHC meta-analysed, with p < 0.0001, for all cases



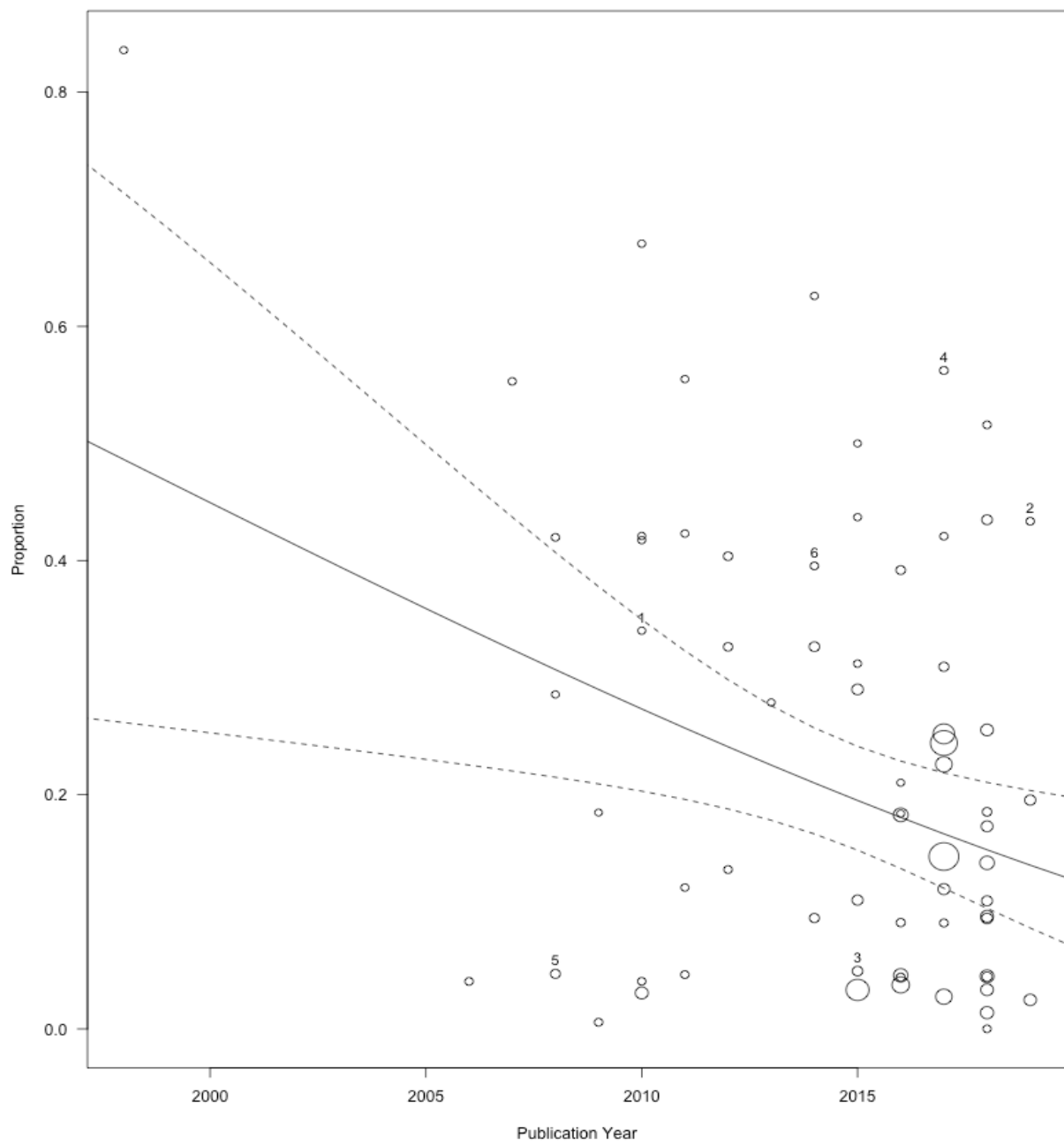
# Appendix5: Univariable scatter-plots for publication year effect (\* indicates QM $p < 0.05$ )

X-axis indicates the univariable meta-regression moderator modeled (ie, publication year), and y-axis indicates reported proportion of each CMHC in the autism sample. Solid line indicates estimated regression line, and dotted line indicates 95% confidence intervals. Circle size represents size of a study's influence on the regression line.

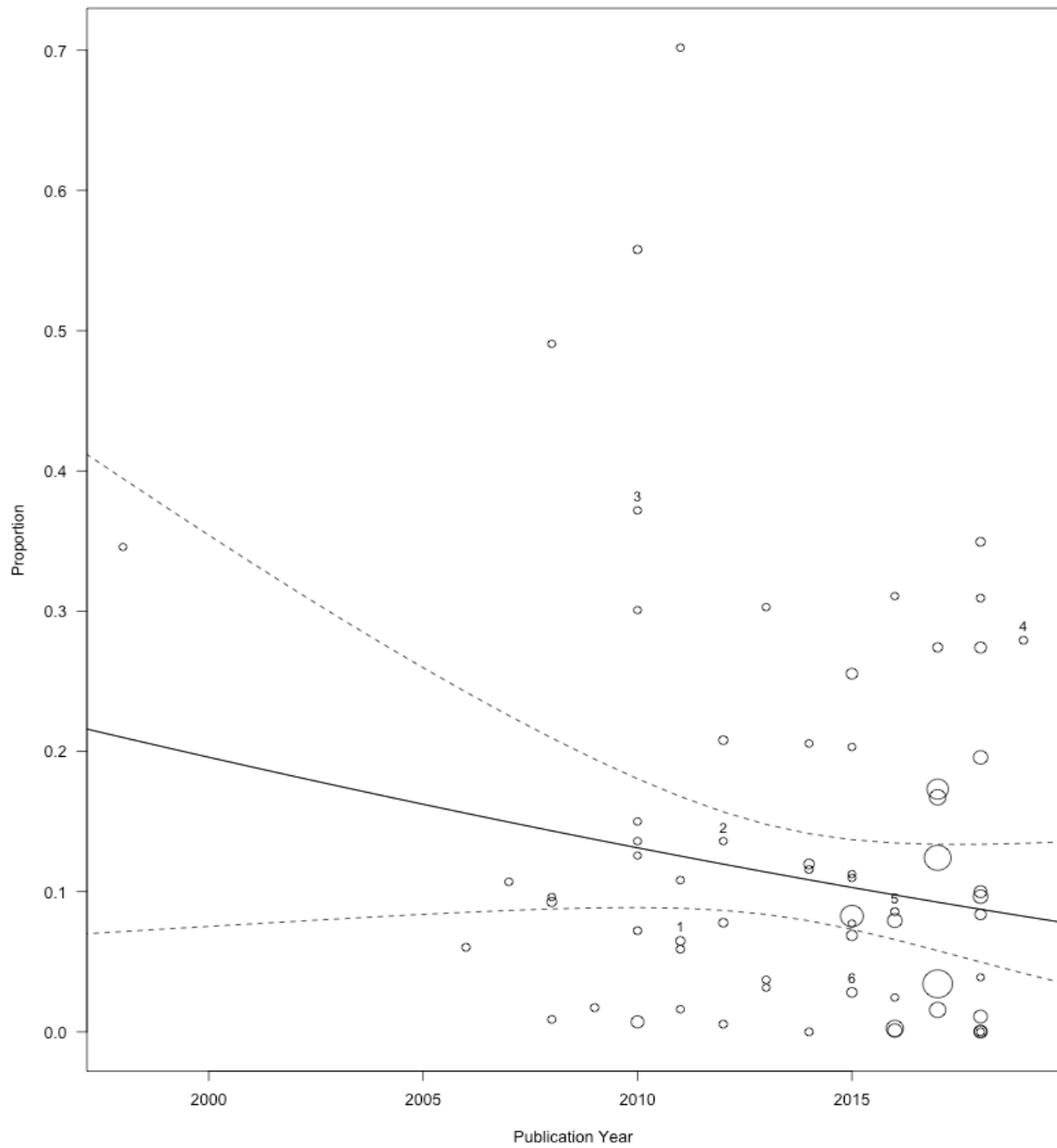
## ADHD



**\*Anxiety disorders**

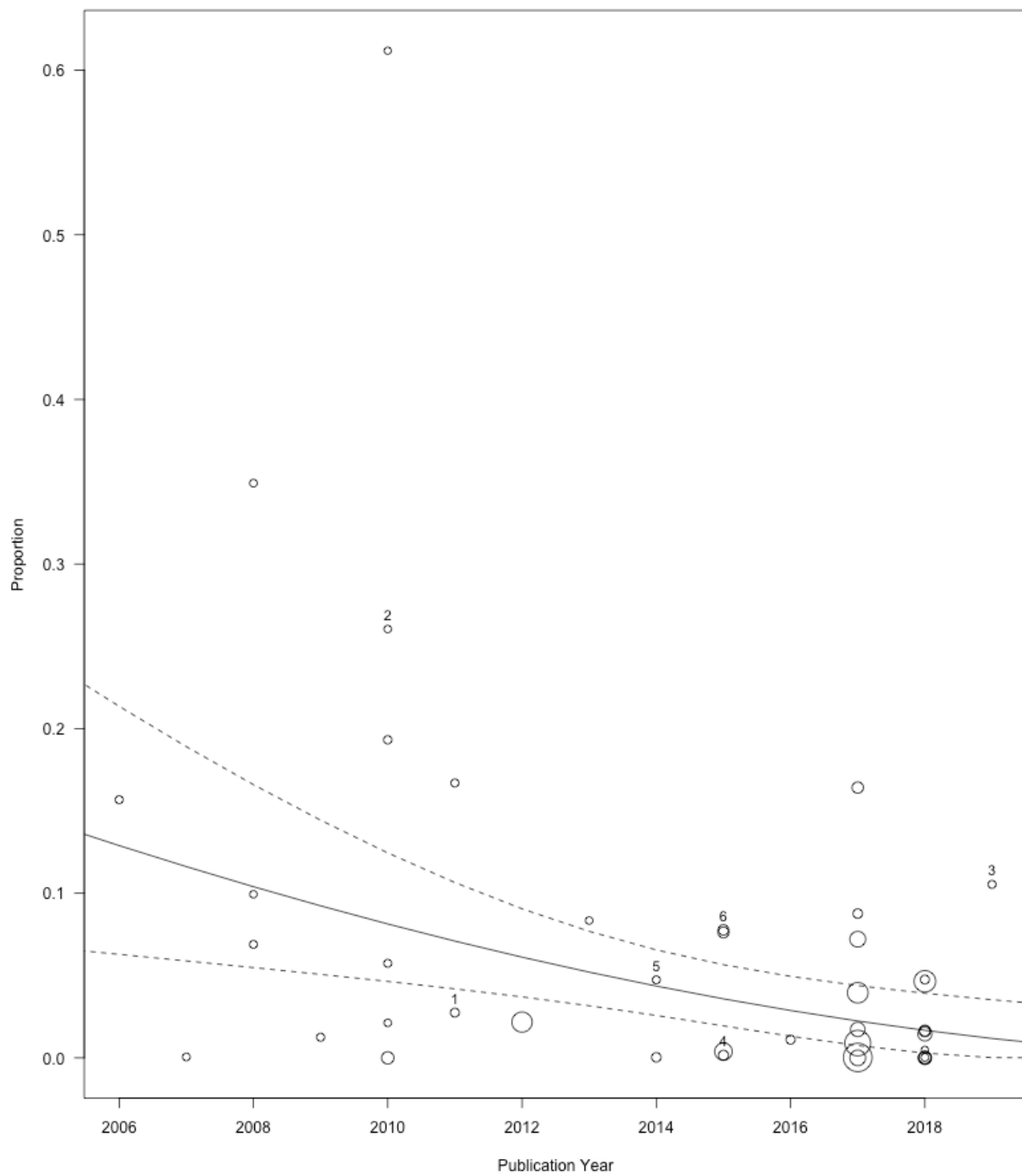


## Depressive disorders

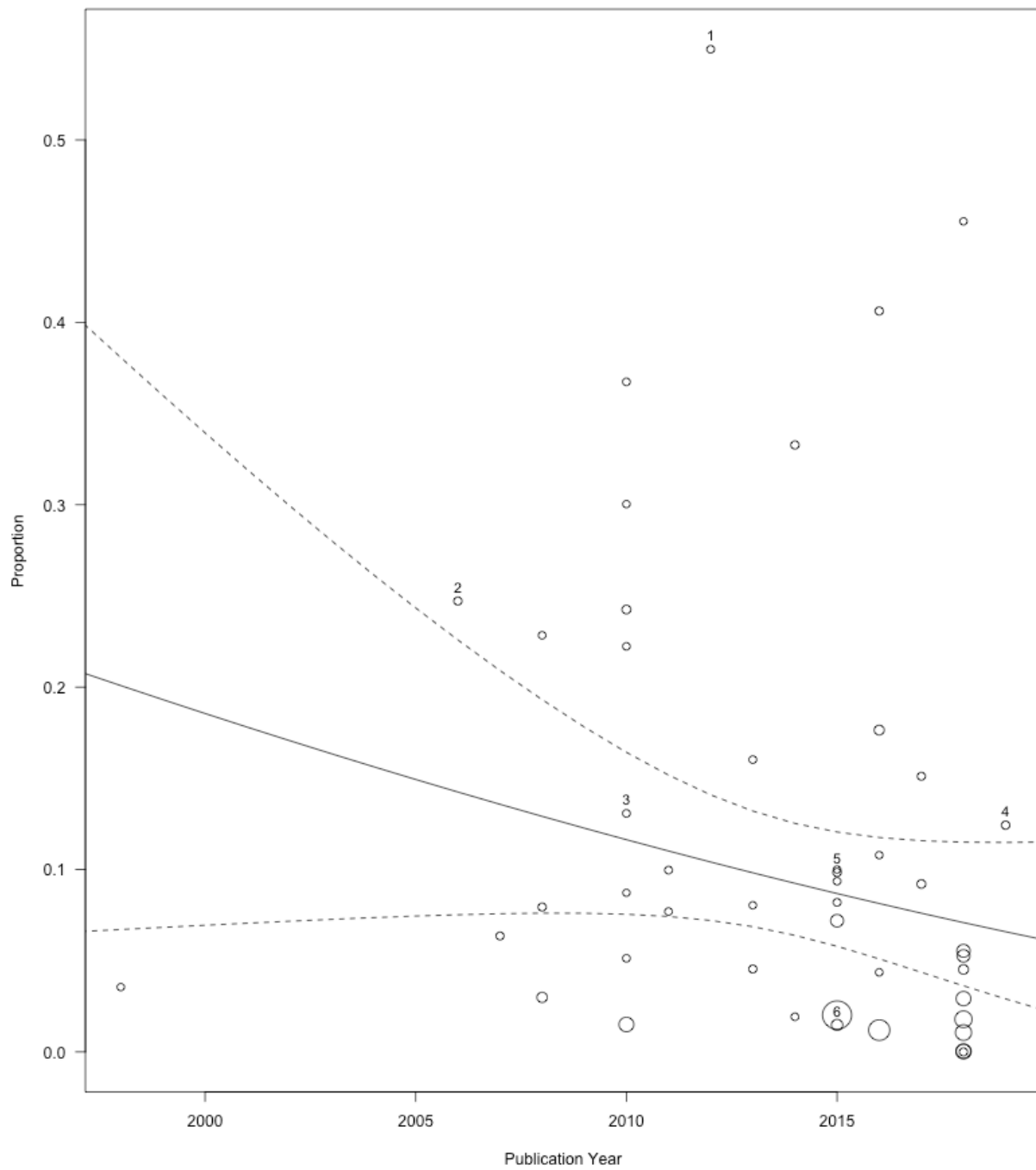




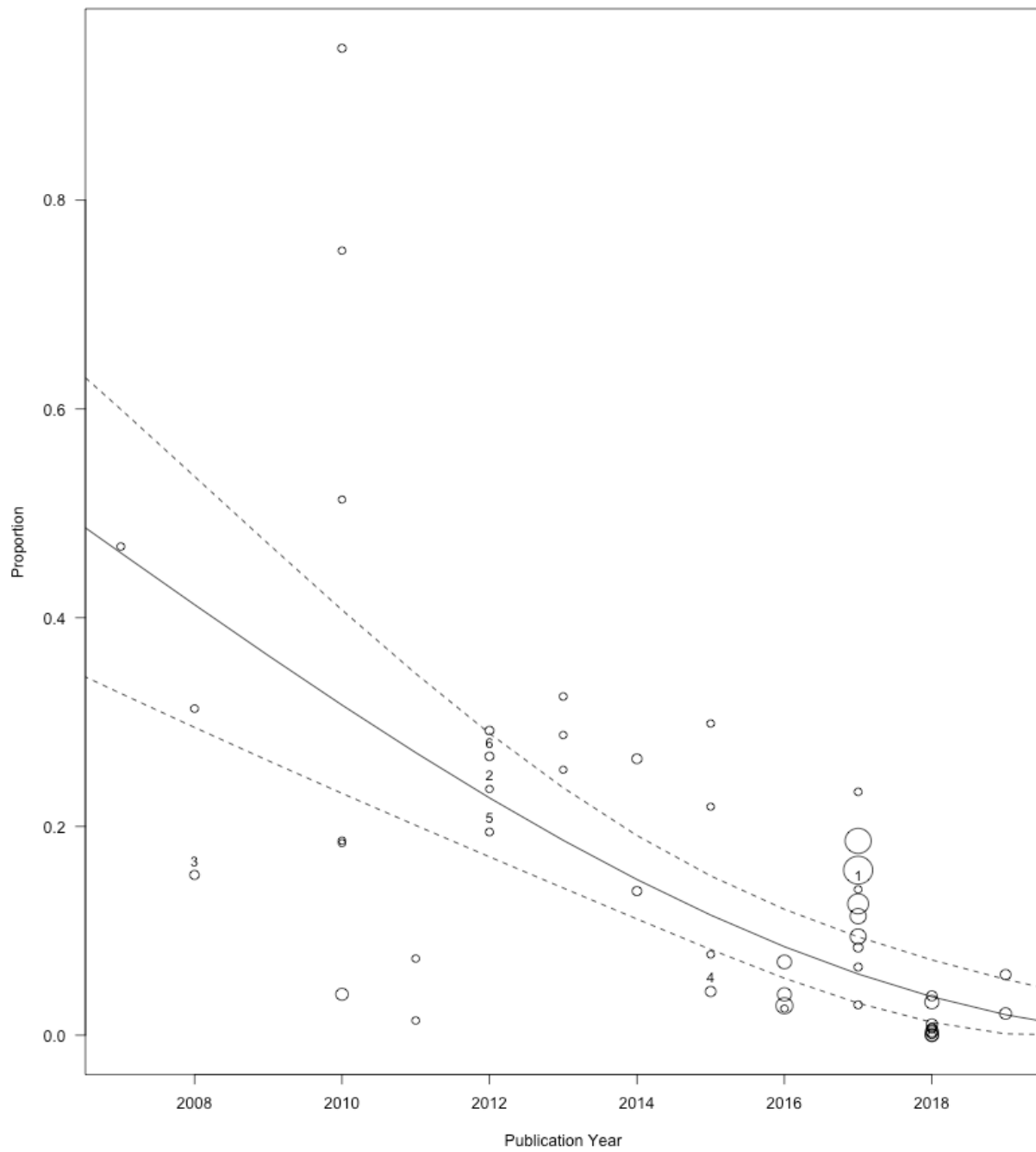
**\*Schizophrenia spectrum and psychotic disorders**



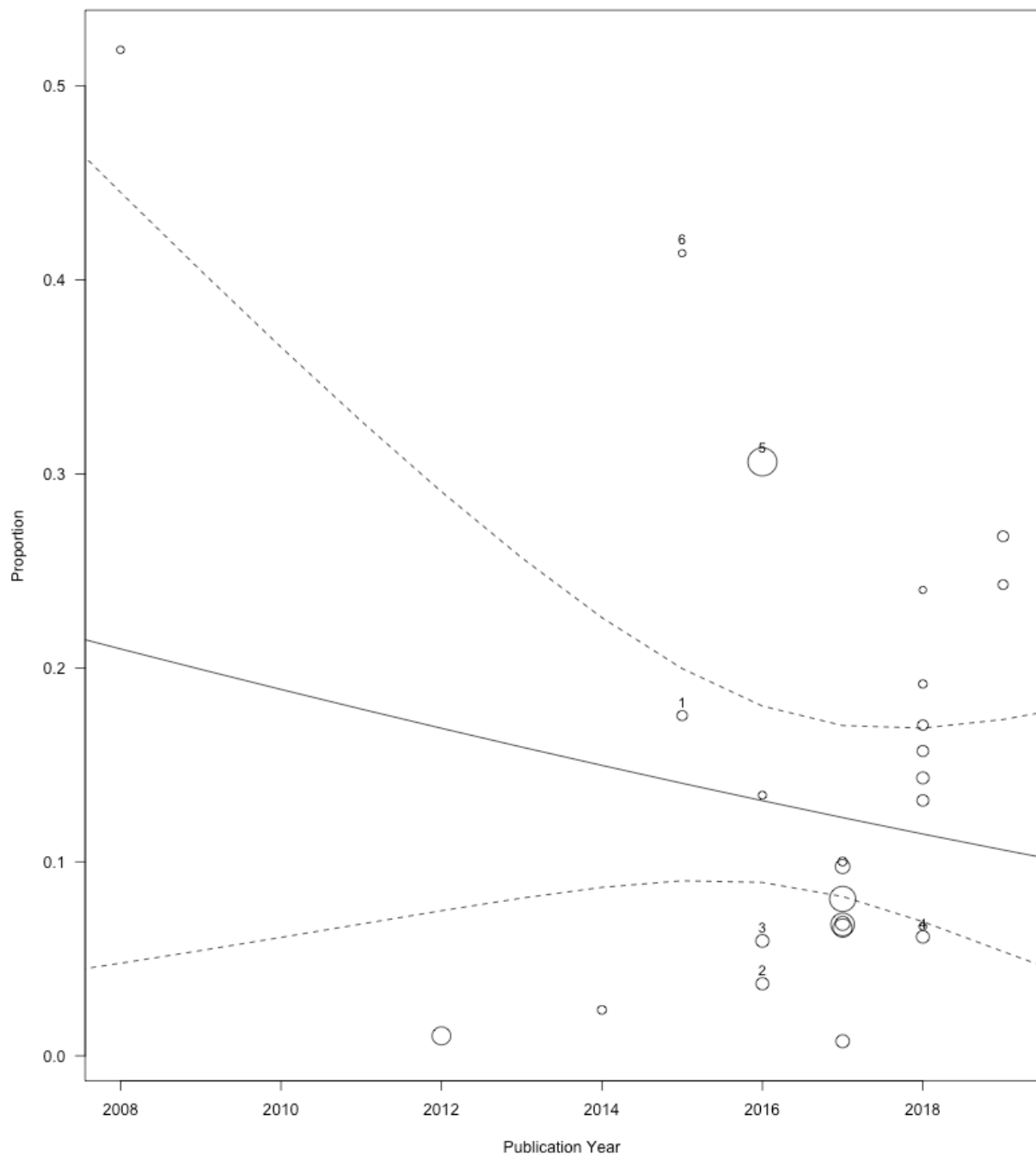
### Obsessive-compulsive disorder



**\*Disruptive, impulse-control and conduct disorders**



### Sleep-wake disorders

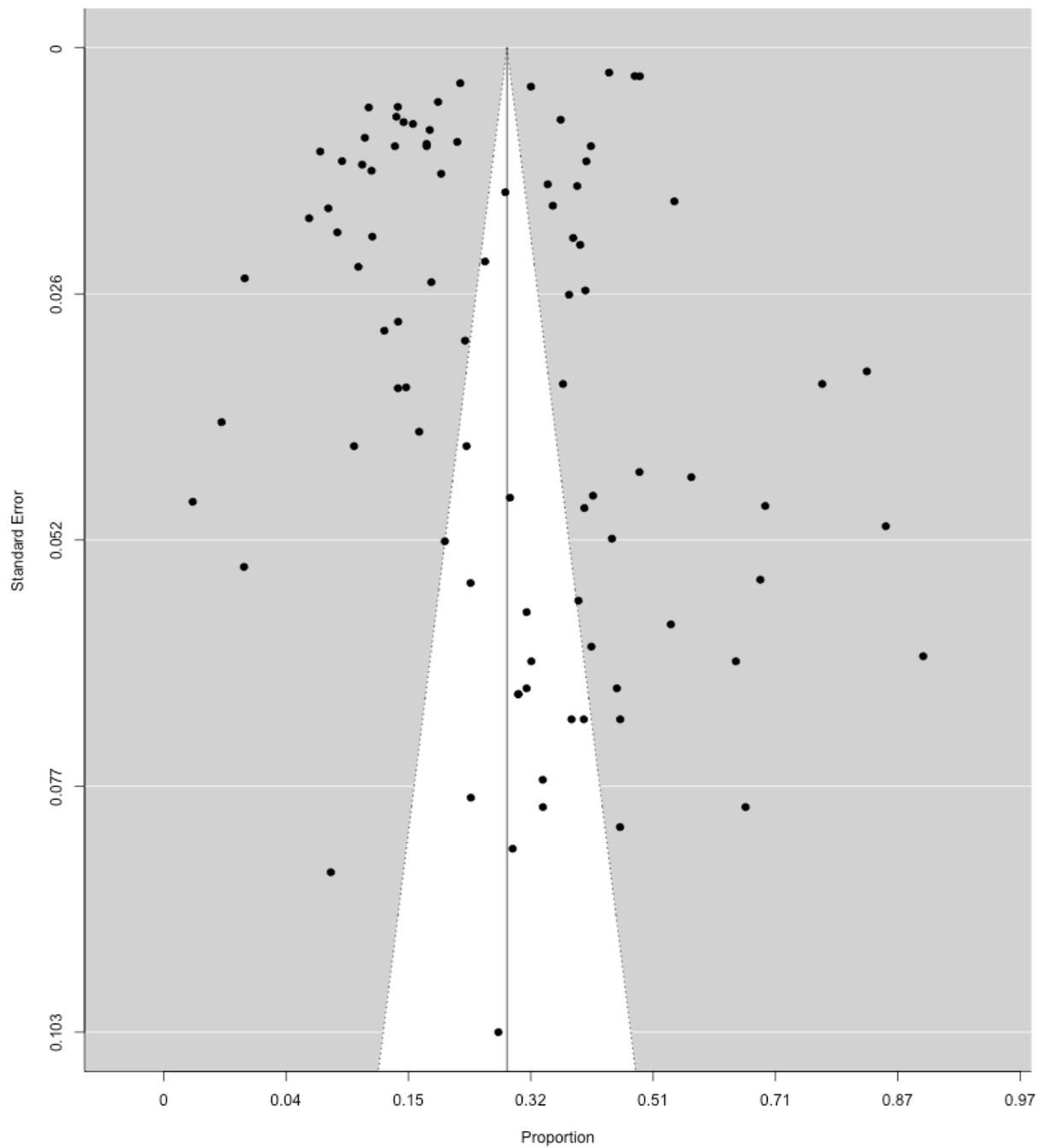




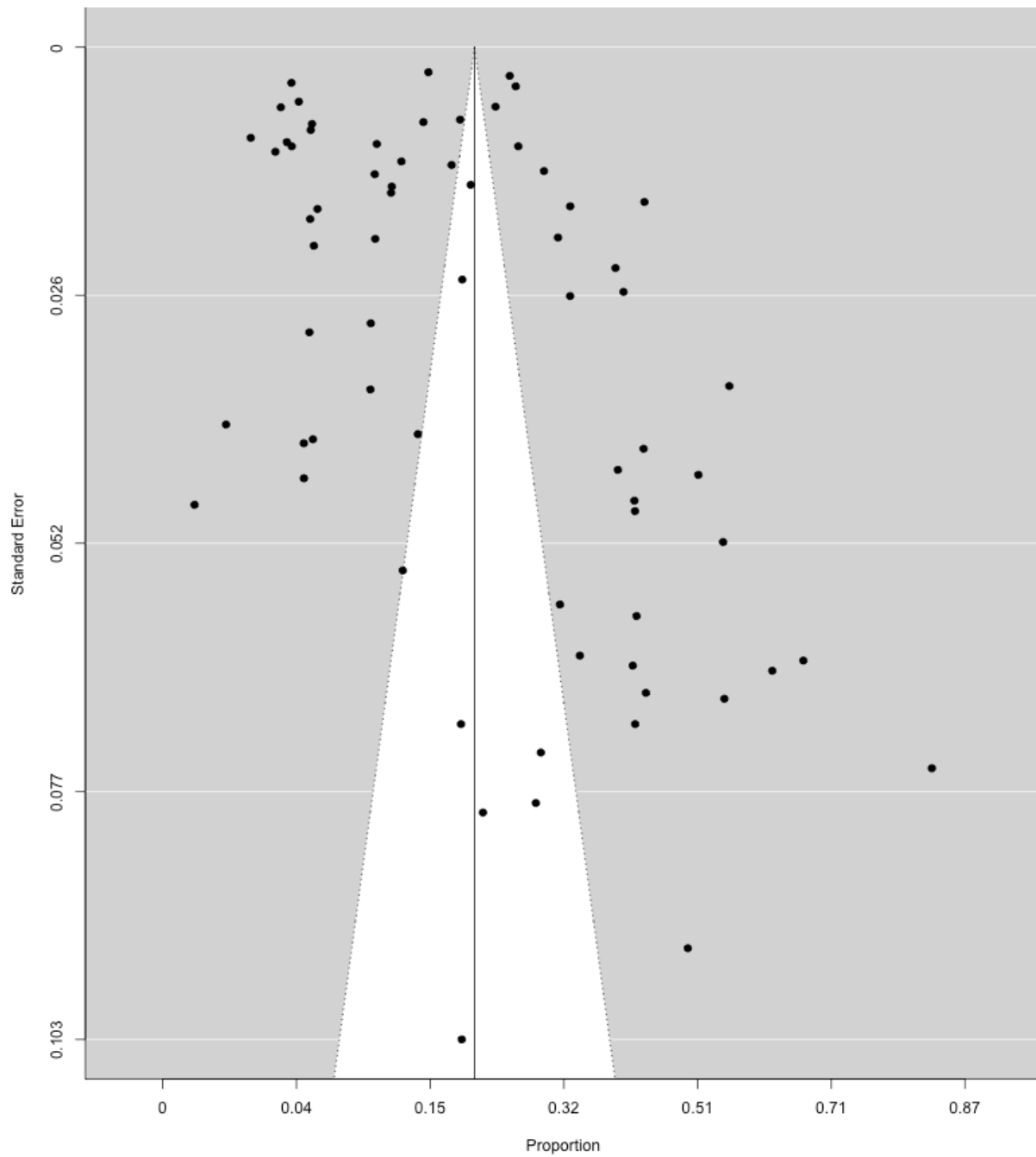
## Appendix6: Funnel plots

For funnel plots, the x-axis indicates an estimate of study effect, and y-axis indicates the study size (measured as the standard error). The dots represent the precision of each study in the analysis. The vertical line indicates the summary effect of the funnel plot. Studies with high precision will be close to the vertical line, while those with low precision should evenly spread on both sides of the line, creating a funnel shape.

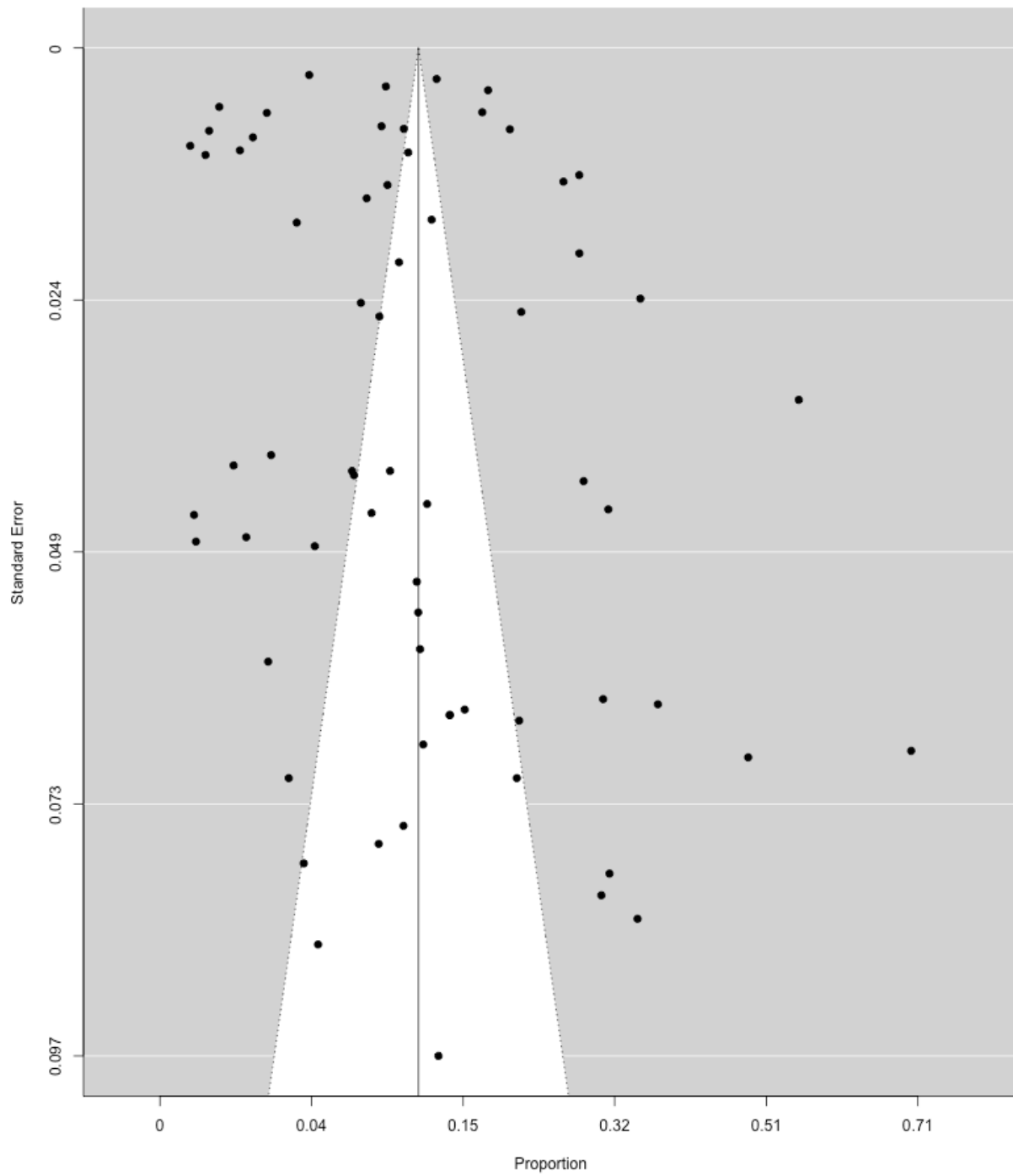
### a. ADHD



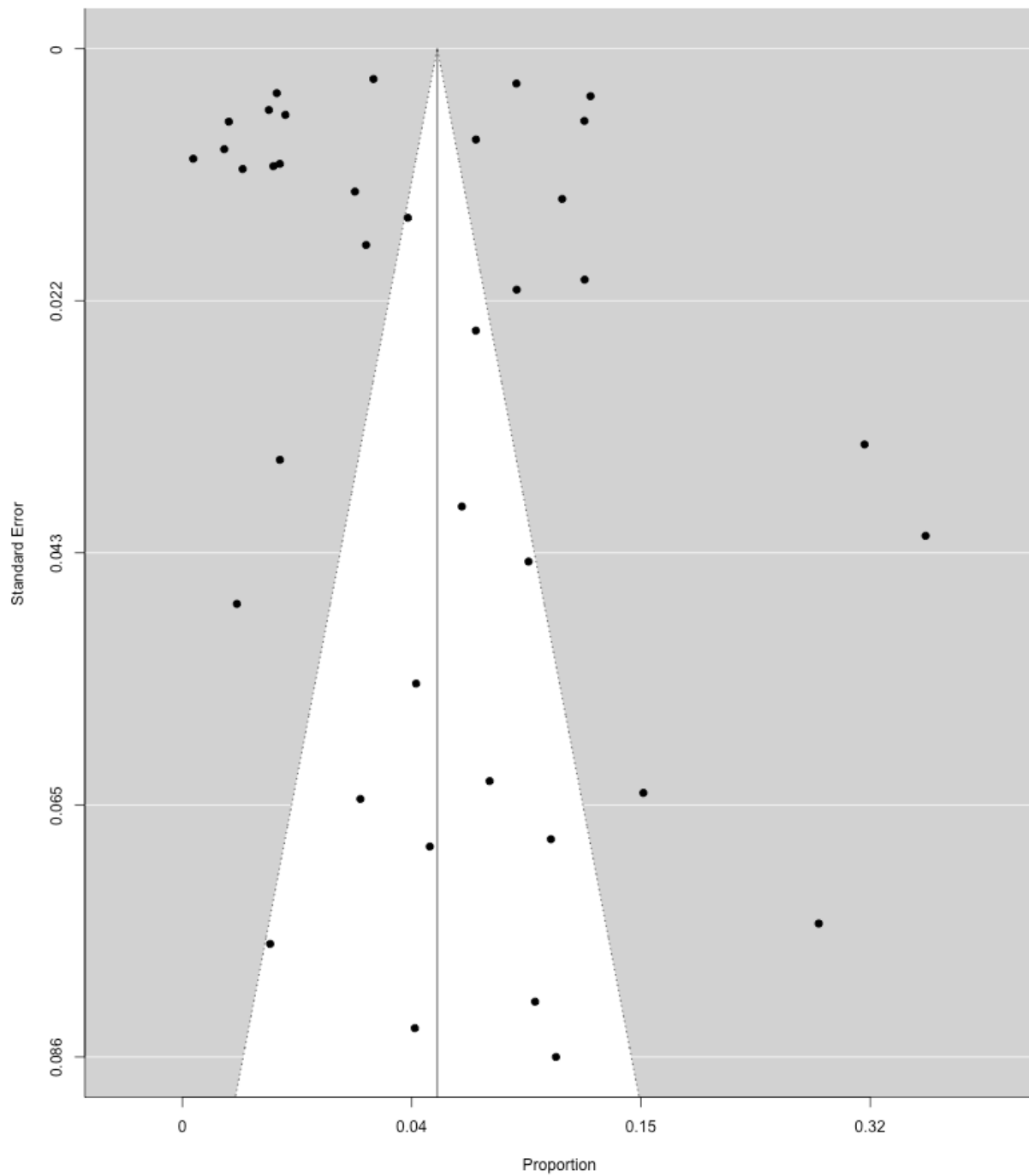
**b. Anxiety disorders**



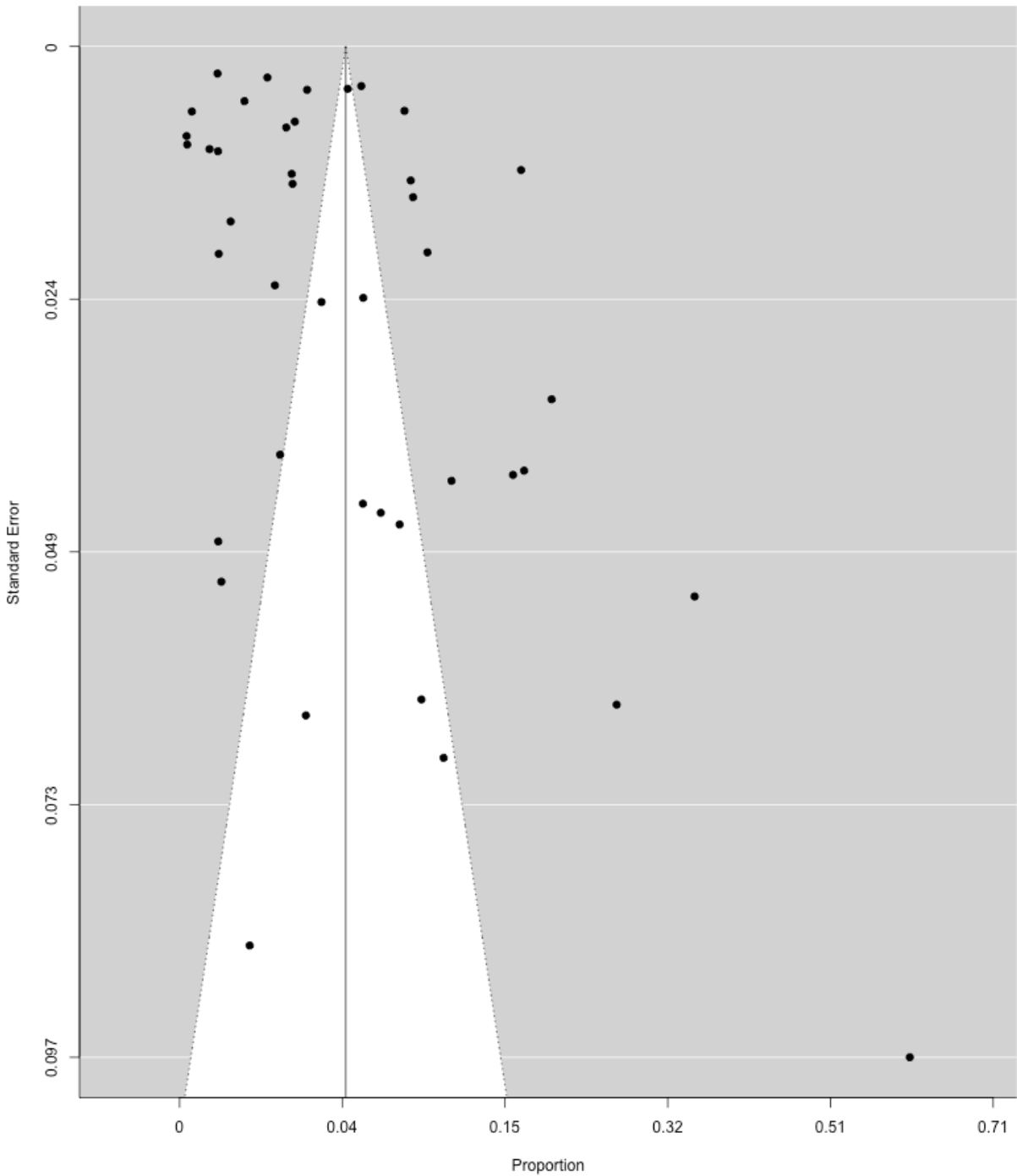
**c. Depressive disorders**



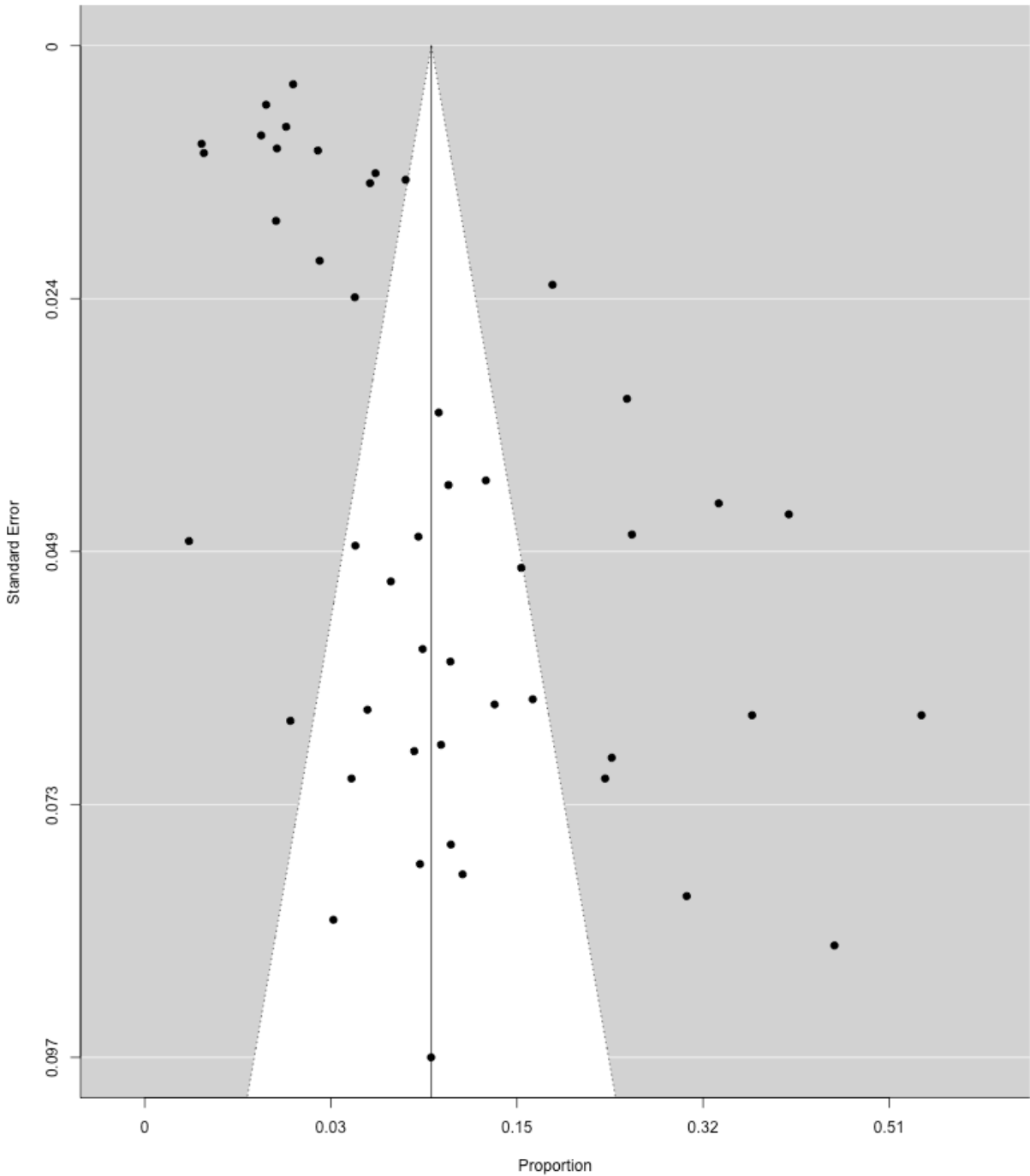
**d. Bipolar and related disorders**



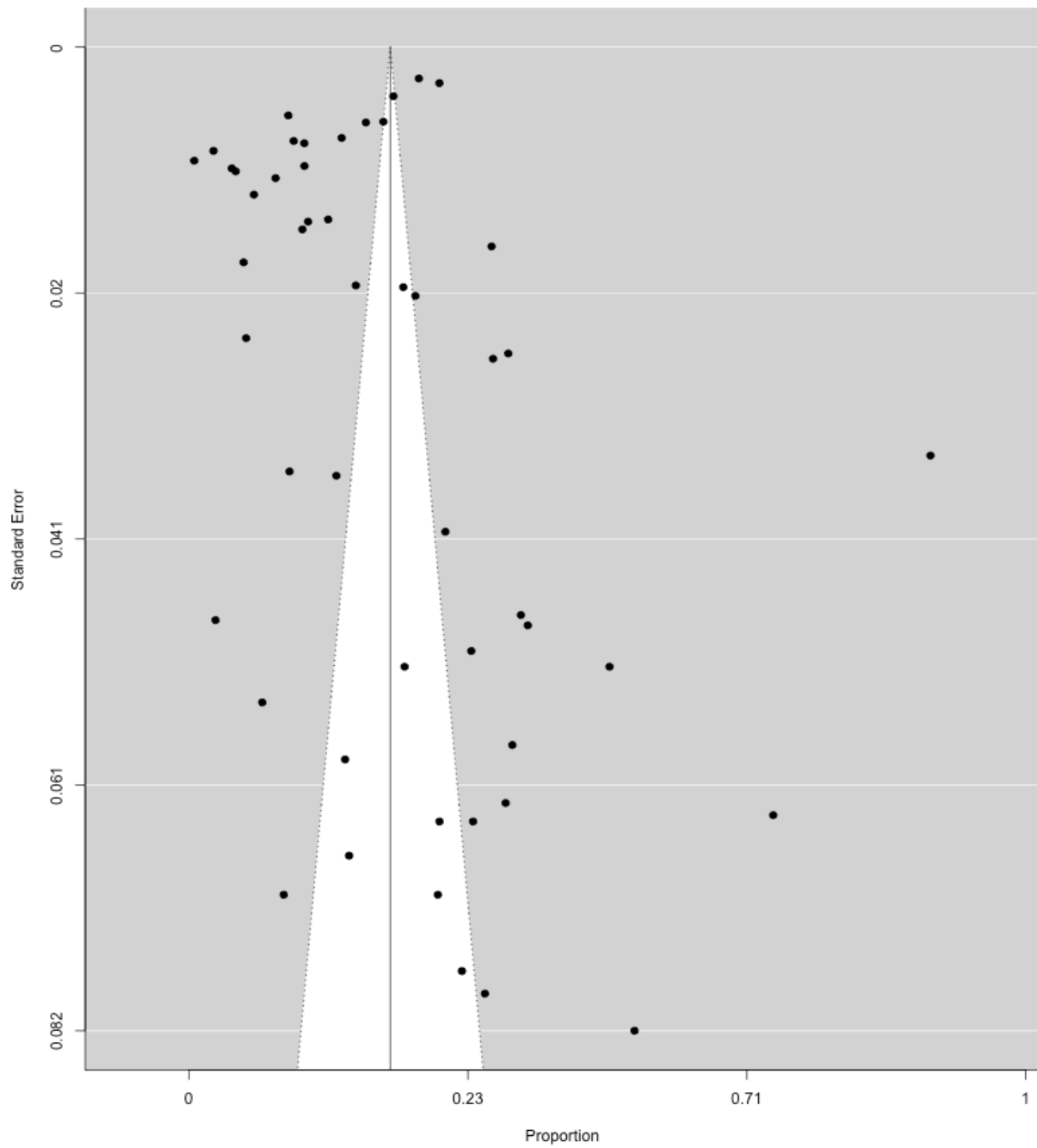
e. Schizophrenia spectrum and psychotic disorders



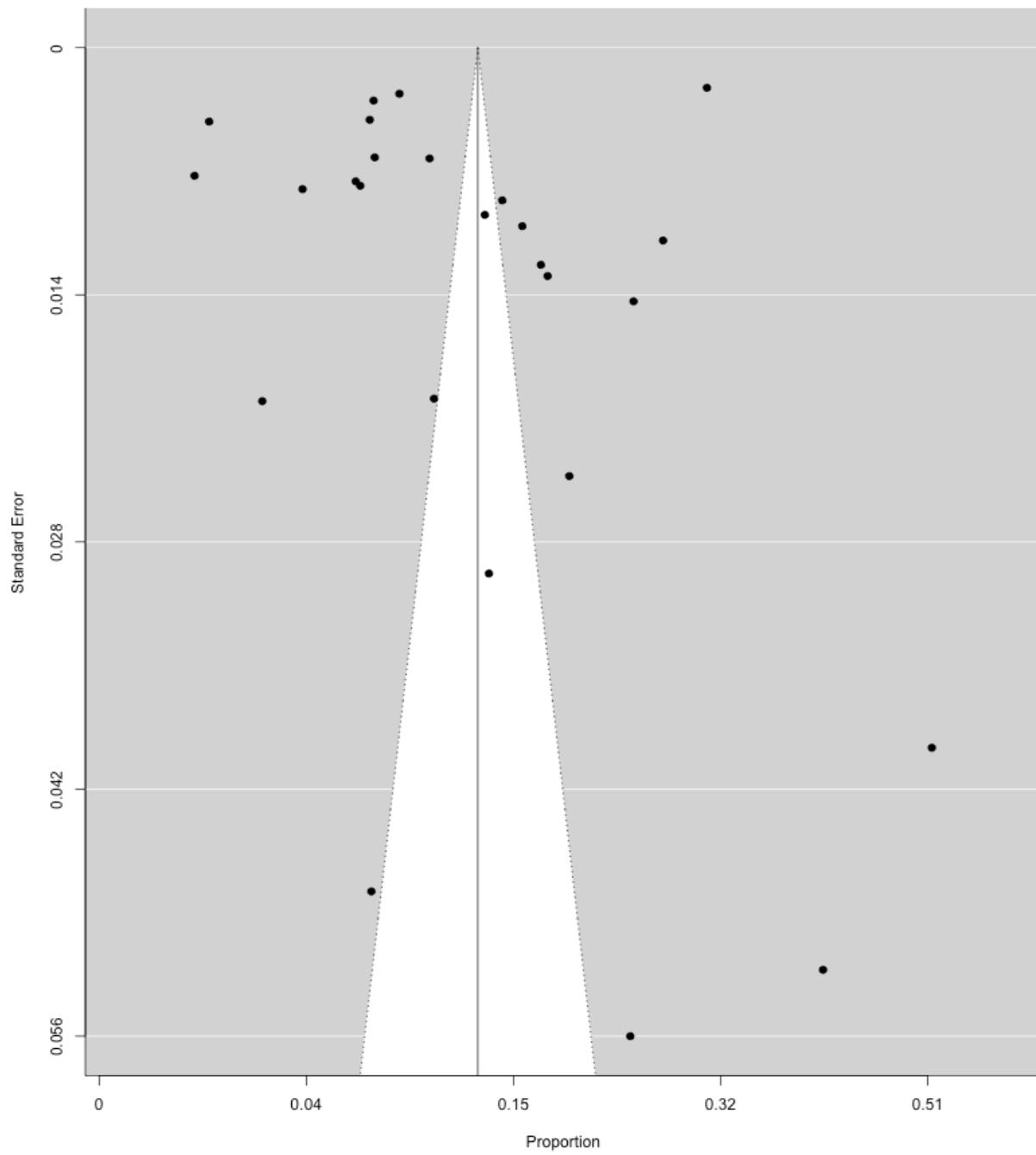
**f. Obsessive-compulsive disorder**



**g. Disruptive, impulse-control and conduct disorders**



**h. Sleep-wake disorders**





**Sensitivity analyses of outliers' influences****Appendix7: Pooled estimates of prevalence with outliers removed**

<sup>a</sup> Co-occurring mental health condition	OVERALL POOLED ESTIMATES OF PREVALECE		
	<sup>b</sup> Data points removed (determined by plotting study influences)	Overall prevalence in autism population <sup>c</sup> (95%CI) <sup>c</sup> [95%PI]	I <sup>2</sup> % (95%CI) Cochran's Q Test (p-value)
<b>ADHD</b> (N = 89) (n = 210,249)	#43, 55, 88	28% (25-32%) [4-64%]	99.66 (99.55-99.82) p<0.0001
<b>Anxiety Disorders</b> (N = 68) (n = 169,829)	#49	20% (17-23%) [2-48%]	99.53 (99.41-99.85) p<0.0001
<b>Depressive Disorders</b> (N = 65) (n = 162,671)	#36, 42	11% (9-13%) [0-33%]	99.41 (99.37-99.75) p<0.0001
<b>Bipolar and Related Disorders</b> (N = 38) (n = 153,192)	#2, 21	5% (3-6%) [0-19%]	99.51 (99.24-99.73) p<0.0001
<b>Schizophrenia Spectrum and Psychotic Disorders</b> (N = 42) (n = 166,627)	#30, 34, 42	4% (3-5%) [0-14%]	99.09 (99.00-99.84) p<0.0001
<b>Obsessive-Compulsive Disorder</b> (N = 47) (n = 53,243)	#1, 9, 18, 31, 33, 34, 37, 39, 47	9% (7-10%) [1-21%]	94.18 (93.14-97.92) p<0.0001
<b>Disruptive, Impulse-Control and Conduct Disorders</b> (N = 50) (n = 140,946)	#26, 49	12% (10-15%) [0.3-36%]	99.49 (99.31-99.83) p<0.0001
<b>Sleep-Wake Disorders</b> (N = 26) (n = 190,963)	#5	13% (9-17%) [0-42%]	99.47 (99.38-99.91) p<0.0001

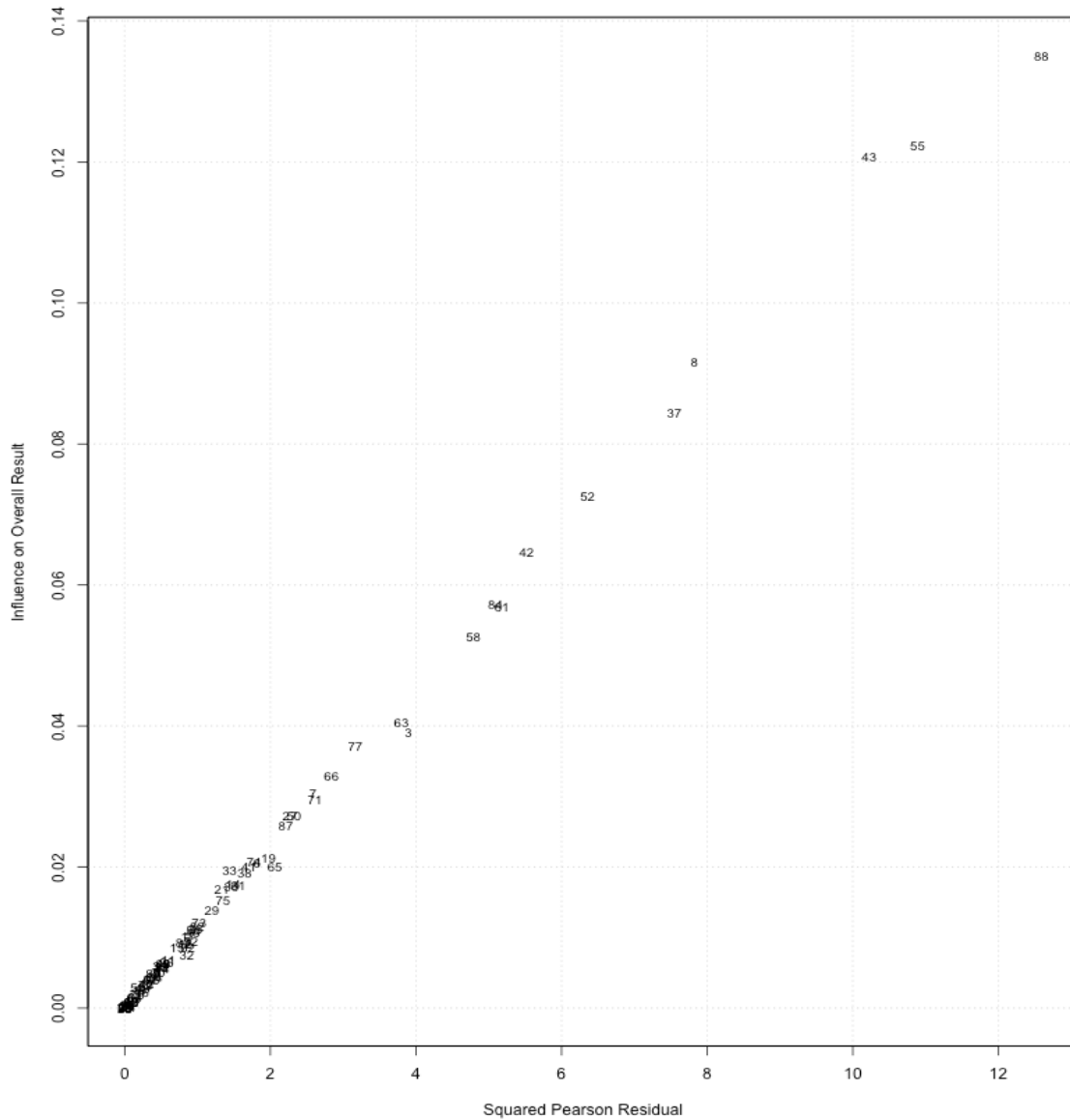
- a. N = number of data-points in complete meta-analyses without removing outliers; n = sample size for individuals with autism included across studies in complete meta-analyses
- b. Please refer to raw data tables (Appendix2-Tables1-8) for information on the data-point removed
- c. CI = confidence interval, PI = prediction interval

## Appendix7: Baujat plots and forest plots ranked by precision

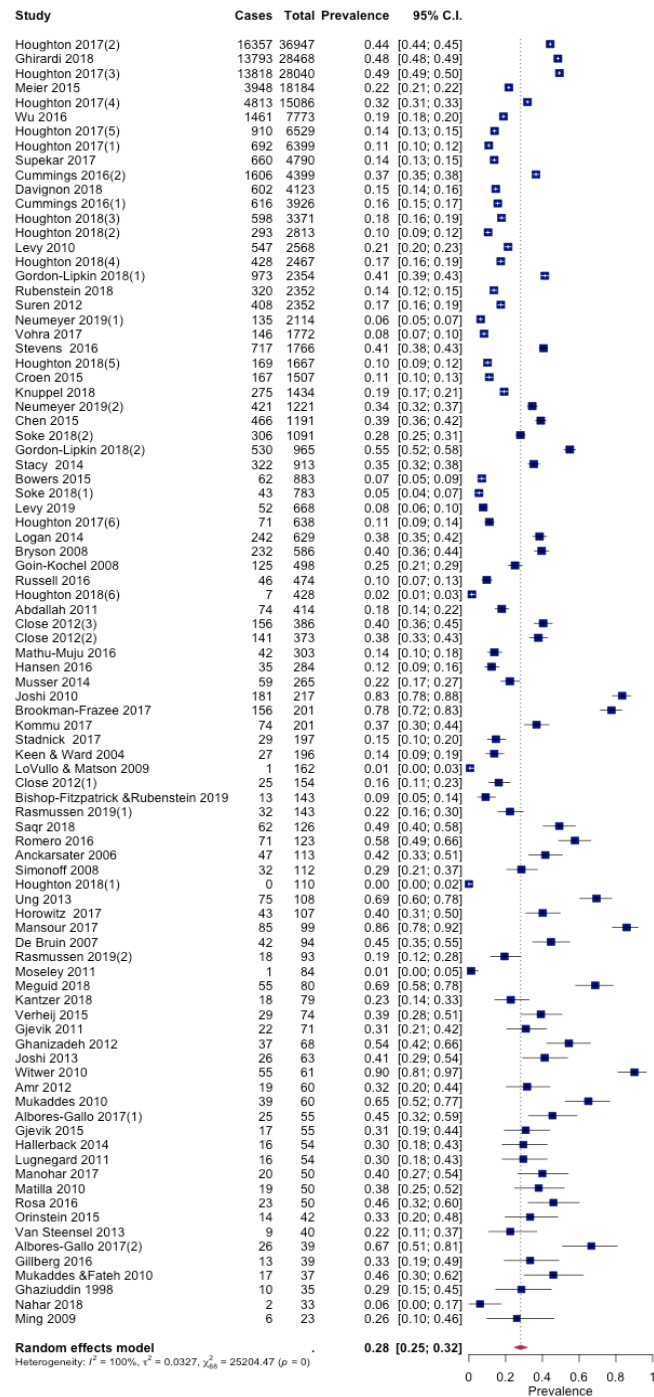
For the Baujat plots, the x-axis indicates the contribution of each study to the Q statistic, and the y-axis indicates the influence of each study on the effect size proportion. Therefore, studies on the top right quadrant are the most heterogeneous, and therefore may indicate outliers. Forest plots presented here rank studies based on precision (high to low from top to bottom).

### a. ADHD

Baujat plot

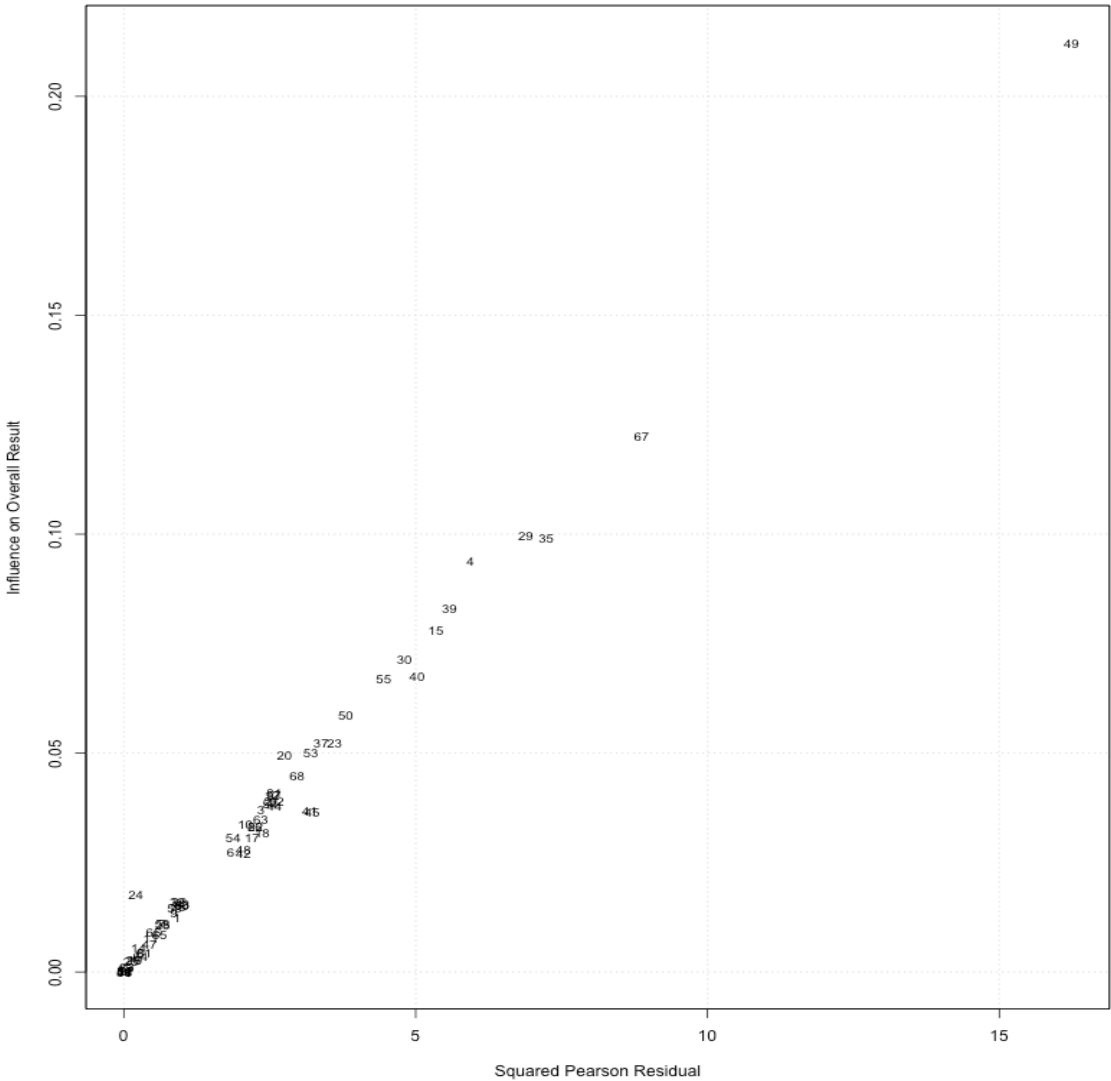


Forest plot by precision (from high to low)

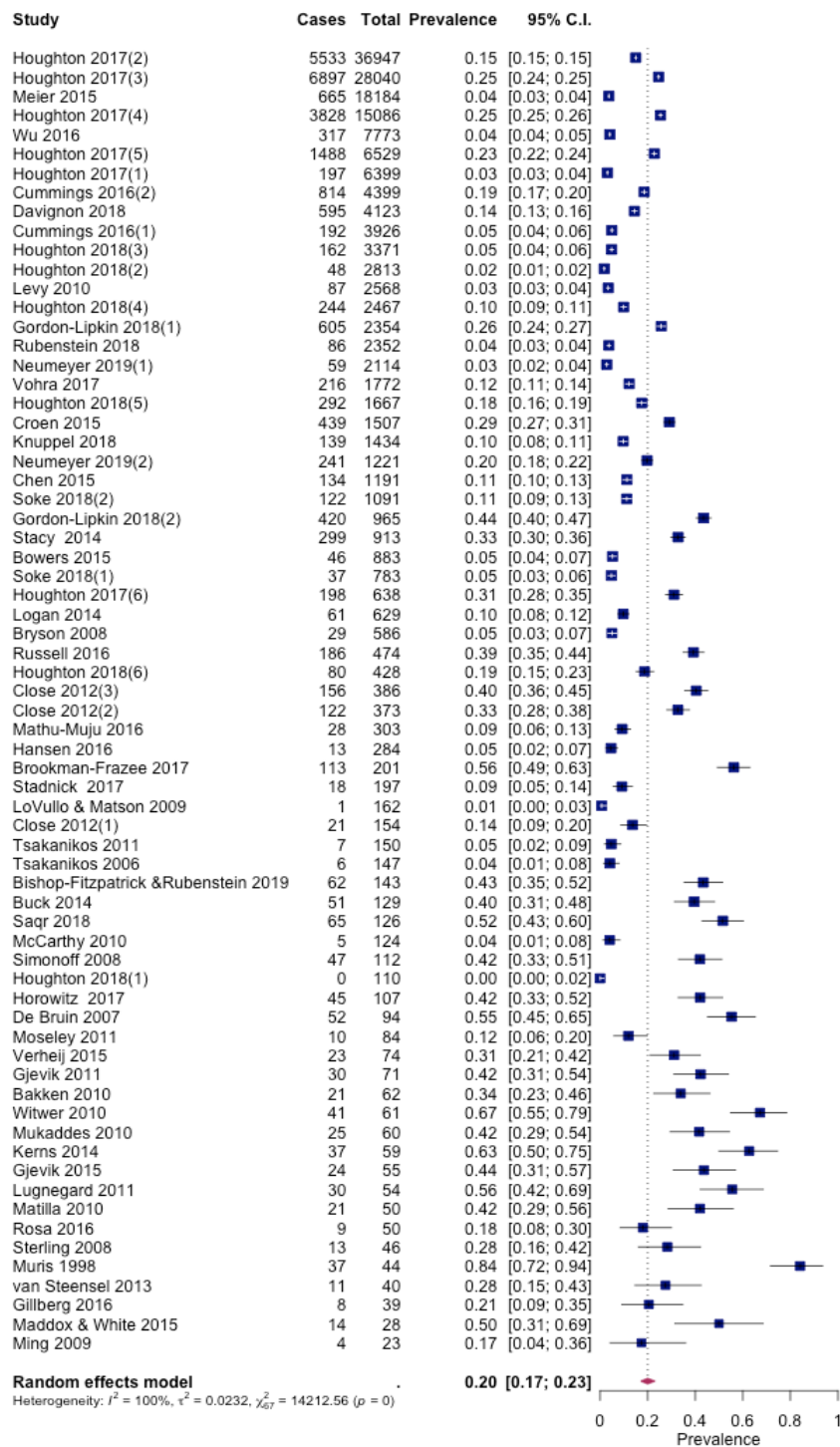


**b. Anxiety disorders**

Baujat plot

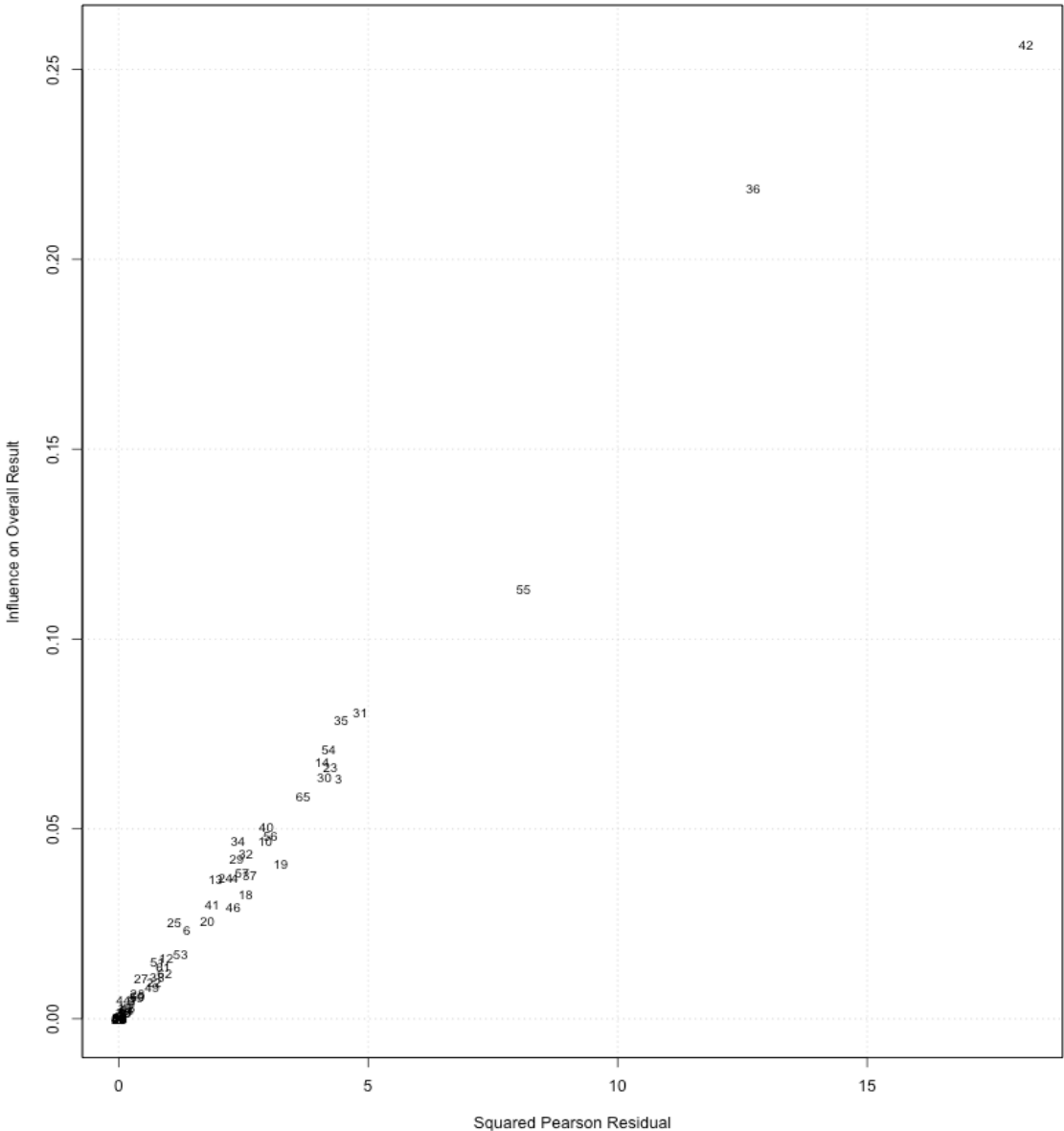


Forest plot by precision (from high to low)

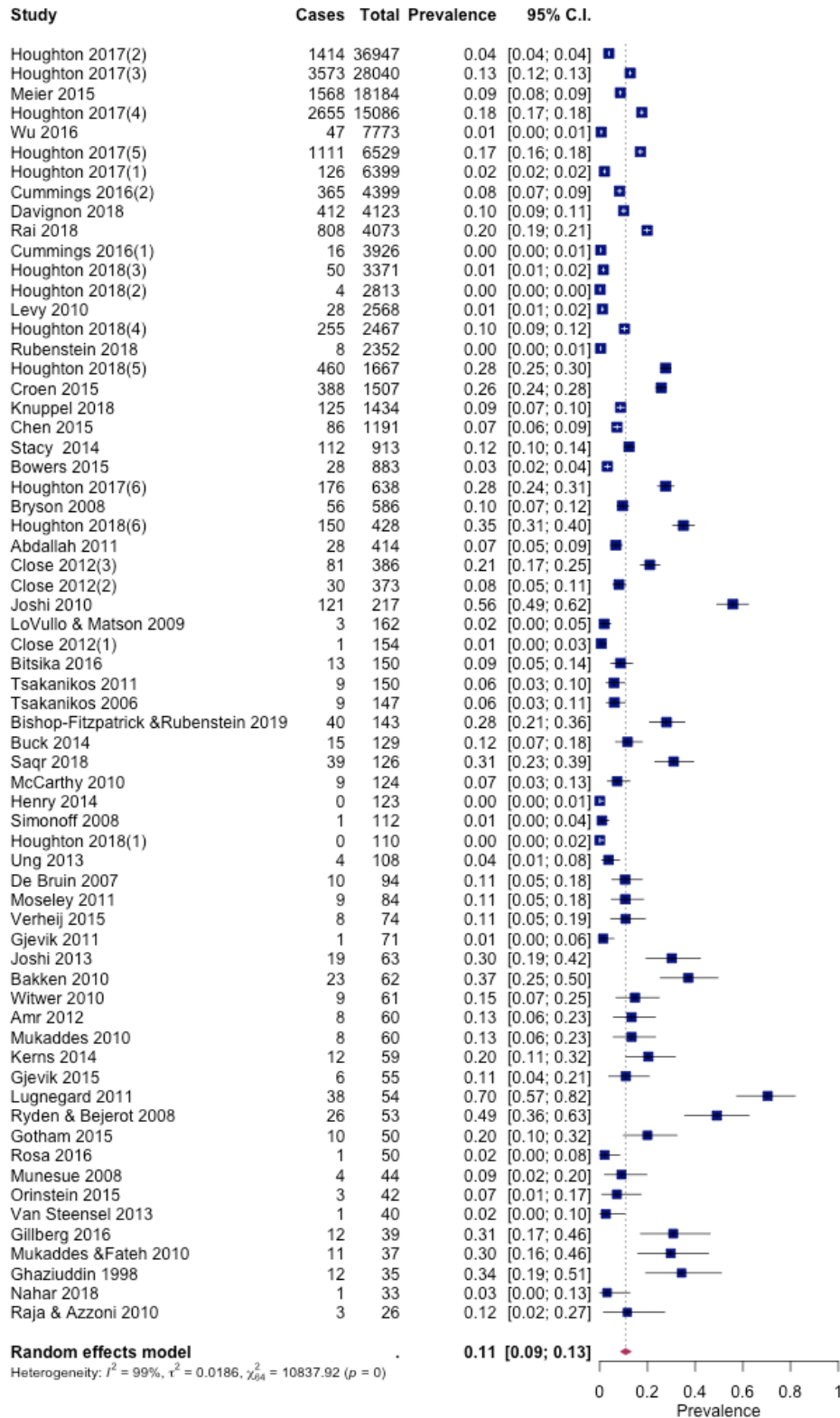


c. Depressive disorders

Baujat plot

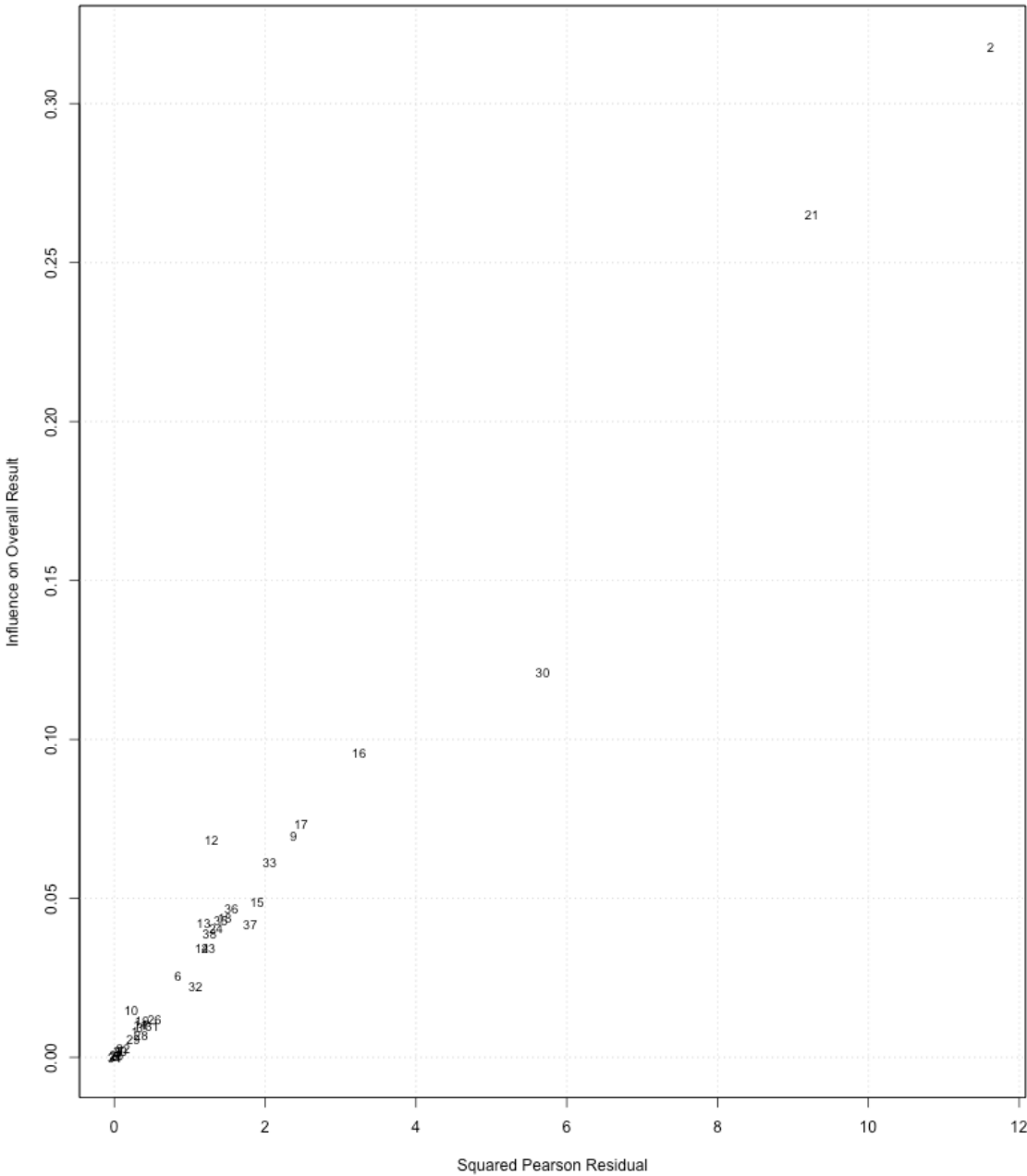


Forest plot by precision (from high to low)



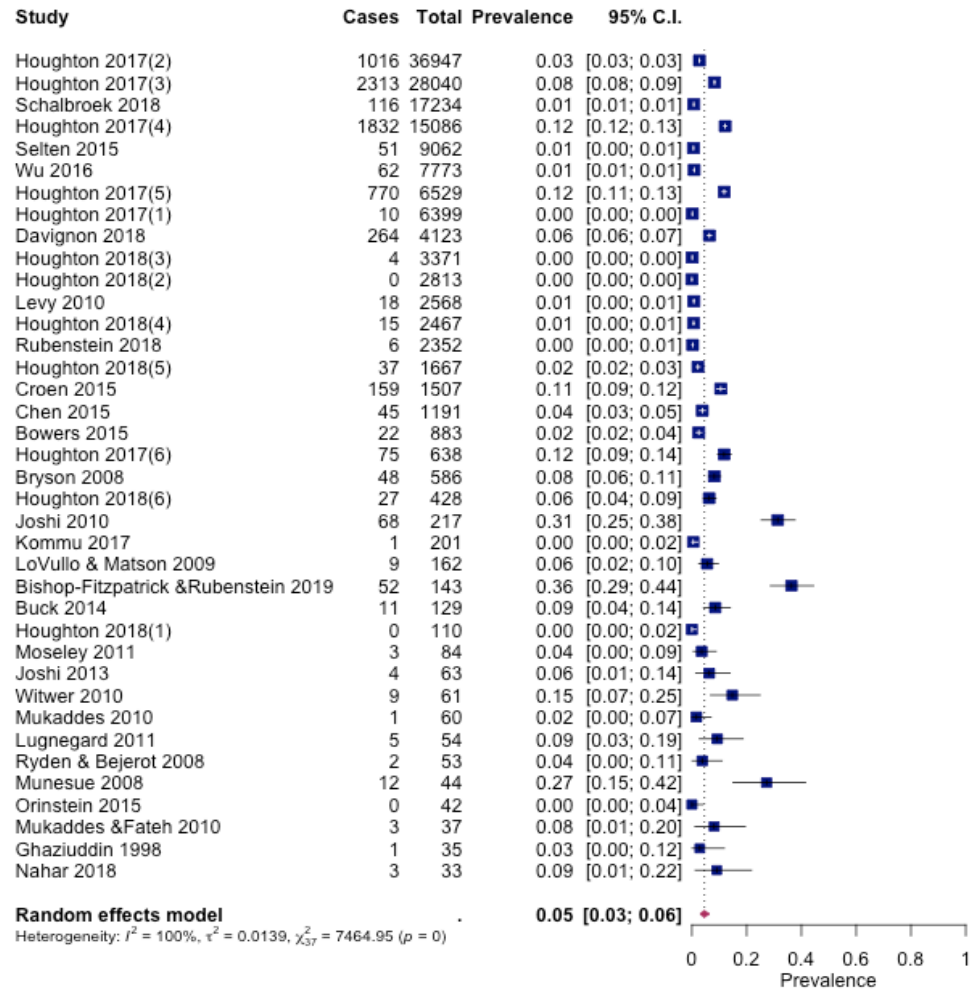
**d. Bipolar and related disorders**

Baujat plot



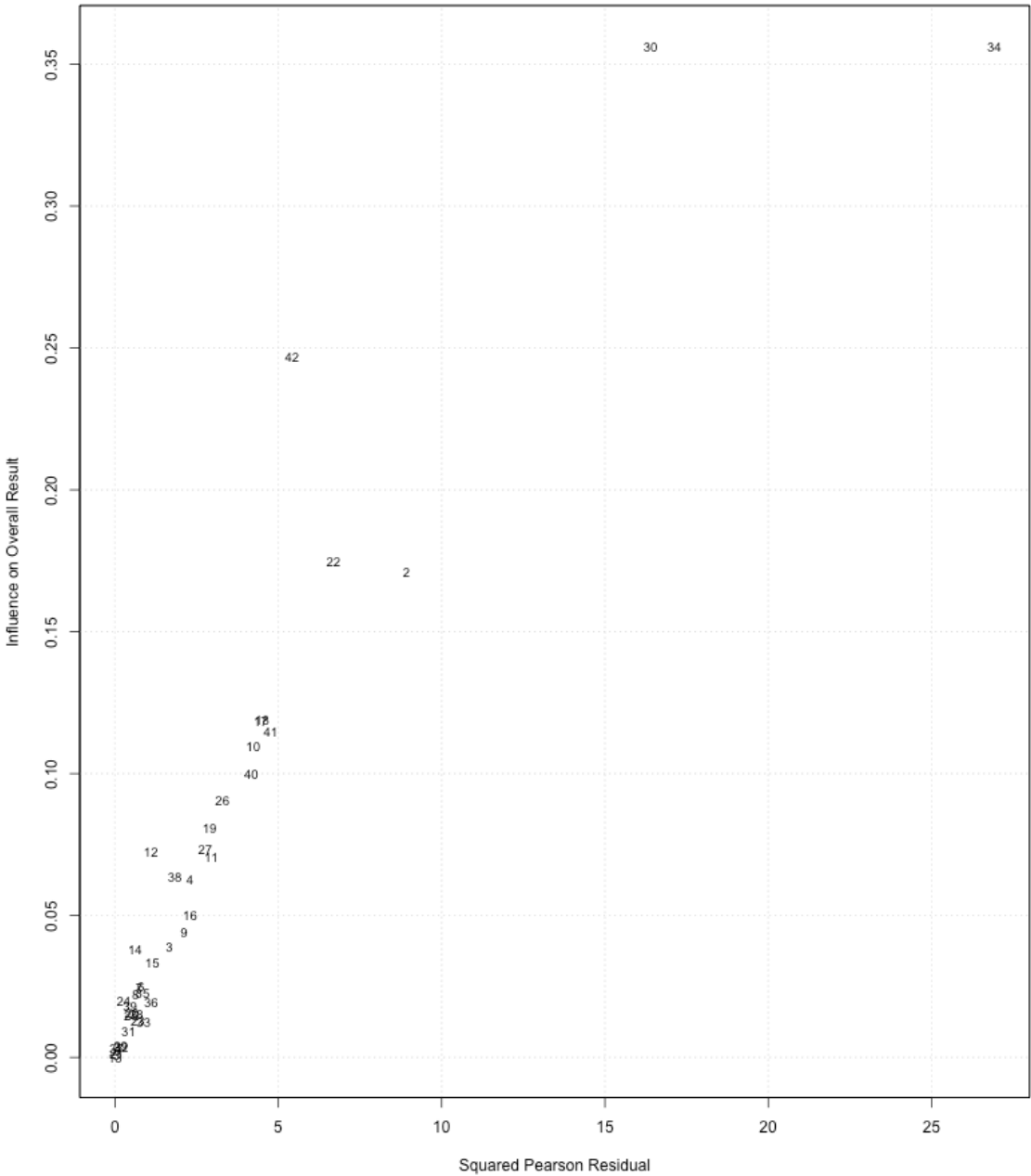


Forest plot by precision (from high to low)

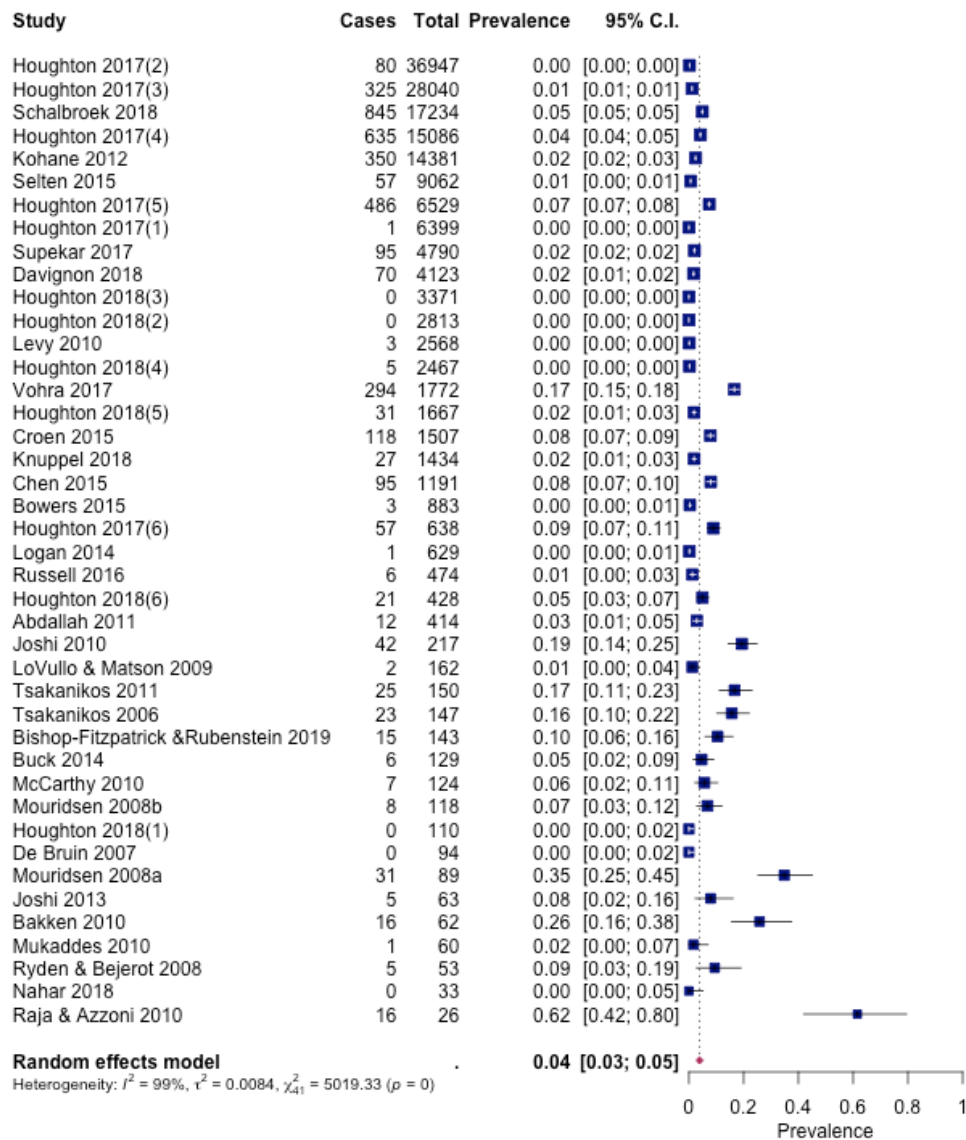


**e. Schizophrenia spectrum and psychotic disorders**

Baujat plot

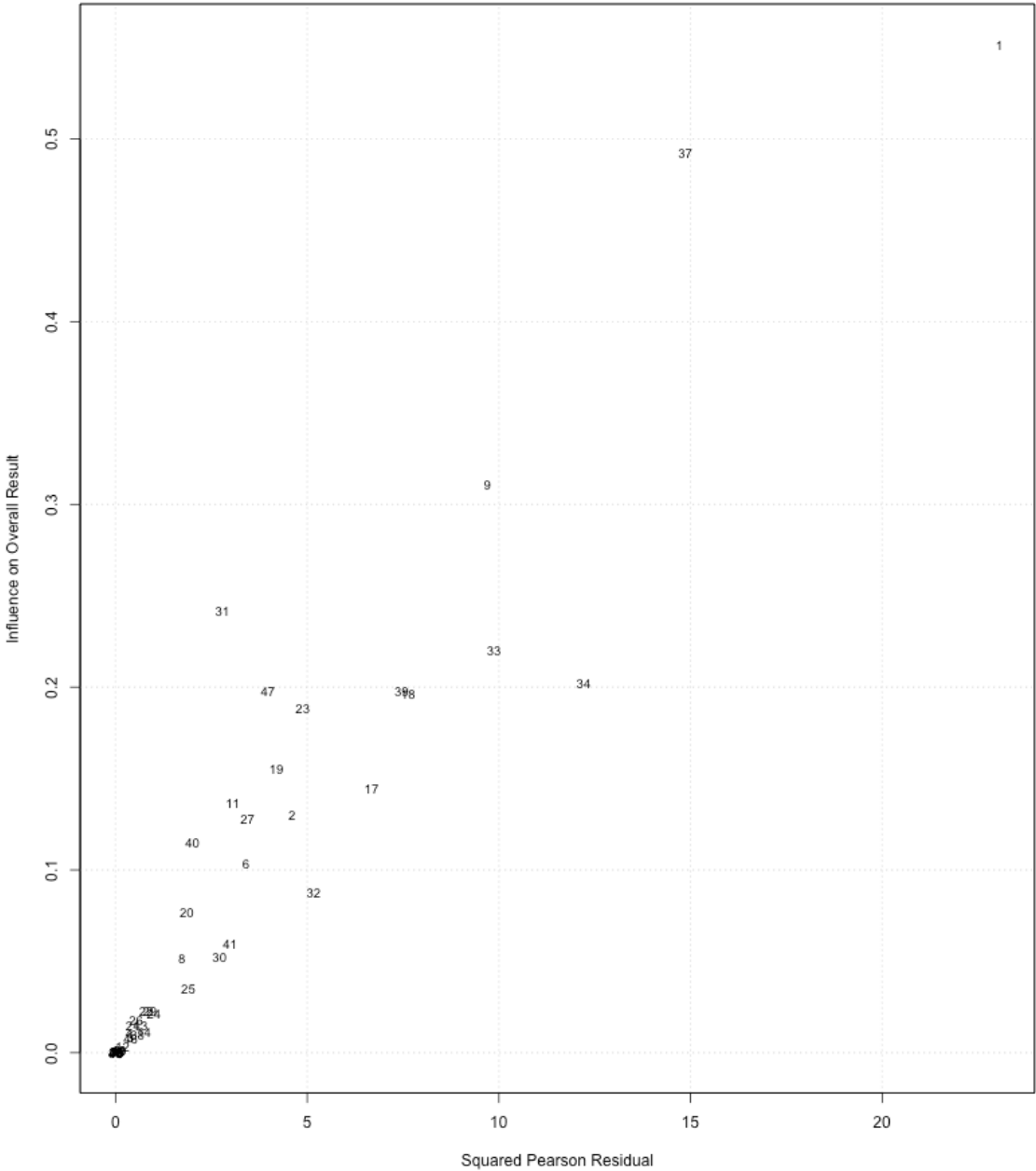


Forest plot by precision (from high to low)

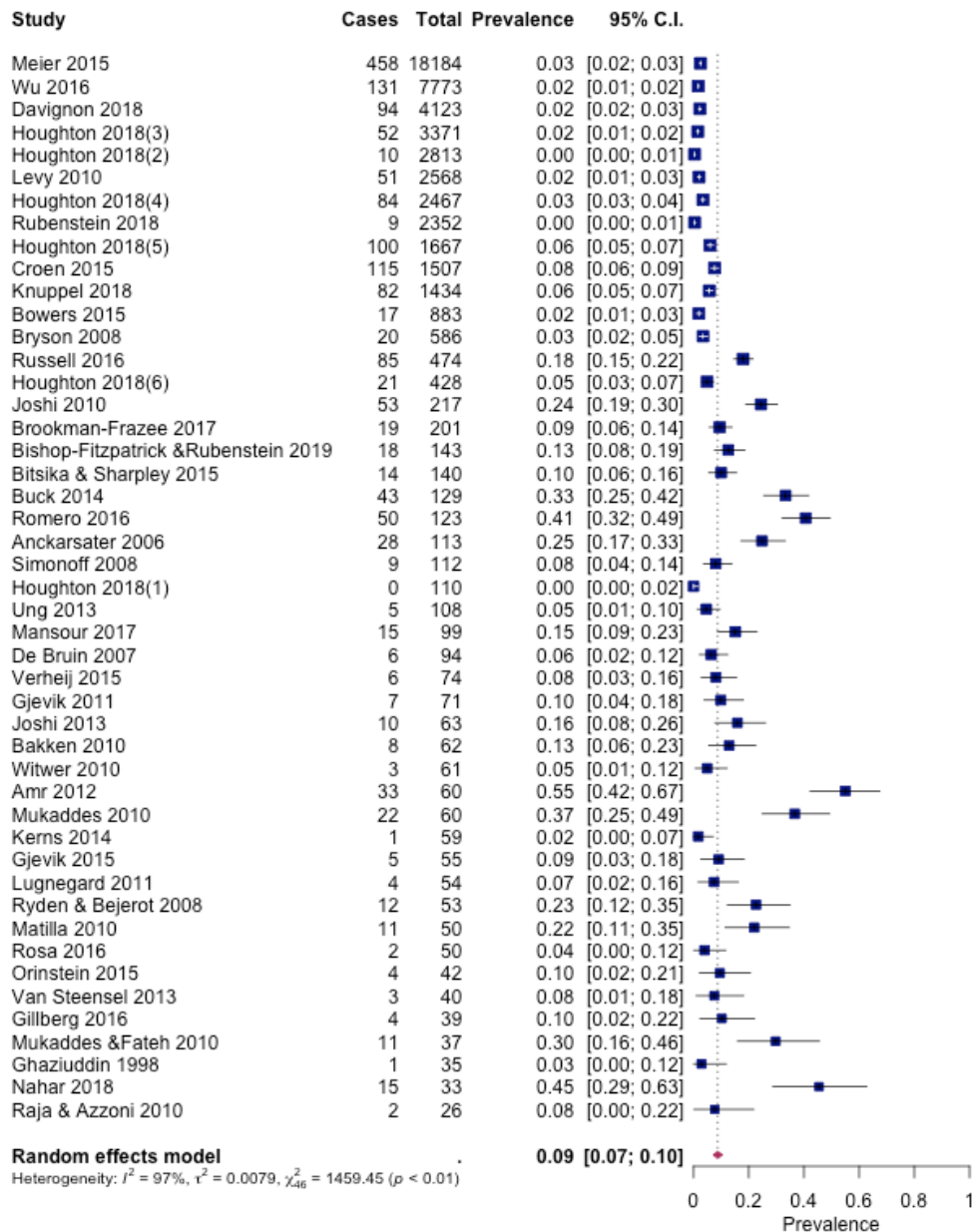


**f. Obsessive-compulsive disorder**

Baujat plot

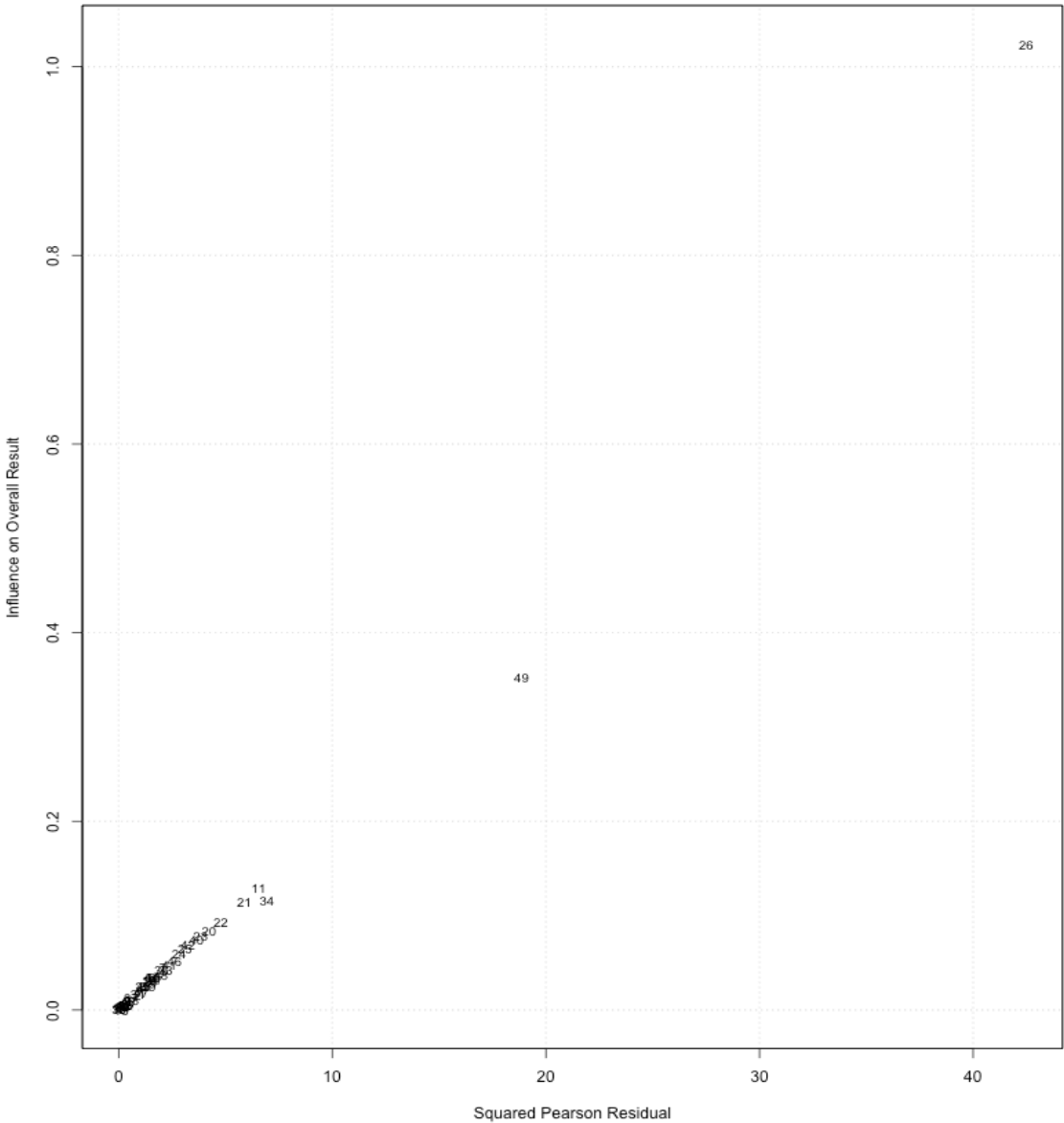


Forest plot by precision (from high to low)

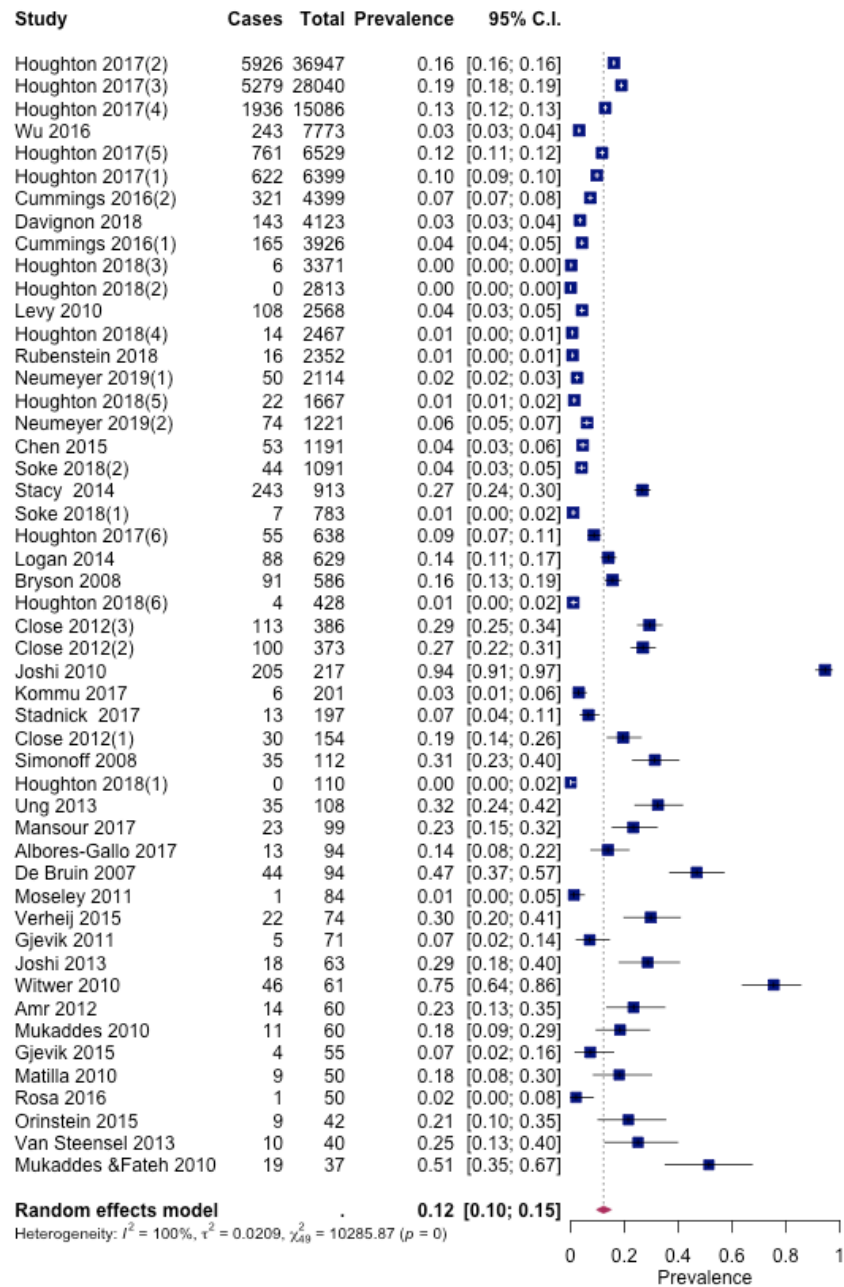


**g. Disruptive, impulse-control and conduct disorder**

Baujat plot

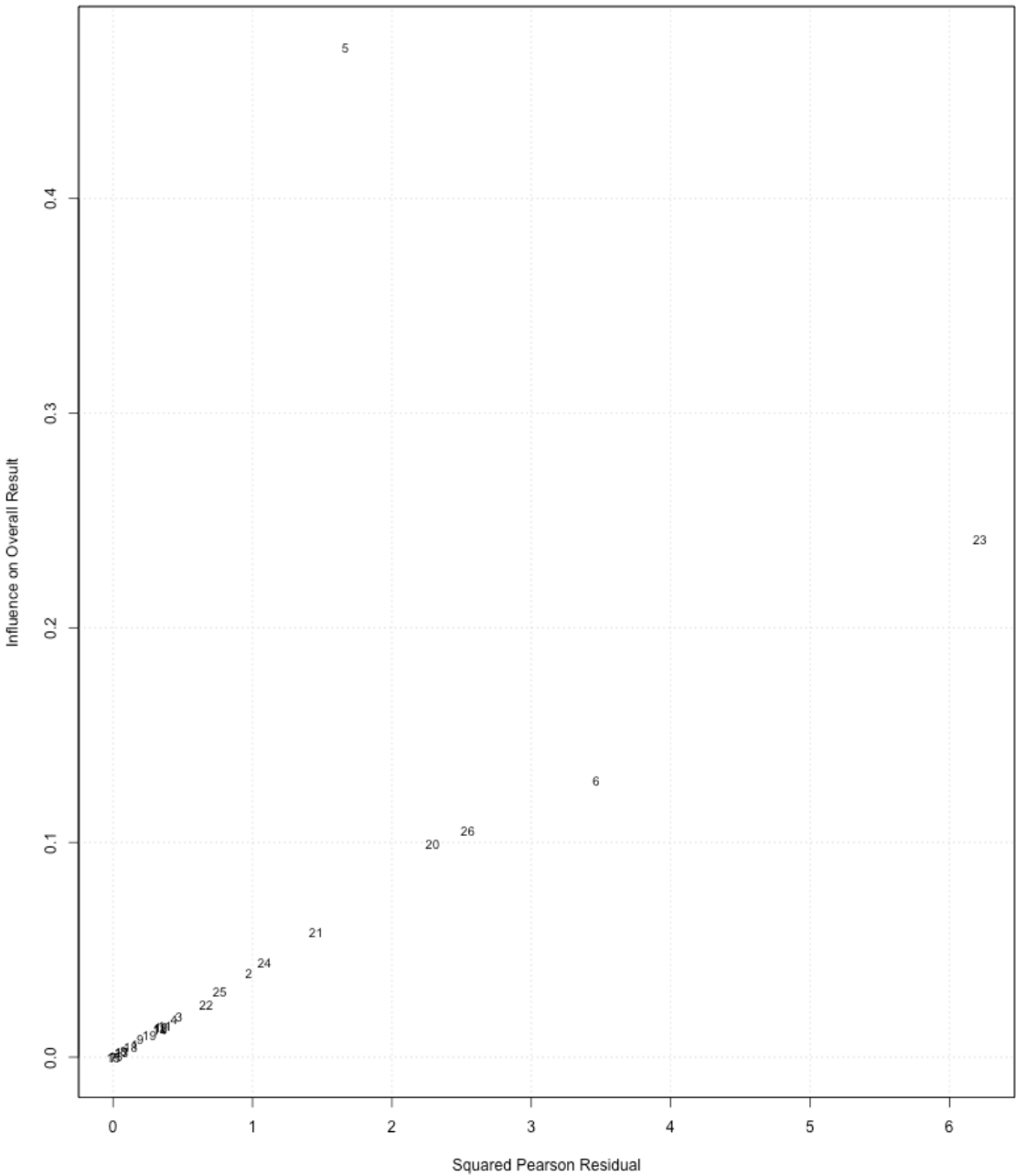


Forest plot by precision (from high to low)



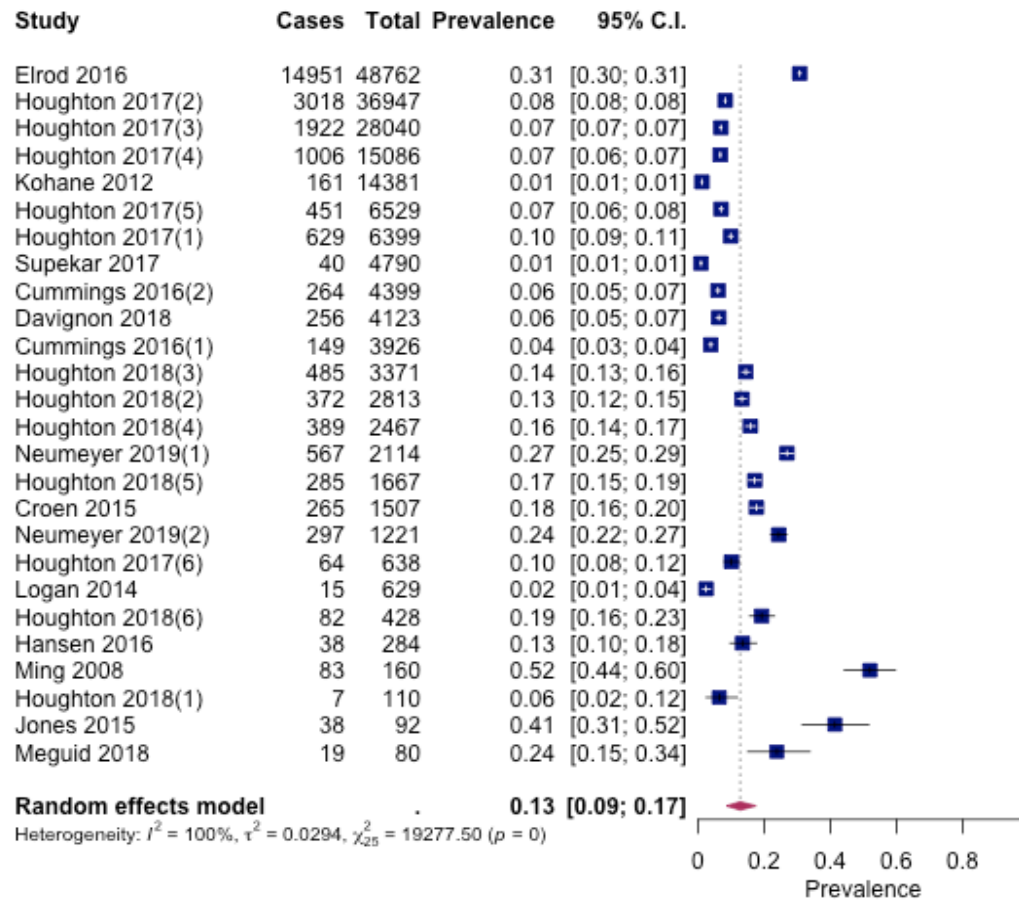
**h. Sleep-wake disorders**

Baujat Plot





Forest plot by precision (from high to low)



**Sensitivity analyses with a different model****Appendix8: Normal-binomial model for overall pooled estimates of prevalence**

<sup>a</sup> Co-occurring mental health condition	Re-calculation of Pooled Estimate of Prevalence, GLMM Model (95%CI; I <sup>2</sup> %)	Pooled Estimate of Prevalence, Main Model (95%CI; I <sup>2</sup> %)
<b>ADHD</b> (N = 89) (n = 210,249)	26% (22-31%; 99·83)	28% (25-32%; 99·65)
<b>Anxiety Disorders</b> (N = 68) (n = 169,829)	17% (13-22%; 99·78)	20% (17-23%; 99·53)
<b>Depressive Disorders</b> (N = 65) (n = 162,671)	8% (5-11%; 99·74)	11% (9-13%; 99·41)
<b>Bipolar and Related Disorders</b> (N = 38) (n = 153,192)	3% (2-5%; 99·76)	5% (3-6%; 99·50)
<b>Schizophrenia Spectrum and Psychotic Disorders</b> (N = 42) (n = 166,627)	2% (1-4%; 99·72)	4% (3-5%; 99·18)
<b>Obsessive-Compulsive Disorder</b> (N = 47) (n = 53,243)	7% (5-10%; 98·11)	9% (7-10%; 96·85)
<b>Disruptive, Impulse-Control and Conduct Disorders</b> (N = 50) (n = 140,946)	8% (5-13%; 99·87)	12% (10-15%; 99·52)
<b>Sleep-Wake Disorders</b> (N = 26) (n = 190,963)	11% (7-16%; 99·86)	13% (9-17%; 99·87)

a. N = number of data-points in meta-analyses; n = sample size for individuals with autism included across studies

**Sensitivity analyses about study design and smaller-sample study influences****Appendix9: Separate Meta-analysis by Study Design, and Excluding Smaller-sample Studies**

The following analyses explored if conducting the meta-analyses of proportions separately by study design, and when excluding smaller-sample studies/data-points (ie, lowest quintile per CMHC), show similar findings as the main analyses. The ‘main analyses’ columns are taken from Table 1 of the manuscript. The ‘separate meta-analyses by study design’ columns refer to pooled estimates of prevalence calculated *separately* for each study design (ie, not analysed as a moderator as in the main analyses). The ‘smallest-20%-excluded’ columns refer to analyses where the smallest quintile (20%, by sample size) of data-points were dropped from each CMHC dataset, and all proportions re-calculated.

	<b>MAIN ANALYSES: MODERATOR ANALYSIS BY STUDY DESIGN SUBGROUPS</b>			<b>SEPARATE META-ANALYSES BY STUDY DESIGN</b>		<b>SMALLEST-20%-EXCLUDED ANALYSES: MODERATOR ANALYSIS BY STUDY DESIGN SUBGROUPS</b>		
<b>Co-occurring mental health condition</b>	<b>Pooled Prevalence Estimate (95%CI; I<sup>2</sup>%)</b>	<b>Pop Reg (95%CI; <sup>a</sup>I<sup>2</sup>%)</b>	<b>Clin Com (95%CI; <sup>a</sup>I<sup>2</sup>%)</b>	<b>Pop Reg (95%CI; I<sup>2</sup>%)</b>	<b>Clin Com (95%CI; I<sup>2</sup>%)</b>	<b>Pooled Prevalence Estimate (95%CI; I<sup>2</sup>%)</b>	<b>Pop Reg (95%CI; <sup>a</sup>I<sup>2</sup>%)</b>	<b>Clin Com (95%CI; <sup>a</sup>I<sup>2</sup>%)</b>
<b>ADHD</b>	28% (25-32%; 99·65)	*22% (17-26%; 99·64)	*34% (29-39%; 99·64)	22% (17-26%; 99·83)	34% (28-40%; 98·05)	26% (22-30%; 99·72)	*21% (17-26%; 99·71)	*31% (26-37%; 99·71)
<b>Anxiety Disorders</b>	20% (17-23%; 99·53)	*15% (11-19%; 99·54)	*26% (22-31%; 99·54)	15% (12-19%; 99·74)	27% (21-33%; 97·70)	16% (13-19%; 99·67)	15% (11-19%; 99·62)	18% (13-24%; 99·62)
<b>Depressive Disorders</b>	11% (9-13%; 99·41)	*8% (5-11%; 99·40)	*14% (11-18%; 99·40)	8% (5-11%; 99·71)	14% (10-19%; 96·03)	10% (7-12%; 99·52)	8% (5-11%; 99·52)	12% (9-16%; 99·52)
<b>Bipolar and Related Disorders</b>	5% (3-6%; 99·50)	*3% (2-5%; 99·50)	*7% (4-10%; 99·50)	3% (2-5%; 99·73)	6% (4-10%; 96·27)	4% (2-6%; 99·61)	*3% (1-5%; 99·61)	*8% (4-12%; 99·61)
<b>Schizophrenia Spectrum and Psychotic Disorders</b>	4% (3-5%; 99·18)	*2% (1-4%; 99·18)	*7% (4-9%; 99·18)	2% (1-4%; 99·52)	7% (4-9%; 96·41)	3% (2-4%; 99·31)	2% (1-4%; 99·32)	5% (3-7%; 99·32)
<b>Obsessive-Compulsive Disorder</b>	9% (7-10%; 96·85)	*4% (2-6%; 96·20)	*12% (10-15%; 96·20)	4% (2-5%; 97·27)	13% (9-17%; 95·47)	8% (7-10%; 97·26)	*4% (2-6%; 96·77)	*12% (10-15%; 96·77)
<b>Disruptive, Impulse-Control and Conduct Disorders</b>	12% (10-15%; 99·52)	*7% (4-10%; 99·53)	*22% (17-27%; 99·53)	7% (4-10%; 99·70)	22% (13-33%; 98·61)	10% (7-13%; 99·61)	*7% (4-10%; 99·62)	*20% (14-27%; 99·62)

<b>Sleep-Wake Disorders</b>	13% (9-17%; 99·87)	11% (7-17%; 99·85)	16% (8-25%; 99·85)	11% (7-17%; 99·89)	18% (6-34%; 99·93)	10% (6-15%; 99·90)	5% (1-15%; 99·89)	12% (7-17%; 99·89)
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a.  $I^2$  value from the same model

\* QM statistically significantly different ( $p < 0.05$ ) in subgroup analyses

## **Appendix10: Studies excluded from full-text review, with reasons**

*Publications removed before making it to this list: conference papers, protocols, non-peer reviewed papers, publications screened out at title/abstract stages (n=33)*

*Note on methods: If a publication was unable to be evaluated from the information in the title/abstract, it was examined in a full-text review, and subsequently excluded afterward, based on criteria that may have applied to the title/abstract exclusion stage*

### **Title/Abstract exclusion criteria:**

1. Title/Abstract screening
  - a. Not available in English or French
  - b. Total autism sample size less than n=20
  - c. Not primary autism population (ie, the primary exposure is a non-autism condition, where additional traits/conditions being examined could include autism, CMHCs, and/or non-psychiatric comorbidities, eg, autistic traits in OCD, sleep disorders in bipolar, gastrointestinal conditions in cerebral palsy)
  - d. No prevalence information (eg, methodology is not observational, etc.)
  - e. Not about autism population (at all) (eg, OCD traits in the general population, sleep problems in parents of special need children, etc.)

### **Full-text review exclusion criteria:**

2. CMHCs not confirmed with DSM/ICD criteria
  - a. CMHC symptoms only, no diagnoses
  - b. Autistic traits and CMHC symptoms only
  - c. Not DSM-IV, DSM-5, ICD-9 or ICD-10 diagnostic criteria
3. Lifetime CMHCs diagnoses
  - a. Lifetime diagnoses only
  - b. Lifetime and current diagnoses combined
4. Cannot disaggregate CMHCs / CMHC information missing
  - a. Combined across categories, eg, 'mood and anxiety disorders' which can include anxiety, depression and/or bipolar disorders, etc.
  - b. Combined autism+CMHC sample at outset: study specifically recruits a unique sub-group, so that prevalence estimates of CMHCs are biased (eg, autism+ADHD)
  - c. No information on individual CMHCs, ie, CMHCs combined into 'psychiatric comorbidity' category or symptom trajectories, information not available, did not report the number of people with CMHCs as a subset of the total autism population
  - d. Not about CMHCs: autism prevalence information only, non-psychiatric comorbidities only

ARTICLE	REASONS FOR EXCLUSION
1. Aathira R, Gulati S, Tripathi M, et al. Prevalence of sleep abnormalities in Indian children with autism spectrum disorder. <i>Pediatr Neurol</i> 2017; <b>74</b> : 62-67	<b>2a:</b> CMHC symptoms only, no diagnoses
2. Abu-Akel A, Clark J, Perry A, Wood SJ, Forty L, Craddock N, et al. Autistic and schizotypal traits and global functioning in bipolar I disorder. <i>J Affect Disord</i> 2017; <b>207</b> : 268-275	<b>1c:</b> Not primary autism population (autistic traits in bipolar disorder)
3. Acquaviva E, Stordeur C. ADHD (attention disorder hyperactivity disorder) and ASD (autism spectrum disorders) comorbidity. <i>Ann Med Psychol (Paris)</i> 2014; <b>172</b> (4): 302-308	<b>1d:</b> No prevalence information (methodology is not observational – review)
4. Ahmedani BK, Hock RM. Health care access and treatment for children with co-morbid autism and psychiatric conditions. <i>Soc Psychiatry Psychiatr Epidemiol</i> 2012; <b>47</b> (11): 1807-1814	<b>3a:</b> Lifetime diagnoses of CMHCs only
5. Akbaş S, Karabekiroğlu K, Pazvantoglu, O. Eight Week Follow-up for Autism Symptoms and Comorbid Features of Autistic Children Under Special Education and Medication. <i>Türk psikiyatri dergisi</i> 2009; <b>12</b> (3): 134-140	<b>1a:</b> Not available in English or French
6. Allik H, Larsson JO, Smedje H. Insomnia in school-age children with Asperger syndrome or high-functioning autism. <i>BMC Psychiatry</i> 2006; <b>6</b> (1): 18	<b>2a:</b> CMHC symptoms only, no diagnoses
7. Al-Salehi SM, Al-Hifthy EH, Ghaziuddin M. Autism in Saudi Arabia: presentation, clinical correlates and comorbidity. <i>Transcult Psychiatry</i> 2009; <b>46</b> (2): 340-347	<b>2a:</b> CMHC symptoms only, no diagnoses
8. Ames CS, White SJ. Brief report: Are ADHD traits dissociable from the autistic profile? Links between cognition and behaviour. <i>J Autism Dev Disord</i> 2011; <b>41</b> (3): 357-363	<b>2a:</b> CMHC symptoms only, no diagnoses
9. Anckarsäter H, Larson T, Hansson SL, et al. Child neurodevelopmental and behavioural problems are intercorrelated and dimensionally distributed in the general population. <i>Open Psychiatr J</i> 2008; <b>2</b> : 5-11	<b>2a:</b> CMHC symptoms only, no diagnoses
10. Anckarsäter H, Lundström S, Kollberg L, et al. The Child and Adolescent Twin Study in Sweden (CATSS). <i>Twin Res Hum Genet</i> 2011; <b>14</b> (6): 495-508	<b>2a:</b> CMHC symptoms only, no diagnoses
11. Anholt GE, Aderka IM, Van Balkom AJLM, et al. Age of onset in obsessive-compulsive disorder: admixture analysis with a large sample. <i>Psychol Med</i> 2014; <b>44</b> (1): 185-194	<b>1c:</b> Not primary autism population (OCD traits in general population)
12. Anholt GE, Cath DC, Van Oppen P, et al. Autism and ADHD symptoms in patients with OCD: are they associated with specific OC symptom dimensions or OC symptom severity? <i>J Autism Dev Disord</i> 2010; <b>40</b> (5): 580-589	<b>1c:</b> Not primary autism population (autistic and ADHD traits in OCD population)
13. Ardizzone I, Soletti L, Panunzi S, Carratelli TI. Autistic dimension in obsessive-compulsive disorder in adolescence. <i>Riv Psichiatr</i> 2010; <b>45</b> (2): 94-101	<b>1c:</b> Not primary autism population (autistic traits in OCD population)
14. Arildskov TW, Højgaard DR, Skarphedinsson G, et al. Subclinical autism spectrum	<b>1c:</b> Not primary autism population

symptoms in pediatric obsessive–compulsive disorder. <i>Eur Child Adolesc Psychiatry</i> 2016; <b>25</b> (7): 711-723	(autistic traits in OCD population)
15. Avni E, Ben-Itzhak E, Ditz A. The presence of comorbid ADHD and anxiety symptoms in autism spectrum disorder: clinical presentation and predictors. <i>Front Psychiatry</i> 2018; <b>9</b> : 717	<b>2a</b> : CMHC symptoms only, no diagnoses
16. Backner W, Clark E, Jenson W, Gardner M, Kahn J. An investigation of psychiatric comorbidity and symptom awareness among male adolescents with autism spectrum disorders. <i>Int J Educ Psychol Res</i> 2013; <b>1</b> (4): 259-268	<b>2a</b> : CMHC symptoms only, no diagnoses
17. Baghdadli A, Rattaz C, Michelon C, Pernon E & Munir K. Fifteen year prospective study of adult outcomes of autism spectrum disorders among children attending centres in five regional departments in France: the EpiTED cohort. <i>Journal of autism and developmental disorders</i> 2019, 1-14	<b>4c</b> : No information on individual CMHCs (comorbidity trajectories examined over time)
18. Bakare MO, Ebigbo PO, Ubochi VN. Prevalence of autism spectrum disorder among Nigerian children with intellectual disability: a stopgap assessment. <i>J Health Care Poor Underserved</i> 2012; <b>23</b> (2): 513-518	<b>4d</b> : Not about CMHCs (prevalence of autism only)
19. Baker EK, Richdale AL. Examining the Behavioural Sleep-Wake Rhythm in Adults with Autism Spectrum Disorder and No Comorbid Intellectual Disability. <i>J Autism Dev Disord</i> 2017; <b>47</b> (4): 1207-1222	<b>2c</b> : Not DSM-IV, DSM-5, ICD-9 or ICD-10 diagnostic criteria (ICSD-3 criteria)
20. Baldwin S, Costley D. The experiences and needs of female adults with high-functioning autism spectrum disorder. <i>Autism</i> 2016; <b>20</b> (4): 483-495	<b>1d</b> : No prevalence information (methodology is not observational – qualitative study)
21. Ballester P, Martinez MJ, Javaloyes A, et al. Sleep problems in adults with spectrum disorder and intellectual disability. <i>Autism Research</i> 2019; <b>12</b> (1): 66-79	<b>2a</b> : CMHC symptoms only, no diagnoses
22. Bauminger N, Solomon M, Rogers SJ. Externalizing and internalizing behaviors in ASD. <i>Autism Research</i> 2019; <b>3</b> (3): 101-112	<b>2a</b> : CMHC symptoms only, no diagnoses
23. Becerra TA, Von Ehrenstein OS, Heck JE, et al. Autism spectrum disorders and race, ethnicity, and nativity: a population-based study. <i>Pediatrics</i> 2014; <b>134</b> (1): 63-71	<b>4d</b> : Not about CMHCs (prevalence of autism rates in demographic subgroups)
24. Bejerot S, Nylander L, Lindström E. Autistic traits in obsessive-compulsive disorder. <i>Nord J Psychiatr</i> 2001; <b>55</b> (3): 169-176	<b>1c</b> : Not primary autism population (autistic traits in OCD)
25. Bejerot S, Wetterberg L. Autism spectrum disorders and psychiatric co-morbidity in adolescents and adults. <i>Clin Neuropsychiatry</i> 2008; <b>5</b> : 3-8	<b>1d</b> : No prevalence information (methodology not observational – review)
26. Bennett T, Szatmari P, Bryson S, et al. Differentiating autism and Asperger syndrome on the basis of language delay or impairment. <i>J Autism Dev Disord</i> 2008; <b>38</b> (4): 616-625	<b>4d</b> : Not about CMHCs (autism subgroups)
27. Berlin KS, Lobato DJ, Pinkos B, Cerezo CS, LeLeiko NS. Patterns of medical and developmental comorbidities among children presenting with feeding problems: a latent class analysis. <i>J Dev Behav Pediatr</i> 2011; <b>32</b> (1): 41-47	<b>1c</b> : Not primary autism population (children with feeding problems)

28. Besag F, Aldenkamp A, Caplan R, et al. Psychiatric and behavioural disorders in children with epilepsy: an ILAE task force report. <i>Epileptic Disord</i> 2016; <b>18</b> (1): 1-86	<b>1d:</b> No prevalence information (methodology is not observational – review)
29. Biscaldi M, Rauh R, Müller C, et al. Identification of neuromotor deficits common to autism spectrum disorder and attention deficit/hyperactivity disorder, and imitation deficits specific to autism spectrum disorder. <i>Eur Child Adolesc Psychiatry</i> 2015; <b>24</b> (12): 1497-1507	<b>4d:</b> Not about CMHCs (about neuro-motor conditions in autism)
30. Bitsika V, Sharpley CF. The association between social responsivity and depression in high-functioning boys with an Autism Spectrum Disorder. <i>J Dev Phys Disabil</i> 2016; <b>28</b> (2): 317-331	<b>2a:</b> CMHC symptoms only, no diagnoses
31. Bitsika V, Sharpley CF, Andronicos NM, Agnew LL. Prevalence, structure and correlates of anxiety-depression in boys with an autism spectrum disorder. <i>Res Dev Disabil</i> 2016; <b>49</b> : 302-311	<b>2a:</b> CMHC symptoms only, no diagnoses
32. Bjorgaas HM, Elgen I, Ryland HK, Hysing M. Autism spectrum symptoms in children with cerebral palsy: Prevalence and co-occurring conditions. <i>Res Autism Spectr Disord</i> 2014; <b>8</b> (5): 581-588	<b>1e:</b> Not primary autism population (autistic symptoms in cerebral palsy)
33. Blakeley-Smith A, Reaven J, Ridge K, Hepburn S. Parent–child agreement of anxiety symptoms in youth with autism spectrum disorders. <i>Res Autism Spectr Disord</i> 2012; <b>6</b> (2): 707-716	<b>1d:</b> No prevalence information (methodology is not observational)
34. Boerema YE, De Boer MN, Van Balkom AJLM, Eikelenboom M, Visser HA, Van Oppen P. Obsessive compulsive disorder with and without hoarding symptoms: characterizing differences. <i>J Affect Disord</i> 2019; <b>249</b> : 652-658	<b>1e:</b> Not about autism population (people with hoarding symptoms)
35. Bolton PF, Pickles A, Murphy M, Rutter M. Autism, affective and other psychiatric disorders: patterns of familial aggregation. <i>Psychol Med</i> 1998; <b>28</b> (2): 385-395	<b>1e:</b> Not about autism population (families of people with autism and Down Syndrome)
36. Bonde E. Comorbidity and subgroups in childhood autism. <i>Eur Child Adolesc Psychiatry</i> 2000; <b>9</b> (1): 7-10	<b>2a:</b> CMHC symptoms only, no diagnoses
37. Borue X, Mazefsky C, Rooks BT, et al. Longitudinal course of bipolar disorder in youth with high-functioning autism spectrum disorder. <i>J Am Acad Child Adolesc Psychiatry</i> 2016; <b>55</b> (12): 1064-1072	<b>4b:</b> Combined autism+CMHC sample at outset (autism+bipolar disorder)
38. Bradley EA, Ames CS, Bolton PF. Psychiatric conditions and behavioural problems in adolescents with intellectual disabilities: correlates with autism. <i>Can J Psychiatry</i> 2011; <b>56</b> (2): 102-109	<b>2a:</b> CMHC symptoms only, no diagnoses
39. Bradley EA, Summers JA, Wood HL, Bryson SE. Comparing rates of psychiatric and behavior disorders in adolescents and young adults with severe intellectual disability with and without autism. <i>J Autism Dev Disord</i> 2004; <b>34</b> (2): 151-161	<b>2a:</b> CMHC symptoms only, no diagnoses



40. Brereton AV, Tonge BJ, Einfeld SL. Psychopathology in children and adolescents with autism compared to young people with intellectual disability. <i>J Autism Dev Disord</i> 2006; <b>36</b> (7): 863-870	<b>2a:</b> CMHC symptoms only, no diagnoses
41. Broquere M, Soussana M, Michelon C, Rattaz C, Brisot J, Baghdadli A. Impact of anxiety disorders on quality of life of adolescents with autism spectrum disorder without intellectual disability. <i>L'Encéphale</i> 2016; <b>42</b> (6): 499-505	<b>4b:</b> Combined autism+CMHC sample at outset (autism+anxiety disorders)
42. Broring T, Oostrom KJ, Van DijkLokkart EM, Lafeber HN, Brugman A, Oosterlaan J. Attention deficit hyperactivity disorder and autism spectrum disorder symptoms in school-age children born very preterm. <i>Res Dev Disabil</i> 2018; <b>74</b> : 103-112	<b>2b:</b> Autistic traits and CMHC symptoms only
43. Bruggink A, Huisman S, Vuijk R, Kraaij V, & Garnefski N. Cognitive emotion regulation, anxiety and depression in adults with autism spectrum disorder. <i>Res Autism Spectr Disord</i> 2016; <b>22</b> : 34-44	<b>2a:</b> CMHC symptoms only, no diagnoses
44. Burns A, Irvine M, Woodcock K. Self-focused attention and depressive symptoms in adults with autistic spectrum disorders. <i>J Autism Dev Disord</i> 2019; <b>49</b> (2): 692-703	<b>2a:</b> CMHC symptoms only, no diagnoses
45. Burton CL, Crosbie J, Dupuis A, et al. Clinical correlates of hoarding with and without comorbid obsessive-compulsive symptoms in a community pediatric sample. <i>J Am Acad Child Adolesc Psychiatry</i> 2016; <b>55</b> (2): 114-121	<b>1c:</b> Not primary autism population (OCD traits and hoarding in the general population)
46. Caamaño M, Boada L, Merchán-Naranjo J, et al. Psychopathology in children and adolescents with ASD without mental retardation. <i>J Autism Dev Disord</i> 2013; <b>43</b> (10): 2442-2449	<b>2a:</b> CMHC symptoms only, no diagnose
47. Cai RY, Richdale AL, Dissanayake C, Uljarević, M. Brief report: Inter-relationship between emotion regulation, intolerance of uncertainty, anxiety, and depression in youth with autism spectrum disorder. <i>J Autism Dev Disord</i> 2018; <b>48</b> (1): 316-325	<b>2a:</b> CMHC symptoms only, no diagnoses
48. Canals J, Morales-Hidalgo P, Jané MC, Domènech E. ADHD prevalence in Spanish preschoolers: Comorbidity, socio-demographic factors, and functional consequences. <i>J Atten Disord</i> 2018; <b>22</b> (2): 143-153	<b>1c:</b> Not primary autism population (autism diagnoses in ADHD)
49. Cawthorpe D. Comprehensive description of comorbidity for autism spectrum disorder in a general population. <i>Perm J</i> 2017; <b>21</b> : 86-90	<b>4d:</b> Not about CMHCs (non-psychiatric comorbidities)
50. Cervantes PE, Matson JL. Comorbid symptomology in adults with autism spectrum disorder and intellectual disability. <i>J Autism Dev Disord</i> 2015; <b>45</b> (12): 3961-3970	<b>2a:</b> CMHC symptoms only, no diagnoses
51. Cervantes P, Matson JL, Tureck K, Adams HL. The relationship of comorbid anxiety symptom severity and challenging behaviors in infants and toddlers with autism spectrum disorder. <i>Res Autism Spectr Disord</i> 2013; <b>7</b> (12): 1528-1534	<b>2a:</b> CMHC symptoms only, no diagnoses <b>1d:</b> no prevalence information (methods are not observational)
52. Chabrol H, Raynal P. The co-occurrence of autistic traits and borderline personality disorder traits is associated to increased suicidal ideation in nonclinical young adults. <i>Compr Psychiatry</i> 2018; <b>82</b> : 141-143	<b>1e:</b> Not about autism population (autistic traits and borderline personality traits in general population)

53. Chandler S, Howlin P, Simonoff E, et al. Emotional and behavioural problems in young children with autism spectrum disorder. <i>Dev Med Child Neurol</i> 2016; <b>58</b> (2): 202-208	<b>2a:</b> CMHC symptoms only, no diagnoses
54. Charlot L, Deutsch CK, Albert A, Hunt A, Connor, DF, McIlvane Jr WJ. Mood and anxiety symptoms in psychiatric inpatients with autism spectrum disorder and depression. <i>J Ment Health Res Intellect Disabil</i> 2008; <b>1</b> (4): 238-253	<b>4b:</b> Combined autism+CMHC sample at outset (CMHC in autism+depression sample) <b>2a:</b> CMHC symptoms only, no diagnoses
55. Charman T, Loth E, Tillmann J et al. The EU-AIMS Longitudinal European Autism Project (LEAP): clinical characterisation. <i>Mol Autism</i> 2017; <b>8</b> (1): 27	<b>2a:</b> CMHC symptoms only, no diagnoses
56. Charasil C, Sriapai P. Attention deficit hyperactivity symptoms in children with autistic disorder: a cross-sectional descriptive study. <i>J Med Assoc Thai</i> 2011; <b>94</b> (2): 231	<b>2a:</b> CMHC symptoms only, no diagnoses
57. Chawarska K, Klin A, Paul R, Volkmar F. Autism spectrum disorder in the second year: Stability and change in syndrome expression. <i>J Child Psychol Psychiatry</i> 2007; <b>48</b> (2): 128-138	<b>4d:</b> Not about CMHCs (autism prevalence and stability)
58. Colombi C, Ghaziuddin M. Neuropsychological characteristics of children with mixed autism and ADHD. <i>Autism Res Treat</i> <b>2017</b> : 5	<b>4b:</b> Combined autism+CMHC at outset (autism+ADHD)
59. Courty A, Maria AS, Lalanne C, et al. Levels of autistic traits in anorexia nervosa: a comparative psychometric study. <i>BMC Psychiatry</i> 2013; <b>13</b> (1): 222	<b>1d:</b> No prevalence information (methodology is not observational)
60. Crane L, Goddard L, Pring L. Autobiographical memory in adults with autism spectrum disorder: The role of depressed mood, rumination, working memory and theory of mind. <i>Autism</i> 2013; <b>17</b> (2): 205-21	<b>4d:</b> Not about CMHCs (non-psychiatric traits)
61. Croen LA, Najjar DV, Ray GT, Lotspeich L, Bernal P. A comparison of health care utilization and costs of children with and without autism spectrum disorders in a large group-model health plan. <i>Pediatrics</i> 2006; <b>118</b> (4): 1203-1211	<b>4d:</b> Not about CMHCs (non-psychiatric conditions)
62. Danchin M, Gulenc A, Efron D, Sciberras E, Symeonides C, Hiscock H. Trends in the prevalence and management of childhood anxiety by Australian Pediatricians. <i>Acad Pediatr</i> 2019; <b>19</b> (1): 35-43	<b>1c:</b> Not primary autism population (autistic traits in anxiety)
63. Darrow SM, Grados M, Sandor P, et al. Autism spectrum symptoms in a Tourette's disorder sample. <i>J Am Acad Child Adolesc Psychiatry</i> 2017; <b>56</b> (7): 610-617	<b>1c:</b> Not primary autism population (autistic traits in Tourette's disorder)
64. Davidson C, Greenwood N, Stansfield A, Wright S. Prevalence of Asperger syndrome among patients of an Early Intervention in Psychosis team. <i>Early Interv Psychiatry</i> 2014; <b>8</b> (4): 138-146	<b>1c:</b> Not primary autism population (Asperger syndrome diagnosis in psychosis)
65. Davidsson M, Hult N, Gillberg C, Särneö C, Gillberg C, Billstedt E. Anxiety and depression in adolescents with ADHD and autism spectrum disorders; correlation between parent-and self-reports and with attention and adaptive functioning. <i>Nord J Psychiatry</i> 2017; <b>71</b> (8): 614-620	<b>2a:</b> CMHC symptoms only, no diagnoses
66. Davis III TE, Hess JA, Moree BN, et al. Anxiety symptoms across the lifespan in people	<b>2a:</b> CMHC symptoms only, no diagnoses

diagnosed with autistic disorder. <i>Res Autism Spectr Disord</i> 2011; <b>5</b> (1): 112-118	
67. De Giacomo A, De Giambattista C, Balducci R, Craig F. SCQ come strumento di screening per ASD in comorbidità con ADHD. <i>Riv Psichiatr</i> 2015; <b>50</b> (1): 34-37	<b>1a:</b> Not available in English or French
68. De Giambattista C, Ventura P, Trerotoli P, Margari M, Palumbi R, Margari L. Subtyping the autism spectrum disorder: comparison of children with high functioning autism and Asperger Syndrome. <i>J Autism Dev Disord</i> 2019; <b>29</b> (1): 138-150	<b>1d:</b> No prevalence information (methodology is not observational)
69. Delobel-Ayoub M, Klapouszczak D, Van Bakel MME, et al. Prevalence and characteristics of autism spectrum disorders in children with cerebral palsy. <i>Dev Med Child Neurol</i> 2017; <b>59</b> (7): 738-742	<b>1c:</b> Not primary autism population (autism diagnoses in cerebral palsy)
70. De Micheli AI, Faggioli R, Boso M, et al. Comorbid psychiatric symptoms in high-functioning autism: a clinical study. <i>J Psychopathol (Italy)</i> 2012; <b>18</b> : 352-358	<b>1a:</b> Not available in English or French
71. Demirkaya SK, Tutkunkardas MD, Mukaddes NM. Assessment of suicidality in children and adolescents with diagnosis of high functioning autism spectrum disorder in a Turkish clinical sample. <i>Neuropsychiatr Dis Treat.</i> 2016; <b>12</b> (6): 2921-2926	<b>2a:</b> CMHC symptoms only, no diagnoses
72. De Vries AL, Noens IL, Cohen-Kettenis PT, Van Berckelaer-Onnes IA, Doreleijers TA. Autism spectrum disorders in gender dysphoric children and adolescents. <i>J Autism Dev Disord</i> 2010; <b>40</b> (8): 930-936	<b>1c:</b> Not primary autism population (autism diagnoses in gender dysphoria)
73. Di Nuovo SF, Buono S. Psychiatric syndromes comorbid with mental retardation: differences in cognitive and adaptive skills. <i>J Psychiatr Res</i> 2007; <b>41</b> (9): 795-800	<b>1e:</b> Not about autism population (CMHCs in intellectual disability)
74. Doshi-Velez F, Ge Y, Kohane I. Comorbidity clusters in autism spectrum disorders: an electronic health record time-series analysis. <i>Pediatrics</i> 2014; <b>133</b> (1): 54-63	<b>2a:</b> CMHC symptoms only, no diagnoses
75. Dovgan K, Mazure MO, Hansen J. Measurement invariance of the child behaviour checklist in children with autism spectrum disorder with and without intellectual disability: follow-up study. <i>Res Autism Spectr Disord</i> 2019; <b>58</b> : 19-29	<b>1d:</b> No prevalence information (methodology is not observational)
76. Downs J, Dean H, Lechler S, Sears N, Patel R, Shetty H, Arango C. Negative symptoms in early-onset psychosis and their association with antipsychotic treatment failure. <i>Schizophr Bull</i> 2018; <b>45</b> (1): 69-79	<b>1e:</b> Not about autism population (psychosis symptoms in general population)
77. Dunn K, Rydzewska E, MacIntyre C, Rintoul J, Cooper SA. The prevalence and general health status of people with intellectual disabilities and autism co-occurring together. A total population study. <i>J Intellect Disabil Res</i> 2019; <b>63</b> (4): 277-285	<b>4d:</b> Not about CMHCs (intellectual disability only)
78. Esler A, Hewitt A, Hall-Lande J, Pettingell SL, Houseworth J. Psychotropic medication use for adults with autism spectrum disorder who receive services and supports through adult developmental disability services in the United States. <i>J Autism Dev Disord</i> 2019; published online January 31. DOI:10.1007/S10803-019-03903-7	<b>4a:</b> Cannot disaggregate CMHCs – combined across categories
79. Espluga-Frigola N, Cardoner N, Pamiás-Massana M, Palao-Vidal DJ. Comorbidity of autism spectrum disorder and bipolar disorder. <i>Actas Esp Psiquiatr</i> 2017; <b>45</b> (2):79-88	<b>1a:</b> Not available in English or French

80. Ezell J, Shui A, Sanders K, Veenstra Vander-Weele J. Pattern of diagnosis and co-occurring symptoms in adopted children with autism spectrum disorder. <i>Pediatrics</i> 2016; <b>137</b> (2): 90-S97	<b>2a:</b> CMHC symptoms only, no diagnoses
81. Factor RS, Ryan SM, Farley JP, Ollendick TH, Scarpa A. Does the presence of anxiety and ADHD symptoms add to social impairment in children with autism spectrum disorder? <i>J Autism Dev Disord</i> 2017; <b>47</b> (4): 1122-1134	<b>2a:</b> CMHC symptoms only, no diagnoses
82. Farley MA, McMahon WM, Fombonne E, et al. Twenty-year outcome for individuals with autism and average or near-average cognitive abilities. <i>Autism Res</i> 2009; <b>2</b> (2): 109-118	<b>4d:</b> Not about CMHCs (non-psychiatric outcomes)
83. Farrugia, S, Hudson, J. Anxiety in adolescents with Asperger syndrome: Negative thoughts, behavioral problems, and life interference. <i>Focus Autism Other Dev Disabil</i> 2006; <b>21</b> (1): 25-35	<b>1d:</b> No prevalence information (methodology is not observational – compared autistic and anxious youth on emotional symptoms)
84. Fernell E, Gillberg C. Autism spectrum disorder diagnoses in Stockholm preschoolers. <i>Res Dev Disabil</i> 2010; <b>31</b> (3): 680-685	<b>4d:</b> Not about CMHCs (prevalence of autism only)
85. Findon J, Cadman T, Stewart CT, et al. Screening for co-occurring conditions in adults with autism spectrum disorder using the strengths and difficulties questionnaire: A pilot study. <i>Autism Res</i> 2016; <b>9</b> (12): 1353-1363	<b>2a:</b> CMHC symptoms only, no diagnoses
86. Flor J, Bellando J, Lopez M, Shui A. Developmental functioning and medical comorbidity profile of children with complex and essential autism. <i>Autism Res</i> 2017; <b>10</b> (8): 1344-1352	<b>4d:</b> Not about CMHCs (non-psychiatric comorbidities)
87. Fodstad JC, Rojahn J, Matson JL. Emergent comorbidity in at risk children with and without autism spectrum disorder—a cross-sectional study. <i>J Dev Phys Disabil</i> 2010; <b>22</b> (4): 381-400	<b>2a:</b> CMHC symptoms only, no diagnoses
88. Fombonne E, Marcin C, Manero AC, et al. Prevalence of Autism Spectrum Disorders in Guanajuato, Mexico: The Leon survey. <i>J Autism Dev Disord</i> 2016; <b>46</b> (5):1669-1685	<b>4d:</b> Not about CMHCs (prevalence of autism only)
89. Fraser R, Angus B, Cotton S, Gentle E, Allott K, Thompson A. Prevalence of autism spectrum conditions in a youth mental health service. <i>Aust N Z J Psychiatry</i> 2011; <b>45</b> (5): 426	<b>4d:</b> Not about CMHCs (prevalence of autism only)
90. Freeth M, Bullock T, Milne E. The distribution of and relationship between autistic traits and social anxiety in a UK student population. <i>Autism</i> 2013; <b>17</b> (5): 571-581	<b>1c:</b> Not primary autism population (autistic traits and social anxiety in general population)
91. Fu X-Y, Xie X-T, Mei Z, Cheng W-H. Clinical features and comorbidities of Asperger syndrome in children. <i>Chinese Journal of Contemporary Pediatrics</i> 2013; <b>15</b> (9): 733-736	<b>1a:</b> Not available in English or French
92. Fung S, Lunsy Y, Weiss JA. Depression in youth with autism spectrum disorder: The role of ASD vulnerabilities and family–environmental stressors. <i>J Ment Health Res Intellect</i>	<b>1d:</b> No prevalence information (methodology is not observational)

<i>Disabil</i> 2015; <b>8</b> (3-4): 120-139.	
93. Fusar-Poli L, Brondino N, Orsi P, et al. Long-term outcome of a cohort of adults with autism and intellectual disability: A pilot prospective study. <i>Res Dev Disabil</i> 2017; <b>60</b> : 223-231	<b>4d</b> : Not about CMHCs (non-psychiatric outcomes)
94. Gabis LV, Baruch YK, Jokel A, Raz R. Psychiatric and autistic comorbidity in fragile X syndrome across ages. <i>J Child Neurol</i> 2011; <b>26</b> (8): 940-948	<b>1c</b> : Not primary autism population (CMHCs in Fragile X syndrome)
95. Gadke DL, McKinney C, Oliveros A. Autism spectrum disorder symptoms and comorbidity in emerging adults. <i>Child Psychiat Hum Dev</i> 2016; <b>47</b> (2): 194-201	<b>2a</b> : CMHC symptoms only, no diagnoses
96. Gadow KD. Schizophrenia spectrum and attention-deficit/hyperactivity disorder symptoms in autism spectrum disorder and controls. <i>J Am Acad Child Adolesc</i> 2012; <b>51</b> (10): 1076-1084	<b>2a</b> : CMHC symptoms only, no diagnoses
97. Gadow KD. Association of schizophrenia spectrum and autism spectrum disorder (ASD) symptoms in children with ASD and clinic controls. <i>Res Dev Disabil</i> 2013; <b>34</b> (4): 1289-1299	<b>2a</b> : CMHC symptoms only, no diagnoses
98. Gadow KD, De-Vincent CJ. Comparison of children with autism spectrum disorder with and without schizophrenia spectrum traits: gender, season of birth, and mental health risk factors. <i>J Autism Dev Disord</i> 2012; <b>42</b> (11): 2285-2296	<b>2a</b> : CMHC symptoms only, no diagnoses
99. Gadow KD, De-Vincent CJ, Drabick DA. Oppositional defiant disorder as a clinical phenotype in children with autism spectrum disorder. <i>J Autism Dev Disord</i> 2008; <b>38</b> (7): 1302-1310	<b>2a</b> : CMHC symptoms only, no diagnoses
100. Gadow KD, DeVincent C & Schneider J. Predictors of psychiatric symptoms in children with an autism spectrum disorder. <i>J Autism Dev Disord</i> 2008; <b>38</b> (9), 1710-1720	<b>2a</b> : CMHC symptoms only, no diagnoses
101. Gadow KD, De-Vincent CJ, Schneider J. Comparative study of children with ADHD only, autism spectrum disorder + ADHD, and chronic multiple tic disorder + ADHD. <i>J Atten Disord</i> 2009; <b>12</b> (5): 474-485	<b>1d</b> : No prevalence information (methodology is not observational)
102. Gadow K, Guttman-Steinmetz S, Rieffe C, De-Vincent CJ. Depression symptoms in boys with autism spectrum disorder and comparison samples. <i>J Autism Dev Disabil</i> 2012; <b>42</b> (7): 1353-1363	<b>2a</b> : CMHC symptoms only, no diagnoses
103. Gadow KD, Perlman G, Ramdhan L, De Ruiter J. Clinical correlates of co-occurring psychiatric and autism spectrum disorder (ASD) symptom-induced impairment in children with ASD. <i>J Abnorm Child Psychol</i> 2016; <b>44</b> (1): 129-139	<b>4d</b> : Not about CMHCs (correlates of CMHC symptoms in autism)
104. Gagnon K, Godbout R. Melatonin and Comorbidities in Children with Autism Spectrum Disorder. <i>Curr Dev Disord Rep</i> 2018; <b>5</b> (3): 197-206	<b>1d</b> : No prevalence information (methodology is not observational)
105. Garcia-Villamizar D, Pilar Saez-Suanes G, Garcia-Martinez M. Depressive Symptomatology and daily life executive dysfunctions in adults with autism: a meditational analysis” <i>Rev Mex de Psicol</i> 2017; <b>34</b> (2): 85-90	<b>1a</b> : Not available in English or French

106. Garcia-Villamizar D, Rojahn J. Comorbid psychopathology and stress mediate the relationship between autistic trait and repetitive behaviours in adults with autism. <i>J Intellect Disabil Res</i> 2015; <b>59</b> (2): 116-124	<b>1d:</b> No prevalence information (methodology is not observational)
107. Gillott A, Furniss F, Walter A. Anxiety in high-functioning children with autism. <i>Autism</i> 2001; <b>5</b> (3): 277-286	<b>2a:</b> CMHC symptoms only, no diagnoses
108. Gillott A, Standen PJ. Levels of anxiety and sources of stress in adults with autism. <i>J Intellect Disabil</i> 2007; <b>11</b> (4): 359-370	<b>2a:</b> CMHC symptoms only, no diagnoses
109. Ginsberg Y, Hirvikoski T, Lindefors N. Attention Deficit Hyperactivity Disorder (ADHD) among longer-term prison inmates is a prevalent, persistent and disabling disorder. <i>BMC Psychiatry</i> 2010; <b>10</b> (1): 112	<b>1c:</b> Not primary autism population (ADHD traits in prison populations)
110. Ghaziuddin M, Zafar S. Psychiatric comorbidity of adults with autism spectrum disorders. <i>Clin Neuropsychiatr</i> 2008; <b>5</b> (1): 9-12	<b>4a:</b> Cannot disaggregate CMHCs – combined across categories
111. Gobrial E, Raghu R. Prevalence of anxiety disorder in children and young people with intellectual disabilities and autism. <i>Adv Ment Health Intellect Disabil</i> 2012; <b>6</b> (3): 130-140	<b>2a:</b> CMHC symptoms only, no diagnoses
112. Goldin RL, Matson JL, Cervantes PE. The effect of intellectual disability on the presence of comorbid symptoms in children and adolescents with autism spectrum disorder. <i>Res Autism Spectr Disord</i> 2014; <b>8</b> (11): 1552-1556	<b>2a:</b> CMHC symptoms only, no diagnoses
113. Goldin RL, Matson JL, Tureck K, Cervantes PE, Jang J. A comparison of tantrum behavior profiles in children with ASD, ADHD and comorbid ASD and ADHD. <i>Res Dev Disabil</i> 2013; <b>34</b> (9): 2669-2675	<b>2a:</b> CMHC symptoms only, no diagnoses
114. Goldstein S, Schwebach AJ. The comorbidity of pervasive developmental disorder and attention deficit hyperactivity disorder: results of a retrospective chart review. <i>J Autism Dev Disord</i> 2004; <b>34</b> (3): 329-339	<b>3b:</b> Lifetime and current diagnoses combined <b>1c:</b> Not primary autism population (autism is not the primary exposure)
115. Gotham K, Bishop SL, Hus V, et al. Exploring the relationship between anxiety and insistence on sameness in autism spectrum disorders. <i>Autism Res</i> 2013; <b>6</b> (1): 33-41	<b>2a:</b> CMHC symptoms only, no diagnoses
116. Gormez A, Kirpinar I. Psychiatric disorders in adults with mental retardation: prevalence and associated factors. <i>Anadolu Psikiyatri Dergi</i> 2017; <b>18</b> (4): 338-334	<b>1a:</b> Not available in English or French
117. Griffiths DL, Farrell LJ, Waters AM, White SW. ASD traits among youth with Obsessive–Compulsive Disorder. <i>Child Psychiatry Hum Dev</i> 2017; <b>48</b> (6): 911-921	<b>1c:</b> Not primary autism population (autistic traits in OCD)
118. Griffiths DL, Farrell LJ, Waters AM, White SW. Clinical correlates of obsessive compulsive disorder and comorbid autism spectrum disorder in youth. <i>J Obsessive Compuls Relat Disord</i> 2017; <b>14</b> : 90-98	<b>1d:</b> No prevalence information (methodology is not observational)
119. Guinchat V, Cravero C, Diaz L, et al. Acute behavioral crises in psychiatric inpatients with autism spectrum disorder (ASD): recognition of concomitant medical or non-ASD	<b>4b:</b> Combined autism+CMHC sample at outset (autism+disruptive behaviours)

psychiatric conditions predicts enhanced improvement. <i>Res Dev Disabil</i> 2015; <b>38</b> : 242-255	
120. Guler S, Yesil G, Ozdil M, Ekici B, Onal H. Sleep disturbances and serum vitamin D levels in children with autism spectrum disorder. <i>Int J Clin Exp Med</i> 2016; <b>9</b> (7): 14691-14697	<b>2a</b> : CMHC symptoms only, no diagnoses
121. Gurkan K, Akcakin M, Kilic BG, Bilgic A. Psychiatric comorbidity and drug treatments in high functioning children and adolescents with pervasive developmental disorders. <i>Neurol Psychiat Br</i> 2008; <b>15</b> (3): 143-150	<b>1a</b> : Not available in English or French
122. Gurney JG, McPheeters ML, Davis MM. Parental report of health conditions and health care use among children with and without autism: National Survey of Children's Health. <i>Arch Pediatr Adolesc Med</i> 2006; <b>160</b> (8): 825-830	<b>2a</b> : CMHC symptoms only, no diagnoses
123. Guttman-Steinmetz S, Gadow KD, De-Vincent CJ. Oppositional defiant and conduct disorder behaviors in boys with autism spectrum disorder with and without attention-deficit hyperactivity disorder versus several comparison samples. <i>J Autism Dev Disord</i> 2009; <b>39</b> (7): 976-985	<b>2a</b> : CMHC symptoms only, no diagnoses
124. Guttman-Steinmetz S, Gadow KD, De-Vincent CJ, Crowell J. Anxiety symptoms in boys with autism spectrum disorder, attention-deficit hyperactivity disorder, or chronic multiple tic disorder and community controls. <i>J Autism Dev Disord</i> 2010; <b>40</b> (8): 1006-1016	<b>2a</b> : CMHC symptoms only, no diagnoses
125. Habayeb S, Rich B, Alvord MK. Targeting heterogeneity and comorbidity in children with autism spectrum disorder through the resilience builder group therapy program. <i>Child Care Q</i> 2017; <b>46</b> (4): 539-557	<b>1d</b> : No prevalence information (methodology is not observational)
126. Hall SS, Lightbody AA, Reiss AL. Compulsive, self-injurious, and autistic behavior in children and adolescents with fragile X syndrome. <i>Am J Ment Retard</i> 2008; <b>113</b> (4): 44-53	<b>1c</b> : Not primary autism sample (autistic traits in Fragile X syndrome)
127. Hall SS, Lightbody AA, Hirt M, Rezvani A, Reiss AL. Autism in fragile X syndrome: a category mistake?. <i>J Am Acad Child Adolesc Psychiatry</i> 2010; <b>49</b> (9): 921-933	<b>1c</b> : Not primary autism population (autistic traits in Fragile X syndrome)
128. Hallerod SLH, Larson T, Stahlberg O, et al. The Autism-Tics, AD/HD and other comorbidities (A-TAC) telephone interview: convergence with Child Behaviour Checklist (CBCL). <i>Nord Psykiatr Tidsskr</i> 2010; <b>64</b> (3): 218-224	<b>2a</b> : CMHC symptoms only, no diagnoses
129. Hallett V, Ronald A, Colvert E, et al. Exploring anxiety symptoms in a large-scale twin study of children with autism spectrum disorders, their co-twins and controls. <i>J Child Psychol Psychiatry</i> 2013; <b>54</b> (11): 1176-1185	<b>2a</b> : CMHC symptoms only, no diagnoses
130. Hammond RK, Hoffman JM. Adolescents with high-functioning autism: An investigation of comorbid anxiety and depression. <i>J Ment Health Res Intellect Disabil</i> 2014; <b>7</b> (3): 246-263	<b>2a</b> : CMHC symptoms only, no diagnoses
131. Hansen BH, Oerbeck B, Skirbekk B, Petrovski BÉ, Kristensen H. Neurodevelopmental disorders: prevalence and comorbidity in children referred to mental	<b>1e</b> : Not about autism population (CMHC in developmental disorders in general)

health services. <i>Nord J Psychiat</i> 2018; <b>72</b> (4): 285-291	
132. Hanson E, Cerban BM, Slater CM, Caccamo LM, Bacic J, Chan E. Brief report: Prevalence of attention deficit/hyperactivity disorder among individuals with an autism spectrum disorder. <i>J Autism Dev Disord</i> 2013; <b>43</b> (6): 1459-1464	<b>2a:</b> CMHC symptoms only, no diagnoses
133. Hannson SL, Svanstrom Rojvall A, Rastam M, Gillberg C, Gillberg C, Anckarsater H. Psychiatric telephone interview with parents for screening of childhood autism – tics, attention-deficit hyperactivity disorder and other comorbidities (A-TAC): preliminary reliability and validity. <i>Br J Psychiatry</i> 2005; <b>187</b> : 262-267	<b>2a:</b> CMHC symptoms only, no diagnoses
134. Hardan A, Sahl R. Psychopathology in children and adolescents with developmental disorders. <i>Res Dev Disabil</i> 1997; <b>18</b> (5): 369-382	<b>1c:</b> Not primary autism sample (psychopathology in children receiving care for a variety of reasons in a developmental disorder clinic)
135. Hartley SL, Sikora DM. Sex differences in autism spectrum disorder: an examination of developmental functioning, autistic symptoms, and coexisting behavior problems in toddlers. <i>J Autism Dev Disord</i> 2009; <b>39</b> (12): 1715	<b>2a:</b> CMHC symptoms only, no diagnoses
136. Haruvi-Lamdan N, Horesh D, Golan O. PTSD and autism spectrum disorder: comorbidity, gaps in research, and potential shared mechanisms. <i>Psychol Trauma Theory, Research, Pract Policy</i> 2018; <b>10</b> (3): 290-299	<b>1d:</b> No prevalence information (methodology is not observational – review)
137. Hayashida K, Anderson B, Paparella T, Freeman SFN, Forness SR. Comorbid psychiatric diagnoses in preschoolers with Autism Spectrum Disorders. <i>Behav Disord</i> 2010; <b>35</b> (3): 243-254	<b>2a:</b> CMHC symptoms only, no diagnoses
138. Hawks ZW, Marrus N, Glowinski AL, Constantino JN. Early origins of autism comorbidity: neuropsychiatric traits are correlated in childhood are independent in infancy. <i>J Abnorm Child Psychol</i> 2019; <b>47</b> (2): 369-379	<b>2b:</b> Autistic traits and CMHC symptoms only
139. Helverschou SB, Martinsen H. Anxiety in people diagnosed with autism and intellectual disability: Recognition and phenomenology. <i>Res Autism Spectrum Disord</i> 2011; <b>5</b> (1): 377-387	<b>4b:</b> Combined autism+CMHC sample at outset (autism+anxiety)
140. Helles A, Gillberg IC, Gillberg C, Billstedt E. Asperger syndrome in males over two decades: Quality of life in relation to diagnostic stability and psychiatric comorbidity. <i>Autism</i> 2017; <b>21</b> (4), 458-469	<b>4a:</b> Cannot disaggregate CMHCs – combined across categories
141. Hepburn SL, Stern JA, Blakeley-Smith A, Kimel LK, Reaven JA. Complex psychiatric comorbidity of treatment-seeking youth with autism spectrum disorder and anxiety symptoms. <i>J Ment Health Res Intellect Disabil</i> 2014; <b>7</b> (4): 359-378	<b>4b:</b> Combined autism+CMHC sample at outset (autism+anxiety)
142. Hess JA, Matson JL, Dixon DR. Psychiatric symptom endorsements in children and adolescents diagnosed with autism spectrum disorders: A comparison to typically developing children and adolescents. <i>J Dev Phys Disabil</i> 2010; <b>22</b> (5): 485-496	<b>2a:</b> CMHC symptoms only, no diagnoses



143. Heylens G, Aspeslagh L, Dierickx J, Baetens K, Van Hoorde B, De Cuypere G, Elaut E. The co-occurrence of gender dysphoria and autism spectrum disorder in adults: an analysis of cross-sectional and clinical chart data. <i>J Autism Dev Disord</i> 2018; <b>48</b> (6): 2217-2223	<b>1c:</b> Not primary autism sample (autistic traits in gender dysphoria)
144. Hill AP, Zuckerman KE, Hagen AD, et al. Aggressive behavior problems in children with autism spectrum disorders: prevalence and correlates in a large clinical sample. <i>Res Autism Spectrum Disord</i> 2014; <b>8</b> (9): 1121-1133	<b>2a:</b> CMHC symptoms only, no diagnoses
145. Hoglund-Carlsson L, Norrelgen F, Kjellmer L, Westerlund J, Gillberg C, Fernell E. Coexisting disorders and problems in preschool children with autism spectrum disorders. <i>Scientific World Journal</i> , 2013: 1-6	<b>2a:</b> CMHC symptoms only, no diagnoses
146. Hoffmann W, Weber L, König U, Becker K, Kamp-Becker I. The role of the CBCL in the assessment of autism spectrum disorders: an evaluation of symptom profiles and screening characteristics. <i>Res Autism Spectrum Disord</i> 2016; <b>27</b> : 44-53	<b>2a:</b> CMHC symptoms only, no diagnoses
147. Hofvander B, Delorme R, Chaste P, et al. Psychiatric and psychosocial problems in adults with normal-intelligence autism spectrum disorders. <i>BMC Psychiatry</i> 2009; <b>9</b> (1): 35	<b>3a:</b> Lifetime diagnoses of CMHCs only
148. Højgaard DR, Skarphedinsson G, Nissen JB, Hybel KA, Ivarsson T, Thomsen PH. Pediatric obsessive-compulsive disorder with tic symptoms: clinical presentation and treatment outcome. <i>Eur Child Adolesc Psychiatry</i> 2017; <b>26</b> (6): 681-689	<b>1c:</b> Not primary autism population (autistic traits in OCD+tics)
149. Hollocks MJ, Pickles A, Howlin P, Simonoff E. Dual cognitive and biological correlates of anxiety in autism spectrum disorders. <i>J Autism Dev Disord</i> 2016; <b>46</b> (10): 3295-3307	<b>1d:</b> No prevalence information (methods are not observational – correlates/predictors of anxiety)
150. Holtmann M, Bölte S, Poustka F. Autism spectrum disorders: Sex differences in autistic behaviour domains and coexisting psychopathology. <i>Dev Med Child Neurol</i> 2007; <b>49</b> (5): 361-366	<b>2a:</b> CMHC symptoms only, no diagnoses
151. Holtmann M, Bölte S, Poustka F. Attention deficit hyperactivity disorder symptoms in pervasive developmental disorders: association with autistic behavior domains and coexisting psychopathology. <i>Psychopathol</i> 2007; <b>40</b> (3): 172-177	<b>1d:</b> No prevalence information (associations between autistic and ADHD symptoms)
152. Idring S, Rai D, Dal H. Autism spectrum disorders in the Stockholm Youth Cohort: design, prevalence and validity. <i>PloS One</i> 2012; <b>7</b> (7): e41280	<b>4d:</b> Not about CMHCs (autism diagnosis prevalence information)
153. Ivanov VZ, Mataix-Cols D, Serlachius E et al. Prevalence, comorbidity and heritability of hoarding symptoms in adolescence: a population based twin study in 15-year olds. <i>PloS One</i> 2013; <b>8</b> (7), e69140	<b>1e:</b> Not about autism population (hoarding in adolescents)
154. Ivarsson T, Melin K. Autism spectrum traits in children and adolescents with obsessive-compulsive disorder (OCD). <i>J Anxiety Disord</i> 2008; <b>22</b> (6): 969-978	<b>1c:</b> Not primary autism population (autistic traits in OCD)
155. Izuwah D, Okoh BA, Alikor EA. Clinical Pattern of Autism in Nigeria. <i>Autism Res</i> 2016; <b>9</b> (3): 376-381	<b>2a:</b> CMHC symptoms only, no diagnoses

156. Jang J, Matson JL, Williams LW, Tureck K, Goldin RL, Cervantes PE. Rates of comorbid symptoms in children with ASD, ADHD, and comorbid ASD and ADHD. <i>Res Dev Disabil</i> 2013; <b>34</b> (8): 2369-2378	<b>2a:</b> CMHC symptoms only, no diagnoses
157. Jensen CM, Steinhausen HC. Comorbid mental disorders in children and adolescents with attention-deficit/hyperactivity disorder in a large nationwide study. <i>Atten Defic Hyperact Disord</i> 2015; <b>7</b> (1): 27-38	<b>1c:</b> Not primary autism population (CMHCs in ADHD)
158. Johnson S, Hollis C, Kochhar P, Hennessy E, Wolke D, Marlow N. Psychiatric disorders in extremely preterm children: longitudinal finding at age 11 years in the EPICure study. <i>J Am Acad Child Adolesc Psychiatry</i> 2010; <b>49</b> (5): 453-463	<b>1c:</b> Not primary autism population (CMHCs in preterm children)
159. Johnston K, Dittner A, Bramham J, Murphy C, Knight A, Russell A. Attention deficit hyperactivity disorder symptoms in adults with autism spectrum disorders. <i>Autism Res</i> 2013; <b>6</b> (4): 225-236	<b>2a:</b> CMHC symptoms only, no diagnoses
160. Jong MD, Punt M, Groot ED. Symptom diagnostics based on clinical records: a tool for scientific research in child psychiatry? <i>Eur Child Adolesc Psychiatry</i> 2009; <b>18</b> (5): 257-264	<b>1d:</b> No prevalence information (about level of agreement for diagnoses for different measures)
161. Joshi G, Biederman J, Petty C, Goldin RL, Furtak SL, Wozniak J. Examining the comorbidity of bipolar disorder and autism spectrum disorders: a large controlled analysis of phenotypic and familial correlates in a referred population of youth with bipolar I disorder with and without autism spectrum disorders. <i>J Clin Psychiatry</i> 2013; <b>74</b> (6): 578-586	<b>1c:</b> Not primary autism population (autism diagnoses in bipolar disorder)
162. Joshi G, Faraone SV, Wozniak J, et al. Symptom profile of ADHD in youth with High-Functioning Autism Spectrum Disorder: A comparative study in psychiatrically referred populations. <i>J Atten Disord</i> 2017; <b>21</b> (10): 846-855	<b>1c:</b> Not primary autism population (compares autism+ADHD to ADHD)
163. Kaat AJ, Gadow KD, Lecavalier L. Psychiatric symptom impairment in children with autism spectrum disorders. <i>J Abnorm Child Psychol</i> 2013; <b>41</b> (6): 959-969	<b>2a:</b> CMHC symptoms only, no diagnosis
164. Kamimura-Nishumura K, Froehlich T, Chirdkiatgumcha V, Adams R, Fredstrom B, Manning P. Autism spectrum disorders and their treatment with psychotropic medications in a nationally representative outpatient sample: 1994–2009. <i>Ann Epidemiol</i> 2017; <b>27</b> (4): 448-453	<b>4d:</b> Not about CMHCs (prevalence of autism)
165. Kamio Y, Ishisaka Y. Psychiatric Comorbidity in Children and Adolescents with Autism and Mental Retardation. <i>Jpn J Child Adolesc Psychiatry</i> 2002; <b>43</b> (3): 260-279	<b>1a:</b> Not available in English or French
166. Kanne SM, Abbacchi AM, Constantino JN. Multi-informant ratings of psychiatric symptom severity in children with autism spectrum disorders: The importance of environmental context. <i>J Autism Dec Disord</i> 2009; <b>39</b> (6): 856-864	<b>2a:</b> CMHC symptoms only, no diagnoses
167. Kantzer AK, Fernell E, Gillberg C, Miniscalco C. Autism in community pre-schoolers: developmental profiles. <i>Res Dev Disord</i> 2013; <b>34</b> (9): 2900-2908	<b>2a:</b> CMHC symptoms only, no diagnoses

168. Karjalainen L, Gillberg C, Rastam M, Wentz E. Eating disorders and eating pathology in young adult and adult patients with ESSENCE. <i>Compr Psychiatry</i> 2016; <b>66</b> : 79-86	<b>1c</b> : Not primary autism population (cannot establish autism as primary exposure)
169. Kattimani S, Sarkar S, Bharadwaj B, Ashvini V, Mahadevan S. Early detection of autism spectrum disorders in children with attention deficit hyperactivity disorder by modified checklist for autism in toddlers: A pilot study from India. <i>J Compr Ped</i> 2014; <b>5</b> (3): e21730	<b>1c</b> : Not primary autism population (autistic traits in ADHD)
170. Kerekes N, Brandstrom S, Lundstrom S, Rastam M, Nilsson T, Anckarsater H. ADHD, autism spectrum disorder, temperament and character: Phenotypical associations and etiology in a Swedish childhood twin study. <i>Compr Psychiatry</i> 2013; <b>54</b> (8): 1140-1147	<b>2a</b> : CMHC symptoms only, no diagnoses
171. Kim MJ, Park I, Lim MH. Prevalence of attention-deficit/hyperactivity disorder and its comorbidity among Korean children in a community population. <i>J Korean Med Sci</i> 2017; <b>32</b> (3): 401-406	<b>1c</b> : Not primary autism population (autism diagnoses in ADHD)
172. Kim JA, Szatmari P, Bryson SE, Streiner DL, Wilson FJ. The prevalence of anxiety and mood problems among children with autism and Asperger syndrome. <i>Autism</i> 2000; <b>4</b> (2): 117-132	<b>2a</b> : CMHC symptoms only, no diagnoses
173. Kincaid DL, Doris M, Shannon C, Mulholland C. What is the prevalence of autism spectrum disorder and ASD traits in psychosis? A systematic review. <i>Psychiatry Res</i> 2017; <b>250</b> : 99-105	<b>1c</b> : Not primary autism population (autism diagnosis and autistic traits in psychosis)
174. Khandaker GM, Stochl J, Zammit S, Lewis G, Jones PB. A population-based longitudinal study of childhood neurodevelopmental disorders, IQ and subsequent risk of psychotic experiences in adolescence. <i>Psychol Med</i> 2014; <b>44</b> (15): 3229-3238	<b>1c</b> : Not primary autism population (psychosis in general neurodevelopmental disabilities)
175. Klusek J, Martin GE, Losh M. Consistency between research and clinical diagnoses of autism among boys and girls with fragile X syndrome. <i>J Intellect Disabil Res</i> 2014; <b>58</b> (10): 940-952	<b>1c</b> : Not primary autism population (autism diagnoses in Fragile X syndrome)
176. Knuppel A, Telleus GK, Jakobsen H, Lauritsen MB. Characteristics of young adults with autism spectrum disorder performing different daytime activities. <i>J Autism Dev Disord</i> 2019; <b>49</b> (2): 542-555	<b>4d</b> : Not about CMHCs (characteristics of daytime activities)
177. Koch SV, Larsen JT, Mouridsen SE, et al. Autism spectrum disorder in individuals with anorexia nervosa and in their first-and second-degree relatives: Danish nationwide register-based cohort-study. <i>Br J Psychiatry</i> 2015; <b>206</b> (5): 401-407	<b>1c</b> : Not primary autism population (autism diagnoses in anorexia)
178. Kochhar P, Batty MJ, Liddle EB, et al. Autistic spectrum disorder traits in children with attention deficit hyperactivity disorder. <i>Child Care Health Dev</i> 2011; <b>37</b> (1): 103-110	<b>1c</b> : Not primary autism population (autistic traits in ADHD)
179. Kogan MD, Blumberg SJ, Schieve LA, et al. Prevalence of parent-reported diagnosis of autism spectrum disorder among children in the US, 2007. <i>Pediatrics</i> 2009; <b>124</b> (5): 1395-1403	<b>1c</b> : Not a primary autism population (no information on autism as the primary exposure for identifying co-occurring

	ADHD rate)
180. Kogan MD, Vladutiu CJ, Schieve LA, et al. The prevalence of parent-reported utism Spectrum Disorder among US children. <i>Pediatrics</i> 2018; <b>142</b> (6): e20174161	<b>4c:</b> Cannot disaggregate CMHC diagnoses – no information on confirmed individual CMHCs
181. Konst MJ, Matson JL. Comorbid psychopathology symptom rates in infants and toddlers with Autism Spectrum Disorders. <i>Res Autism Spectrum Disord</i> 2014; <b>8</b> (2): 147-155	<b>2a:</b> CMHC symptoms only, no diagnoses
182. Konst MJ, Matson JL, Goldin R, Rieske R. How does ASD symptomology correlate with ADHD presentations? <i>Res Dev Disabil</i> 2014; <b>35</b> (9): 2252-2259	<b>1c:</b> Not primary autism population (autistic traits in ADHD)
183. Kose S, Yilmaz H, Ocakoglu F, Ozbaran N. Sleep problems in children with autism spectrum disorder and intellectual disability without autism spectrum disorder. <i>Sleep Med</i> 2017; <b>40</b> : 69-77	<b>2a:</b> CMHC symptoms only, no diagnoses
184. Kotte A, Joshi G, Fried R, et al. Autistic traits in children with and without ADHD. <i>Pediatrics</i> 2013; <b>132</b> (3): 612-622	<b>1c:</b> Not primary autism population (autistic traits in ADHD)
185. Kozlowski AM, Matson JL, Sipes M. Differences in challenging behaviors between children with high functioning autism and Asperger's disorder. <i>J Dev Phys Disabil</i> 2012; <b>24</b> (4): 359-371	<b>2a:</b> CMHC symptoms only, no diagnoses
186. Kozlowski AM, Matson JL, Belva B, Rieske R. Feeding and sleep difficulties in toddlers with autism spectrum disorders. <i>Res Autism Spectrum Disord</i> 2012; <b>6</b> (1): 385-390	<b>2a:</b> CMHC symptoms only, no diagnoses
187. Kraper CK, Kenworthy L, Popal H, Martin A, Wallace GL. The gap between adaptive behavior and intelligence in autism persists into young adulthood and is linked to psychiatric co-morbidities. <i>J Autism Dev Disord</i> 2017; <b>47</b> (10): 3007-3017	<b>2a:</b> CMHC symptoms only, no diagnoses
188. Kumar S, Devendran Y, Devendran P. Prevalence of Autism Spectrum Disorders and its association with epileptiform activity among children with Intellectual Disability in a tertiary centre. <i>J Indian Assoc Child Adolesc Ment Health</i> 2017; <b>13</b> (1): 26-47	<b>4d:</b> Not about CMHCs (autism prevalence only)
189. Kusaka H, Miyawaki D, Nakai Y. Psychiatric comorbidity in children with high-functioning pervasive developmental disorder. <i>Osaka City Med J</i> 2014; <b>60</b> (1): 1-10	<b>1a:</b> Not available in English or French
190. Lalanne L, Weiner L, Trojak B, Berna, F, Bertschy G. Substance-use disorder in high-functioning autism: clinical and neurocognitive insights from two case reports. <i>BMC Psychiatry</i> 2015; <b>15</b> (1): 149	<b>1d:</b> No prevalence information (methodology is not observational – case report)
191. La Malfa G, Lassi S, Salvini R, Giganti C, Bertelli M, Albertini G. The relationship between autism and psychiatric disorders in Intellectually Disabled Adults. <i>Res Autism Spectr Disord</i> 2007; <b>1</b> (3): 218-228	<b>1c:</b> Not primary autism population (autism in intellectual disabilities)
192. Lamanna AL, Craig F, Matera E, Simone M, Buttiglione M, Margari L. Risk factors for the existence of attention deficit hyperactivity disorder symptoms in children with autism spectrum disorders. <i>Neuropsychiatr Dis Treat</i> 2017; <b>13</b> : 1559	<b>1d:</b> No prevalence information (methodology is not observational)

193. Larson T, Anckarsater H, Gillberg C, et al. The autism-tics, AD/HD and other comorbidities inventory (A-TAC): further validation of a telephone interview for epidemiological research. <i>BMC Psychiatry</i> 2010; <b>10</b> (1): 1	<b>2a:</b> CMHC symptoms only, no diagnoses
194. Lecavalier L, McCracken CE, Aman MG, et al. An exploration of concomitant psychiatric disorders in children with autism spectrum disorder. <i>Compr Psychiatry</i> 2019; <b>88</b> : 57-64	<b>4b:</b> Combined autism+CMHC sample at outset (autism+disruptive behaviours)
195. Lehnhardt FG, Gawronski A, Volpert K, Schilbach L, Tepest R, Vogeley K. Psychosocial functioning of adults with late diagnosed autism spectrum disorders: a retrospective study. <i>Fortschr Neuro Psychiatri</i> 2012; <b>80</b> (2): 88-97	<b>1a:</b> Not available in English or French
196. Leno VC, Charman T, Pickles A, et al. Callous-unemotional traits in adolescents with autism spectrum disorder. <i>Br J Psychiatry</i> 2015; <b>207</b> (5): 392-399	<b>2a:</b> CMHC symptoms only, no diagnoses
197. Lerner MD, Mazefsky CA, Weber RJ, Transue E, Siegel M, Gadow KD. Verbal ability and psychiatric symptoms in clinically referred inpatient and outpatient youth with ASD. <i>J Autism Dev Disord</i> 2018; <b>48</b> (11): 3689-3701	<b>2a:</b> CMHC symptoms only, no diagnoses
198. Leung V, Chan LF. A cross-sectional cohort study of prevalence, co-morbidities, and correlates of attention deficit hyperactivity disorder among adult patients admitted to the Li Ka Shing psychiatric outpatient clinic, Hong Kong. <i>East Asian Arch Psychiatry</i> 2017; <b>27</b> (2): 63	<b>1c:</b> Not primary autism population (autistic traits in ADHD)
199. Lever AG, Geurts HM. Psychiatric co-occurring symptoms and disorders in young, middle-aged, and older adults with autism spectrum disorder. <i>J Autism Dev Disord</i> 2016; <b>46</b> (6): 1916-1930	<b>3a:</b> Lifetime diagnoses of CMHCs only
200. Leyfer OT, Folstein SE, Bacalman S. Comorbid psychiatric disorders in children with autism: interview development and rates of disorders. <i>J Autism Dev Disord</i> 2006; <b>36</b> (7): 849-861	<b>3a:</b> Lifetime diagnoses of CMHCs only
201. Liew SM, Thevaraja N, Hong RY, Magiati I. The relationship between autistic traits and social anxiety, worry, obsessive-compulsive, and depressive symptoms: specific and non-specific mediators in a student sample. <i>J Autism Dev Disorder</i> 2015; <b>45</b> (3): 858-872	<b>1e:</b> Not about autism population (autistic and anxiety traits in general population)
202. Lipsker CW, Bölte S, Hirvikoski T, Lekander M, Holmström L, Wicksell RK. Prevalence of autism traits and attention-deficit hyperactivity disorder symptoms in a clinical sample of children and adolescents with chronic pain. <i>J Pain Res</i> 2018; <b>11</b> : 2827	<b>1c:</b> Not primary autism population (autistic traits in chronic pain population)
203. Liu X, Hubbard JA, Fabes RA, Adam JB. Sleep disturbances and correlates of children with autism disorders. <i>Child Psychiatry Hum Dev</i> 2006; <b>37</b> (2): 179-191	<b>2a:</b> CMHC symptoms only, no diagnoses
204. Louwerse A, Eussen MLJM, Van der Ende J, et al. ASD symptom severity in adolescence of individuals diagnosed with PDD-NOS in childhood: Stability and the relation with psychiatric comorbidity and societal participation. <i>J Autism Dev Disord</i> 2015; <b>45</b> (12): 3908-3918	<b>1d:</b> No prevalence information (methodology is not observational – about diagnostic stability for autism)

205. Lundström S, Reichenberg A, Melke J. Autism spectrum disorders and coexisting disorders in a nationwide Swedish twin study. <i>J Child Psychol Psychiatry</i> 2015; <b>56</b> (6): 702-710	<b>1c:</b> Not primary autism population (cannot establish primary direction of exposure)
206. Lundstrom S, Reichenberg A, Anckarsäter H, Lichtenstein P, Gillberg C. Autism phenotype versus registered diagnosis in Swedish children: prevalence trends over 10 years in general population samples. <i>BMJ</i> 2015; <b>350</b> : 961	<b>4d:</b> Not about CMHCs (prevalence of autism only)
207. Lyall K, Schweitzer JB, Schmidt RJ, Hertz-Picciotto I, Solomon M. Inattention and hyperactivity in association with autism spectrum disorders in the CHARGE study. <i>Res Autism Spectrum Disord</i> 2017; <b>35</b> : 1-12	<b>1c:</b> Not primary autism population (CMHC in ADHD, compared to autism+ADHD sample)
208. MacNeil BM, Lopes VA, Minnes PM. Anxiety in children and adolescents with autism spectrum disorders. <i>Res Autism Spectrum Disord</i> 2009; <b>3</b> (1): 1-21	<b>1d:</b> No prevalence information (methodology is not observational – review)
209. Mandell DS. Psychiatric hospitalization among children with autism spectrum disorders. <i>J Autism Dev Disord</i> 2008; <b>38</b> (6): 1059-1065	<b>1d:</b> No prevalence information (predictors of psychiatric hospitalizations in autism)
210. Manouilenko I, Pagani M, Stone-Elender S. Autistic traits, ADHD symptoms, neurological soft signs and regional cerebral blood flow in adults with autism spectrum disorders. <i>Res Autism Spectrum Disord</i> 2013; <b>7</b> (5): 566-578	<b>1d:</b> No prevalence information (PET study on cerebral blood flow in autism and CMHC groups)
211. Mannion A, Leader G, Healy O. An investigation of comorbid psychological disorders, sleep problems, gastrointestinal symptoms and epilepsy in children and adolescents with autism spectrum disorder. <i>Res Autism Spectrum Disord</i> 2013; <b>7</b> (1): 35-42	<b>2c:</b> Not DSM-IV, DSM-5, ICD-9 or ICD-10 diagnostic criteria (not reported, hence unsure if self-reported diagnoses follow these criteria)
212. Mannion A, Leader G. An investigation of comorbid psychological disorders, sleep problems, gastrointestinal symptoms and epilepsy in children and adolescents with autism spectrum disorder: A two-year follow-up. <i>Res Autism Spectrum Disord</i> 2016; <b>22</b> : 20-33	<b>2c:</b> Not DSM-IV, DSM-5, ICD-9 or ICD-10 diagnostic criteria (not reported, hence unsure if self-reported diagnoses follow these criteria)
213. Marland C, Lichtenstein P, Degl'Innocenti A, et al. The Autism Tics, ADHD and other comorbidities inventory (A-TAC): previous and predictive validity. <i>BMC Psychiatry</i> 2017; <b>17</b> (1): 401	<b>2a:</b> CMHC symptoms only, no diagnoses
214. Marriage S, Wolverson A, & Marriage K. Autism spectrum disorder grown up: A chart review of adult functioning. <i>J Can Acad Child Adolesc Psychiatry</i> 2009; <b>18</b> (4): 322	<b>3b:</b> Lifetime and current diagnoses combined
215. Maski KP, Jeste SS, Spence SJ. Common neurological co-morbidities in autism spectrum disorders. <i>Curr Opin Pediatr</i> 2011; <b>23</b> (6): 609	<b>1d:</b> No prevalence information (methodology not observational – review)
216. Matson JL, Boisjoli JA. Autism spectrum disorders in adults with intellectual disability and comorbid psychopathology: Scale development and reliability of the ASD-CA. <i>Res Autism Spectrum Disord</i> 2008; <b>2</b> (2): 276-287	<b>1d:</b> No prevalence information (psychometric analysis of a new scale for CMHC)
217. Matson JL, Boisjoli JA, Hess JA, Wilkins J. Comorbid psychopathology factor	<b>1d:</b> No prevalence information

structure on the Baby and Infant Screen for Children with aUtism Traits-Part 2 (BISCUIT-Part 2). <i>Res Autism Spectrum Disord</i> 2011; <b>5</b> (1): 426-432	(psychometric analysis of a new scale for CMHC)
218. Matson JL, Hess JA, Boisjoli JA. Comorbid psychopathology in infants and toddlers with autism and pervasive developmental disorders-not otherwise specified (PDD-NOS). <i>Res Autism Spectrum Disord</i> 2010; <b>4</b> (2) :300-304	<b>1d</b> : No prevalence information (psychometric analysis of a new scale for CMHC)
219. Matson JL, Dempsey T, Rivet TT. The interrelationships of psychopathology symptoms on social skills in adults with autism or PDD-NOS and intellectual disability. <i>J Dev Phys Disabil</i> 2009; <b>21</b> (1): 39-5	<b>1d</b> : No prevalence information (interrelationship between CMHC and autistic symptoms)
220. Matson JL, Horovitz M. Stability of Autism Spectrum Disorders symptoms over time. <i>J Dev Phys Disabil</i> . 2010; <b>22</b> (4) :331-342	<b>1d</b> : No prevalence information (methodology is not observational – review)
221. Matson JL, Fodstad JC, Mahan S, Sevin JA. Cutoffs, norms, and patterns of comorbid difficulties in children with an ASD on the Baby and Infant Screen for Children with Autism Traits (BISCUIT-Part 2). <i>Res Autism Spectrum Disord</i> 2009; <b>3</b> (4): 977-988	<b>1d</b> : No prevalence information (correlation between autism symptoms and CMHC)
222. Matson JL, Mahan S, Fodstad JC, Worley JA, Neal D, Sipes M. Effects of symptoms of co-morbid psychopathology on challenging behaviours among infants and toddlers with autistic disorder and PDD-NOS as assessed with the Baby and Infant Screen for Children with Autism Traits (BISCUIT). <i>Dev Neurorehabil</i> 2011; <b>14</b> (3): 129-139	<b>2a</b> : CMHC symptoms only, no diagnoses
223. Matson J, Williams L. Depression and mood disorders among persons with Autism Spectrum Disorders. <i>Res Dev Disabil</i> 2014; <b>35</b> (9): 2003-2007	<b>1d</b> : No prevalence information (methodology is not observational – review)
224. Matsuo J, Kamio Y, Takahashi H, et al. Autistic-like traits in adult patients with mood disorders and schizophrenia. <i>PLoS One</i> 2015; <b>10</b> (4): e0122711	<b>1c</b> : Not primary autism population (autistic traits in mood disorders and schizophrenia)
225. Matsushima N, Miyawaki D, Tsuji H, et al. Evaluation of attention-deficit/hyperactivity disorder symptoms in male children with high-functioning pervasive developmental disorders. <i>Osaka City Med J</i> 2008; <b>54</b> (1): 1-10	<b>1a</b> : Not available in English or French
226. May T, Cornish K, Rinehart N. Does gender matter? A one year follow-up of autistic, attention and anxiety symptoms in high functioning children with autism spectrum disorder. <i>J Autism Dev Disord</i> 2014; <b>44</b> (5): 1077-1086	<b>2a</b> : CMHC symptoms only, no diagnoses
227. Mayes SD, Calhoun SL. Variables related to sleep problems in children with autism. <i>Res Autism Spectrum Disord</i> 2009; <b>3</b> (4): 931-941	<b>1d</b> : No prevalence information (correlates of sleep problems in autism)
228. Mayes SD, Calhoun S, Bixler EO, Vgontzas AN. Sleep problems in children with autism, ADHD, anxiety, depression, acquired brain injury, and typical development. <i>Sleep Med Clin</i> 2009; <b>4</b> (1): 19-25	<b>2a</b> : CMHC symptoms only, not diagnoses
229. Mayes SD, Calhoun SL, Waschbusch DA, Baweja R. Autism and reactive attachment/disinhibited social engagement disorders: Co-occurrence and	<b>1c</b> : Not primary autism population (autism traits in children with attachment disorders)

differentiation. <i>Clin Child Psychol Psychiatry</i> 2017; <b>22</b> (4): 620-631	
230. Mayes SD, Gorman AA, Hillwig-Garcia J, Syed E. Suicide ideation and attempts in children with autism. <i>Res Autism Spectrum Disord</i> 2013; <b>7</b> (1): 109-119	<b>2a:</b> CMHC symptoms only, no diagnoses
231. Mayes SD, Waxmonsky J, Calhoun SL, Kokotovich C, Mathiowetz C, Baweja R. Disruptive mood dysregulation disorder (DMDD) symptoms in children with autism, ADHD, and neurotypical development and impact of co-occurring ODD, depression, and anxiety. <i>Res Autism Spectrum Disord</i> 2015; <b>18</b> : 64-72	<b>2a:</b> CMHC symptoms only, no diagnoses
232. Mayes S, Calhoun S, Aggarwal R, et al. Explosive, oppositional and aggressive behaviour in children with autism compared to other clinical disorders and typical children. <i>Res Autism Spectr Disord</i> 2012; <b>6</b> (1): 1-10	<b>2a:</b> CMHC symptoms only, no diagnoses
233. Mazefsky CA, Oswald DP, Day TN, Eack SM, Minshew NJ, Lainhart JE. ASD, a psychiatric disorder, or both? Psychiatric diagnoses in adolescents with high-functioning ASD. <i>J Clin Child Adolesc Psychol</i> 2012; <b>41</b> (1): 516-523	<b>3a:</b> Lifetime diagnoses of CMHCs only
234. Mazurek MO, Brown R, Curran A, Sohl K. ECHO Autism: A new model for training primary care providers in best-practice care for children with autism. <i>Clin Pediatr</i> 2017; <b>56</b> (3): 247-256	<b>1d:</b> No prevalence information (methodology is not observational – description of professional training model)
235. Mazurek MO, Dovgan K, Neumeyer AM, Malow BA. Course and predictors of sleep and co-occurring problems in children with autism spectrum disorder. <i>J Autism Spectrum Disord</i> 2019; January 25. DOI: /10.1007/s10803-019-03894-5	<b>2a:</b> CMHC symptoms only, no diagnoses
236. Mazurek MO, Petroski G. Sleep problems in children with autism spectrum disorder: Examining the contributions of sensory over-responsivity and anxiety. <i>Sleep Med</i> 2015; <b>16</b> (2): 270-279	<b>2a:</b> CMHC symptoms only, no diagnoses
237. Mazzone L, Ruta L, Reale L. Psychiatric comorbidities in asperger syndrome and high functioning autism: diagnostic challenges. <i>Ann Gen Psychiatry</i> 2012; <b>11</b> (1): 16	<b>1d:</b> No prevalence information (methodology not observational – review)
238. Mazzone L, Postorino V, De Peppo L, et al. Mood symptoms in children and adolescents with autism spectrum disorders. <i>Res Dev Disabil</i> 2013; <b>34</b> (11): 3699-3708	<b>2a:</b> CMHC symptoms only, no diagnoses
239. McKenna K, Gordon CT, Lenane M, Kaysen D, Fahey K, Rapoport JL. Looking for childhood-onset schizophrenia: the first 71 cases screened. <i>J Am Acad Child Adolesc Psychiatry</i> 1994; <b>33</b> (5): 636-644	<b>1e:</b> Not about autism population (childhood schizophrenia in the general population)
240. Miano S, Bruni O, Elia M, et al. Sleep in children with autistic spectrum disorder: a questionnaire and polysomnographic study. <i>Sleep Med</i> 2007; <b>9</b> (1): 64-70	<b>2a:</b> CMHC symptoms only, no diagnoses
241. Michel TM, Sheldrick AJ, Frentzel TG. Evaluation of diagnostic and therapeutic services in German university hospitals for adults with autism spectrum disorder (ASD). <i>Fortschr Neurol Psychiatr</i> 2010; <b>78</b> (7): 402-413	<b>1a:</b> Not available in English or French
242. Midouhas E, Yogaratnam A, Flouri E, Charman T. Psychopathology trajectories of children with autism spectrum disorder: The role of family poverty and parenting. <i>J Am</i>	<b>2a:</b> CMHC symptoms only, no diagnoses



<i>Acad Child Adolesc Psychiatry</i> 2013; <b>52</b> (10): 1057-1065	
243. Mito H, Matsuura N, Mukai K. The impacts of elevated autism spectrum disorder traits on clinical and psychosocial features and long-term treatment outcome in adult patients with obsessive-compulsive disorder. <i>Compr Psychiatry</i> 2014; <b>55</b> (7): 1526-1533	<b>1c:</b> Not primary autism population (autistic traits in OCD population)
244. Moss P, Howlin P, Savage S, Bolton P, Rutter M. Self and informant reports of mental health difficulties among adults with autism findings from a long-term follow-up study. <i>Autism</i> 2015; <b>19</b> (7): 832-841	<b>2a:</b> CMHC symptoms only, no diagnoses
245. Mouridsen SE, Rich B, Isager T. Cerebral palsy in individuals with a history of Asperger's syndrome: A Danish nationwide register study based on hospital diagnoses. <i>J Ped Neurol</i> 2013; <b>11</b> (1): 29-34	<b>4d:</b> Not about CMHCs (cerebral palsy in those with autism)
246. Mulligan A, Anney RJ, O'Regan M, et al. Autism symptoms in attention-deficit/hyperactivity disorder: a familial trait which correlates with conduct, oppositional defiant, language and motor disorders. <i>J Autism Dev Disord</i> 2009; <b>39</b> (2): 197-209	<b>1c:</b> Not primary autism population (autistic traits in ADHD)
247. Mulligan RC, Reiersen AM, Todorov AA. Attention-Deficit/Hyperactivity Disorder, Autistic Traits, and Substance Use Among Missouri Adolescents. <i>Scand J Child Adolesc Psychiatr Psychol</i> 2014; <b>2</b> (2): 86-92	<b>1e:</b> Not about autism population (ADHD and substance use in general population)
248. Murray C, Kovshoff H, Brown A, Abbot P, Hadwin JA. Exploring the anxiety and depression profile in individuals diagnosed with an autism spectrum disorder in adulthood. <i>Res Autism Spectrum Disord</i> 2019; <b>58</b> : 1-8	<b>2a:</b> CMHC symptoms only, no diagnoses
249. Nadeau JM, Arnold EB, Keene AC. Frequency and clinical correlates of sleep-related problems among anxious youth with autism spectrum disorders. <i>Child Psychiatry Hum Dev</i> 2015; <b>46</b> (4): 558-566	<b>4b:</b> Combined autism+CMHC sample at outset (sleep issues in autism+anxiety)
250. Nah YH, Brewer N, Young RL, Flower R. Brief report: Screening adults with Autism Spectrum Disorder for Anxiety and Depression. <i>J Autism Dev Disord</i> 2018; <b>48</b> (5): 1841-1846	<b>2a:</b> CMHC symptoms only, no diagnoses
251. Nahar A, Thippeswamy H, Reddy MSS, Kishore MT, Chaturvedi SK. Psychiatric comorbidity in persons with high-functioning autism spectrum disorders: Findings from a tertiary care neuropsychiatric hospital. <i>Asian J Psychiatry</i> 2019; <b>41</b> : 50-53	<b>3a:</b> Lifetime diagnoses of CMHCs only
252. Nakai Y, Miyawaki D, Kusaka H. Anxiety in children with high-functioning pervasive developmental disorder. <i>Osaka City Med J</i> 2013; <b>59</b> (1): 23-34	<b>1a:</b> Not available in English or French
253. Neuhaus E, Bernier RA, Tham SW, Webb SJ. Gastrointestinal and psychiatric symptoms among children with adolescents with autism spectrum disorders. <i>Frontiers in Psychiatry</i> 2018; <b>9</b> : 515	<b>2a:</b> CMHC symptoms only, no diagnoses
254. Nieminen-Von Wendt T, Paavonen JE, et al. Subjective face recognition difficulties, aberrant sensibility, sleeping disturbances and aberrant eating habits in families with Asperger syndrome. <i>BMC Psychiatry</i> 2005; <b>5</b> (1): 20	<b>2a:</b> CMHC symptoms only, no diagnoses

255. Niemczyk J, Fischer R, Wagner C, Burau A, Link T, Von Gontard A. Detailed assessment of incontinence, psychological problems and parental stress in children with autism spectrum disorder. <i>J Autism Dev Disord</i> 2019; published online Jan 12. DOI: 10.1007/s10803-019-03885-6	2a: CMHC symptoms only, no diagnoses
256. Nishimura M, Hashimoto T, Miyazaki M, Mori K, Kuroda Y. High functioning pervasive developmental disorder: coexistence with other clinical disorders. <i>No To Hattatsu</i> 2005; <b>37</b> (1): 26-30	1a: Not available in English or French
257. Noterdaeme MA & Wriedt E. Comorbidity in autism spectrum disorders-I. Mental retardation and psychiatric comorbidity. <i>Z Kinder Jug-Psych</i> 2010; <b>38</b> (4): 257-266	1a: Not available in English or French
258. Nylander L, Axmon A, Bjorne P, Ahlstrom G, Gillberg C. Older adults with autism spectrum disorders in Sweden: a register study of diagnoses, psychiatric care utilization and psychotropic medication of 601 individuals. <i>J Autism Dev Disord</i> 2018; <b>48</b> (9): 3076-3085	4c: No information on individual CMHCs (prevalence information for individual CMHCs not reported)
259. Nylander L, Gillberg C. Screening for autism spectrum disorders in adult psychiatric out-patients: a preliminary report. <i>Acta Psychiatr Scand</i> 2001; <b>103</b> (6): 428-434	1c: Not primary autism population (prevalence of autism in psychiatric outpatients)
260. Nylander L, Holmqvist M, Gustafson L, Gillberg C. Attention-deficit/hyperactivity disorder (ADHD) and autism spectrum disorder (ASD) in adult psychiatry. A 20-year register study. <i>Nord J Psychiatry</i> 2013; <b>67</b> (5): 344-350	1d: No prevalence information (trends in the diagnosis of autism and ADHD in adults)
261. Oeseburg B, Jansen DEMC, Dijkstra GJ, Groothoff JW, Reijneveld SA. Prevalence of chronic diseases in adolescents with intellectual disability. <i>Res Dev Disabil</i> 2010; <b>31</b> (3): 698-704	1e: Not about autism population (chronic diseases in intellectual disability)
262. Olsson MB, Lundström S, Westerlund J, Giacobini MB, Gillberg C, Fernell E. Preschool to school in autism: Neuropsychiatric problems 8 years after diagnosis at 3 years of age. <i>J Autism Dev Disord</i> 2016; <b>46</b> (8): 2749-2755	2a: CMHC symptoms only, no diagnoses
263. Oshodi YO, Olagunju AT, Oyelohunnu MA, et al. Autism spectrum disorder in a community-based sample with neurodevelopmental problems in Lagos, Nigeria. <i>J Public Health Afr</i> 2016; <b>7</b> (2): 559	4d: Not about CMHCs (autism prevalence only)
264. Ozyurt G, Besiroglu L. Autism spectrum symptoms in children and adolescents with obsessive compulsive disorder and their mothers. <i>Noro Psikiyatr Ars</i> 2018; <b>55</b> (1): 40-48	1a: Not available in English or French
265. Pan PY, Yeh CB. The comorbidity of disruptive mood dysregulation disorder in autism spectrum disorder. <i>Psychiatry Res</i> 2016; <b>241</b> : 108-109	1d: No prevalence information (methodology is not observational – letter to editor)
266. Park S, Cho SC, Cho IH. Sleep problems and their correlates and comorbid psychopathology of children with autism spectrum disorders. <i>Res Autism Spectrum Disord</i> 2012; <b>6</b> (3): 1068-1072	2a: CMHC symptoms only, no diagnoses

267. Park KJ, Lee JS, Kim HW. Medical and psychiatric comorbidities in Korean children and adolescents with Attention-Deficit/Hyperactivity Disorder. <i>Psychiatry Investig</i> 2017; <b>14</b> (6): 817-824	<b>1c:</b> Not primary autism population (autism diagnoses in ADHD)
268. Park S, Park MH, Kim HJ, Yoo HJ. Anxiety and depression symptoms in children with Asperger syndrome compared with attention-deficit/hyperactivity disorder and depressive disorder. <i>J Child Fam Stud</i> 2013; <b>22</b> (4): 559-568	<b>2a:</b> CMHC symptoms only, no diagnoses
269. Pasterski V, Gilligan L, Curtis R. Traits of autism spectrum disorders in adults with gender dysphoria. <i>Arch Sex Behav</i> 2014; <b>43</b> (2): 387-393	<b>1c:</b> Not primary autism population (autistic traits in gender dysphoria)
270. Pertusa A, Bejerot S, Eriksson J. Do patients with hoarding disorder have autistic traits?. <i>Depress Anxiety</i> 2012; <b>29</b> (3): 210-218	<b>1c:</b> Not primary autism population (autistic traits in hoarding populations)
271. Pijper J, De Wied M, Van Rijn S, Van Goozen S, Swaab H, Meeus W. Callous unemotional traits, autism spectrum disorder symptoms and empathy in boys with oppositional defiant disorder or conduct disorder. <i>Psychiatry Res</i> 2016; <b>245</b> : 340-345	<b>1c:</b> Not primary autism population (autistic traits in oppositional defiant disorder or conduct disorder)
272. Pine DS, Guyer AE, Goldwin M, Towbin KA, Leibenluft E. Autism spectrum disorder scale scores in pediatric mood and anxiety disorders. <i>J Am Acad Child Adolesc Psychiatry</i> 2008; <b>47</b> (6): 652-661	<b>1c:</b> Not primary autism population (autistic traits in mood and anxiety disorders)
273. Pitzianti M, D'agati E, Pontis M, et al. Comorbidity of ADHD and high-functioning autism: A pilot study on the utility of the overflow movements measure. <i>J Psychiatr Pract</i> 2016; <b>22</b> (1): 22-30	<b>1d:</b> No prevalence information (evaluating cognitive and movement measures in autism and ADHD groups)
274. Philippe P, Scholl J, Jacques J. Comorbidity in autism spectrum. <i>Psychiatr Danub</i> 2010; <b>22</b> (1): 158-160	<b>1a:</b> Not available in English or French
275. Pondé MP, Novaes CM, Losapio MF. Frequency of symptoms of attention deficit and hyperactivity disorder in autistic children. <i>Arq Neuropsiquiatr</i> 2010; <b>68</b> (1): 103-106	<b>1a:</b> Not available in English or French
276. Pooni J, Ninteman A, Bryant-Waugh R, Nicholls D, Mandy W. Investigating autism spectrum disorder and autistic traits in early onset eating disorder. <i>Int J Eat Disord</i> 2010; <b>45</b> (4): 583-591	<b>1c:</b> Not primary autism population (autistic traits and autism diagnosis in eating disorders)
277. Posserud M, Hysing M, Helland W, Gillberg C, Lundervold AJ. Autism traits: the importance of "co-morbid" problems for impairment and contact with services. Data from the Bergen Child Study. <i>Res Dev Disabil</i> 2018; <b>72</b> : 275-283	<b>2b:</b> Autistic traits and CMHC symptoms only
278. Postorino V, Fatta LM, Sanges V. Intellectual disability in autism spectrum disorder: investigation of prevalence in an Italian sample of children and adolescents. <i>Res Dev Disabil</i> 2016; <b>48</b> : 193-201	<b>4d:</b> Not about CMHCs (intellectual disability in autism)
279. Pritchard MA, De Dassel T, Beller E, Bogossian F, Johnston L, Paynter J, Russo S, Scott J. Autism in toddlers born very preterm. <i>Pediatrics</i> 2016; <b>137</b> (2): e20151949	<b>4d:</b> Not about CMHCs (prevalence of autism only)
280. Quek LH, Sofronoff K, Sheffield J, White A, Kelly A. Co-occurring anger in young people with Asperger's syndrome. <i>J Clin Psychol</i> 2012; <b>68</b> (10): 1142-1148	<b>2a:</b> CMHC symptoms only, no diagnoses

281. Ramos M, Boada L, Moreno C, Llorente C, Romo J, Parellada M. Attitude and risk of substance use in adolescents diagnosed with Asperger syndrome. <i>Drug Alcohol Depend</i> 2013; <b>133</b> (2): 535-540	<b>1d:</b> No prevalence information (risk for drug use in autism)
282. Rao PA, Landa RJ. Association between severity of behavioral phenotype and comorbid attention deficit hyperactivity disorder symptoms in children with autism spectrum disorders. <i>Autism</i> 2014; <b>18</b> (3): 272-280	<b>1d:</b> No prevalence information (correlation of ADHD symptoms to other behaviours in autism)
283. Råstam M, Täljemark J, Tajnia A. Eating problems and overlap with ADHD and autism spectrum disorders in a nationwide twin study of 9-and 12-year-old children. <i>Scientific World Journal</i> 2013; 7	<b>2b:</b> Autistic traits and CMHC symptoms only
284. Rattaz C, Michel C, Munir K, Baghdadli A. Challenging behaviours at early adulthood in autism spectrum disorders: topography, risk factors and evolution. <i>J Intellect Disabil Res</i> 2018; <b>62</b> (7): 637-649	<b>2a:</b> CMHC symptoms only, no diagnoses
285. Reiersen AM. Links between autism spectrum disorder and ADHD symptoms trajectories: important findings and unanswered questions. <i>J Am Acad Child Adolesc Psychiatry</i> 2011; <b>50</b> (9): 857-859	<b>1d:</b> No prevalence information (methodology is not observational – editorial)
286. Reiersen AM, Constantino JN, Todd RD. Co-occurrence of motor problems and autistic symptoms in attention-deficit/hyperactivity disorder. <i>J Am Acad Child Adolesc Psychiatry</i> 2008; <b>47</b> (6): 662-672	<b>1c:</b> Not primary autism population (motor problem and autistic traits in ADHD)
287. Reiersen AM, Constantino JN, Volk HE, Todd RD. Autistic traits in a population-based ADHD twin sample. <i>J Child Psychol Psychiatry</i> 2007; <b>48</b> (5): 464-472	<b>1c:</b> Not primary autism population (autistic traits in ADHD population)
288. Reinvald O, Moisiö AL, Lahti-Nuuttila P, Voutilainen A, Laasonen M, Kujala T. Psychiatric symptoms in children and adolescents with higher functioning autism spectrum disorders on the Development and Well-Being Assessment. <i>Res Autism Spectrum Disord</i> 2016; <b>25</b> : 47-57	<b>2a:</b> CMHC symptoms only, no diagnoses
289. Reynolds KC, Patriquin M, Alfano CA, Loveland KA, Pearson DA. Parent-reported problematic sleep behaviors in children with comorbid autism spectrum disorder and attention-deficit/hyperactivity disorder. <i>Res Autism Spectrum Disord</i> 2017; <b>39</b> : 20-32.	<b>4b:</b> Combined autism+CMHC sample at outset (autism+ADHD)
290. Richdale AL, Schreck KA. Sleep problems in autism spectrum disorders: prevalence, nature, & possible biopsychosocial aetiologies. <i>Sleep Med Rev</i> 2009; <b>13</b> (6): 403-411	<b>1d:</b> No prevalence information (methodology is not observational – review)
291. Riedel A, Schröck C, Ebert D, Fangmeier T, Bubl E, Van Elst Tebartz L. Well educated unemployed—On education, employment and comorbidities in adults with High-Functioning Autism Spectrum Disorders in Germany. <i>Psychiatrische Praxis</i> 2016; <b>43</b> (1): 38-44	<b>1a:</b> Not available in English or French
292. Rieske RD, Matson JL, Davis TEII. The moderating effect of autism symptomatology on anxiety symptoms. <i>J Multihandicap Pers</i> 2013; <b>25</b> (5): 517-531	<b>1d:</b> No prevalence information (autism and anxiety symptom relations)

293. Rieseke RD, Matson JL, May AC, Kozlowski AM. Anxiety in children with high-functioning autism spectrum disorders: Significant differences and the moderating effects of social impairments. <i>J Dev Phys Disabil</i> 2012; <b>24</b> (2): 167-180	<b>1d:</b> No prevalence information (autism and anxiety symptom relations)
294. Rintala H, Chudal R, Leppämäki S, Leivonen S, Hinkka-Yli-Salomäki S, Sourander A. Register-based study of the incidence, comorbidities and demographics of obsessive-compulsive disorder in specialist healthcare. <i>BMC Psychiatry</i> 2017; <b>17</b> (1): 64	<b>1c:</b> Not primary autism population (autism diagnoses in OCD)
295. Ronald A, Larsson H, Anckarsater H, Lichtenstein P. Symptoms of autism and ADHD: a Swedish twin study examining their overlap. <i>J Abnorm Psychol</i> 2014; <b>123</b> (2): 440	<b>2b:</b> Autistic traits and CMHC symptoms only
296. Rommelse NN, Altink ME, Fliers EA, et al. Comorbid problems in ADHD: degree of association, shared endophenotypes, and formation of distinct subtypes. Implications for a future DSM. <i>J Abnorm Child Psychol</i> 2009; <b>37</b> (6): 793-804	<b>1e:</b> Not about autism population (ADHD subtypes)
297. Rosen T, Mazefsky C, Vasa R, Lerner M. Co-occurring psychiatric conditions in autism spectrum disorder. <i>Int Rev Psychiatry</i> 2018; <b>30</b> (1): 40-61	<b>1d:</b> No prevalence information (methodology is not observational – review)
298. Rosbergen GJ, Jansen MP, Rosbergen-De AV, Roke Y, Otten R. Sleep-wake patterns in adults with autism spectrum disorders in a clinical setting: a pilot study. <i>Tijdschr Psychiatr</i> 2017; <b>59</b> (9): 520-527	<b>1a:</b> Not available in English or French
299. Rosenberg RE, Kaufmann WE, Law JK, Law PA. Parent report of community psychiatric comorbid diagnoses in autism spectrum disorders. <i>Autism Res Treat</i> 2011; Article ID 405849.	<b>3a:</b> Lifetime diagnoses of CMHCs only
300. Rosenberg R, Law J, Yemokkyan G, McGready K, Kaufmann W, Law PA. Characteristics and concordance of autism spectrum disorders among 277 twin pairs. <i>Arch Pediatr Adolesc Med</i> 2009; <b>163</b> (10): 907-914	<b>1d:</b> No prevalence information (twin concordance in autism)
301. Rowlandson PH, Smith C. An interagency service delivery model of autistic spectrum disorders and attention deficit hyperactivity disorder. <i>Child Care Health Dev</i> 2009; <b>35</b> (5): 681-690	<b>1c:</b> Not primary autism population (cannot establish a primary autism sample; describing a service model for autism, ADHD and other developmental difficulties)
302. Roy MD, Ohlmeier M, Osterhagen L, Prox-Vagedes V, Dillo W. Asperger syndrome: a frequent comorbidity in first diagnosed adult ADHD patients?. <i>Psychiatr Danub</i> 2013; <b>25</b> (2): 133-141.	<b>1c:</b> Not primary autism population (autism diagnosis in ADHD)
303. Rubenstein E, Bishop-Fitzpatrick L. A matter of time: the necessity of temporal language in research on health conditions that present with autism spectrum disorder. <i>Autism Res</i> 2019; <b>12</b> (1): 20-25	<b>1d:</b> No prevalence information (methodology is not observational – commentary)
304. Ruta L, Mugno D, D'Arrigo VG, Vitiello B, Mazzone L. Obsessive-compulsive traits	<b>2a:</b> CMHC symptoms only, no diagnoses

in children and adolescents with Asperger syndrome. <i>Eur Child Adolesc Psychiatry</i> 2010; <b>19</b> (1): 17	
305. Rybakowski F, Bialek A, Chojnicka I, et al. Autism spectrum disorders – epidemiology, symptoms, comorbidity and diagnosis. <i>Psychiatr Pol.</i> 2014; <b>48</b> (4): 653-665	<b>1a:</b> Not available in English or French
306. Rydzewska E, Hughes-McCormack LA, Gillberg C, Henderson A, MacIntyre C, Rintoul J, Cooper SA. Prevalence of long-term health conditions in adults with autism: observational study of a whole country population. <i>BMJ Open</i> 2018; <b>8</b> (8): e023945	<b>4d:</b> Not about CMHCs (non-psychiatric conditions in autism)
307. Rydzewska E, Hughes-McCormack LA, Gillberg C, Henderson A, MacIntyre C, Rintoul J, Cooper SA. Prevalence of sensory impairments, physical and intellectual disabilities, and mental health in children and young people with self/proxy-reported autism: Observational study of a whole country population. <i>Autism</i> 2018; published online Oct 17. DOI:10.1177/1362361318791279	<b>4c:</b> No information on individual CMHCs <b>4d:</b> Not about CMHCs (non-psychiatric conditions in autism)
308. Saemundsen E, Ludvigsson P, Rafnsson V. Autism spectrum disorders in children with a history of infantile spasms: a population-based study. <i>J Child Neurol</i> 2007; <b>22</b> (9): 1102-1107	<b>4d:</b> Not about CMHCs (prevalence of autism only)
309. Saemundsen E, Magnusson P, Georgsdóttir I, Egilsson E, Rafnsson V. Prevalence of autism spectrum disorders in an Icelandic birth cohort. <i>BMJ Open</i> 2013; <b>3</b> (6): e002748	<b>4d:</b> Not about CMHCs (prevalence of autism only)
310. Schendel DE, Overgaard M, Christensen J, Hjort L, Jørgensen M, Vestergaard M, Parner ET. Association of psychiatric and neurologic comorbidity with mortality among persons with autism spectrum disorder in a Danish population. <i>JAMA Pediatrics</i> 2016; <b>170</b> (3): 243-250	<b>3a:</b> Lifetime diagnoses of CMHCs only
311. Schiltz H, McIntyre N, Swain-Lerro L, Zajic M, Mundy P. The stability of self-reported anxiety in youth with autism versus ADHD or typical development. <i>J Autism Dev Disord</i> 2017; <b>47</b> (12): 3756-3764	<b>2a:</b> CMHC symptoms only, no diagnoses
312. Schroeder J, Weiss JA, Bebko J. CBCL profiles of children and adolescents with Asperger syndrome: A review and pilot study. <i>J Dev Disabil</i> 2011; <b>17</b> (1): 167-171	<b>2a:</b> CMHC symptoms only, no diagnoses
313. Shi LJ, Liu WH, Shi HS, et al. Co-occurrence of autistic and schizotypal traits and its association with emotional and psychosocial function in Chinese college students. <i>Psychiatry Res</i> 2017; <b>248</b> : 64-70	<b>1c:</b> Not primary autism population (autistic and schizotypal traits in general population)
314. Sikora DM, Vora P, Coury DL, Rosenberg D. Attention-deficit/hyperactivity disorder symptoms, adaptive functioning, and quality of life in children with autism spectrum disorder. <i>Pediatrics</i> 2012; <b>130</b> (2): 91-97	<b>2a:</b> CMHC symptoms only, no diagnoses
315. Simonoff E, Jones CR, Baird G, Pickles A, Happé F, Charman T. The persistence and stability of psychiatric problems in adolescents with autism spectrum disorders. <i>J Child Psychol Psychiatry</i> 2013; <b>54</b> (2): 186-194	<b>2a:</b> CMHC symptoms only, no diagnoses
316. Singh S, Singh LK, Sahu M, Tikka SK. Do comorbidities among patients with mental	<b>4c:</b> No information on individual CMHCs

retardation differ across various age groups? <i>Asian J Psychiatry</i> 2019; <b>39</b> : 12-14	
317. Sinzig J, Morsch D, & Lehmkuhl G. Do hyperactivity, impulsivity and inattention have an impact on the ability of facial affect recognition in children with autism and ADHD?. <i>Eur Child Adolesc Psychiatry</i> 2008; <b>17</b> (2): 63-72	<b>1d</b> : No prevalence information (correlation between ADHD symptoms and facial affect recognition)
318. Sinzig J, Vinzelberg I, Bell H, Quirnbach L. Special characteristics in the multiaxial classification, developmental history, and psychopathology in children and adolescents with autism spectrum disorder and attention-deficit/hyperactivity disorder. <i>Kindh Entwickl</i> 2014; <b>23</b> (1): 23-33	<b>1a</b> : Not available in English or French
319. Shtayermman O. Peer victimization in adolescents and young adults diagnosed with Asperger's syndrome: A link to depressive symptomatology, anxiety symptomatology and suicidal ideation. <i>Issues Compr Pediatr Nurs</i> 2007; <b>30</b> (3): 87-107	<b>2a</b> : CMHC symptoms only, no diagnoses
320. Shtayermman O. Suicidal ideation and comorbid disorders in adolescents and young adults diagnosed with Asperger's syndrome: A population at risk. <i>J Hum Behav Soc Environ</i> 2008; <b>18</b> (3): 301-328	<b>2a</b> : CMHC symptoms only, no diagnoses
321. Skokauskas N, Gallagher L. Mental health aspects of autistic spectrum disorders in children. <i>J Intellect Disabil Res</i> 2012; <b>56</b> (3): 248-257	<b>2a</b> : CMHC symptoms only, no diagnoses
322. Skovgaard AM, Houmann T, Christiansen E et al. The prevalence of mental health problems in children 1½ years of age—the Copenhagen Child Cohort 2000. <i>J Child Psychol Psychiatry</i> 2007; <b>48</b> (1): 62-70	<b>1c</b> : Not primary autism population (mental health concerns in general population)
323. Smalley S, McCracken J, Tanguay P. Autism, affective disorders and social phobia. <i>Am Med Genet Neuropsychiatr Genet</i> 1995; <b>60</b> (1): 19-26	<b>4d</b> : Not about CMHCs
324. Smith KR, Matson J. Behaviour problems: differences among intellectually disabled adults with co-morbid autism spectrum disorders and epilepsy. <i>Res Dev Disabil</i> 2010; <b>31</b> (5): 1062-1069	<b>1d</b> : No prevalence information (behavioural problem differences across different developmentally disabled groups)
325. Smith KR, Matson J. Psychopathology: differences among adults with intellectually disabled, comorbid autism spectrum disorders and epilepsy. <i>Res Dev Disabil</i> 2010; <b>31</b> (3): 743-749	<b>1d</b> : No prevalence information (psychopathology differences across different developmentally disabled groups)
326. Soke GN, Rosenberg SA, Hamman RF, et al. Brief Report: prevalence of self-injuries behaviours among children with autism spectrum disorder: a population based study. <i>J Autism Dev Disord</i> 2016; <b>46</b> (11): 3607-3614	<b>2a</b> : CMHC symptoms only, no diagnoses
327. Sokolova E, Oerlemans A, Rommelse N, et al. A causal and mediation analysis of the comorbidity between attention deficit hyperactivity disorder (ADHD) and autism spectrum disorder (ASD). <i>J Autism Dev Disord</i> 2017; <b>47</b> (6): 1595-1604	<b>1d</b> : No prevalence information (relations between autism and ADHD symptoms)
328. Souders MC, Mason TB, Valladares O, et al. Sleep behaviors and sleep quality in children with autism spectrum disorders. <i>Sleep</i> 2009; <b>32</b> (12): 1566-1578	<b>2a</b> : CMHC symptoms only, no diagnoses
329. Spain D, Happé F, Johnston P, et al. Social anxiety in adult males with autism	<b>2a</b> : CMHC symptoms only, no diagnoses

spectrum disorders. <i>Res Autism Spectrum Disord</i> 2016; <b>32</b> : 13-23	
330. Sreedaran P, Ashok MV. Asperger syndrome in India: Findings from a case-series with respect to clinical profile and comorbidity. <i>Indian J Psychol Med</i> 2015; <b>37</b> (2): 212	<b>4d</b> : Not about CMHCs (prevalence of Asperger's syndrome)
331. Stahlberg O, Soderstrom H, Rastam M, Gillberg C. Bipolar disorder, schizophrenia and other psychotic disorders in adults with childhood onset ADHD and/or autism spectrum disorders. <i>J Neural Transm</i> 2004; <b>111</b> (7): 891-902	<b>4b</b> : Combined autism+CMHC sample at outset
332. Sterling L, Dawson G, Estes A, Greenson J. Characteristics associated with presence of depressive symptoms in adults with autism spectrum disorder. <i>J Autism Dev Disord</i> 2008; <b>38</b> (6): 1011-1018	<b>2a</b> : CMHC symptoms only, no diagnoses
333. Storch EA, Arnold EB, Jones AM, et al. The role of co-occurring disruptive behaviour in the clinical presentation of children and adolescents with anxiety in the context of autism spectrum disorders. <i>Child Psychiatry Hum Dev</i> 2012; <b>43</b> (5): 734-746	<b>4b</b> : Combined autism+CMHC sample at outset (autism+anxiety)
334. Storch EA, Nadeau JM, Johnco C. Hoarding in youth with autism spectrum disorders and anxiety: incidence, clinical correlates, and behavioral treatment response. <i>J Autism Dev Disord</i> 2016; <b>46</b> (5): 1602-1612	<b>4b</b> : Combined autism+CMHC sample at outset (hoarding behaviours in autism+anxiety)
335. Stralin P & Hetta J. First episode psychosis and comorbid ADHD, autism and intellectual disability. <i>European Psychiatry</i> 2019; <b>55</b> : 18-22	<b>1c</b> : Not primary autism population (neurodevelopmental disorders in first episode psychosis)
336. Strang JF, Kenworthy L, Daniolos P, et al. Depression and anxiety symptoms in children and adolescents with autism spectrum disorders without intellectual disability. <i>Res Autism Spectrum Disord</i> 2012; <b>6</b> (1): 406-412	<b>2a</b> : CMHC symptoms only, no diagnoses
337. Strunz S, Westphal L, Ritter K, Heuser I, Dziobek I, Roepke S. Personality pathology of adults with autism spectrum disorder without accompanying intellectual impairment in comparison to adults with personality disorders. <i>J Autism Child Schizophr.</i> 2015; <b>45</b> (12): 4026-4038	<b>2a</b> : CMHC symptoms only, no diagnoses
338. Sukhodolsky DG, Scahill L, Gadow KD, et al. Parent-rated anxiety symptoms in children with pervasive developmental disorders: Frequency and association with core autism symptoms and cognitive functioning. <i>J Abnorm Child Psychol</i> 2008; <b>3</b> (6): 117-128	<b>2a</b> : CMHC symptoms only, no diagnoses
339. Sullivan S, Rai D, Golding J, Zammit S, Steer C. The association between autism spectrum disorder and psychotic experiences in the Avon longitudinal study of parents and children (ALSPAC) birth cohort. <i>J Am Acad Child Adolesc Psychiatry</i> 2013; <b>52</b> (8): 806-814	<b>1d</b> : No prevalence information (relations between autistic traits and psychotic symptoms in a birth cohort)
340. Suren P, Schjolberg S, Oyen A, et al. The autism birth cohort (ABC): a study of autism spectrum disorders in MoBa. <i>Nor Epidemiol</i> 2014; <b>24</b> (1-2): 39-50	<b>1d</b> : No prevalence information (methodology is not observational – cohort description)
341. Sverd J, Dubey DR, Schweitzer R, Ninan R. Pervasive developmental disorders	<b>4d</b> : Not about CMHCs (autism in



among children and adolescents attending psychiatric day treatment. <i>Psychiatr Serv</i> 2003; <b>54</b> (11): 1519-1525	psychiatric clinics)
342. Syriopoulou-Delli CK, Polychronopoulou SA, Kolaitis GA, Antoniou A-SG. Views of teachers on anxiety symptoms in students with autism spectrum disorder. <i>J Autism Dev Disord</i> 2019; <b>49</b> (2): 704-720	<b>2a:</b> CMHC symptoms only, no diagnoses
343. Takara K, Kondo T. Comorbid atypical autistic traits as a potential risk factor for suicide attempts among adult depressed patients: a case-control study. <i>Ann Gen Psychiatry</i> 2014; <b>13</b> (1): 33	<b>1c:</b> Not primary autism population (autistic traits in people with depression)
344. Tani P, Lindberg N, Appelberg B, et al. Childhood inattention and hyperactivity symptoms self-reported by adults with Asperger syndrome. <i>Psychopathology</i> 2006; <b>39</b> (1): 49-54	<b>2a:</b> CMHC symptoms only, no diagnoses
345. Tani P, Lindberg N, Nieminen-von Wendt T, et al. Insomnia is a frequent finding in adults with Asperger syndrome. <i>BMC Psychiatry</i> 2003; <b>3</b> (1): 12	<b>2a:</b> CMHC symptoms only, no diagnoses
346. Taylor JL, Gotham KO. Cumulative life events, traumatic experiences, and psychiatric symptomatology in transition-aged youth with autism spectrum disorder. <i>J Neurodev Disord</i> 2016; <b>8</b> (1): 28	<b>2a:</b> CMHC symptoms only, no diagnoses
347. Taylor MJ, Robinson EB, Happé F, Bolton P, Freeman D, Ronald A. A longitudinal twin study of the association between childhood autistic traits and psychotic experiences in adolescence. <i>Mol Autism</i> 2015; <b>6</b> (1): 44	<b>1c:</b> Not primary autism population (autistic traits and psychosis in the general population)
348. Tchanturia K, Adamson J, Leppanen J, Westwood H. Characteristics of autism spectrum disorder in anorexia nervosa: a naturalistic study in an inpatient treatment programme. <i>Autism</i> 2019; <b>23</b> (1): 123-130	<b>1c:</b> Not primary autism population (autistic traits in anorexia)
349. Tillmann J, Caceres ASJ, Chatham CH, et al. Investigating the factors underlying adaptive functioning in autism in the EU-AIMS Longitudinal European Autism Project. <i>Autism Research</i> 2019; published online February 1. DOI:10.1002/aur.2081	<b>4d:</b> Not about CMHCs (factors that influence adaptive functioning in autism)
350. Thorson RT, Matson JL. Cutoff scores for the autism spectrum disorder-comorbid for children (ASD-CC). <i>Res Autism Spectrum Disord</i> 2012; <b>6</b> (1): 556-559	<b>1d:</b> No prevalence information (aim was to determine cut-offs for a new assessment tool)
351. Thurman AJ, McDuffie A, Hagerman R, Abbeduto L. Psychiatric symptoms in boys with Fragile X syndrome: a comparison with non-syndromic autism spectrum disorder. <i>Res Dev Disabil</i> 2014; <b>35</b> (4): 1072-1086	<b>1c:</b> Not primary autism population (CMHCs in Fragile X syndrome) <b>2a:</b> CMHC symptoms only, no diagnoses
352. Tick B, Colvert E, McEwen F, et al. Autism Spectrum Disorders and other mental health problems: Exploring etiological overlaps and phenotypic causal associations. <i>J Am Acad Child Adolesc Psychiatry</i> 2016; <b>55</b> (2): 106-113	<b>1d:</b> No prevalence information (genetic overlap between autism and CMHC symptoms)
353. Tint A, Weiss JA, Lunsky Y. Identifying the clinical needs and patterns of health service use of adolescent girls and women with autism spectrum disorder. <i>Autism Res</i>	<b>1d:</b> No prevalence information (methodology is not observational –

2017; <b>10</b> (9): 1558-1566	qualitative study)
354. Tsai LY. Prevalence of comorbid psychiatric disorders in children and adolescents with Autism Spectrum Disorders. <i>J Exp Clin Med</i> 2014; <b>6</b> (6): 179-186	<b>1d</b> : No prevalence information (methodology is not observational – review)
355. Tsai LY. Brief report: comorbid psychiatric disorders of autistic disorder. <i>J Autism Dev Disord</i> 1996; <b>26</b> (2): 159-163	<b>1d</b> : No prevalence information (methodology is not observational – review)
356. Tsai FJ, Chiang HL, Lee CM, et al. Sleep problems in children with autism, attention-deficit hyperactivity disorder, and epilepsy. <i>Res Autism Spectrum Disord</i> 2012; <b>6</b> (1): 413-421	<b>2a</b> : CMHC symptoms only, no diagnoses
357. Tudor ME, Hoffman CD, Sweeney DP. Children with autism: sleep problems and symptom severity. <i>Focus Autism Other Dev Disabil</i> 2012; <b>27</b> (4): 254-262	<b>2a</b> : CMHC symptoms only, no diagnoses
358. Tureck K, Matson JL, May A, Davis TE, Whiting SE. Investigation of the rates of comorbid symptoms in children with ADHD compared to children with ASD. <i>J Dev Phys Disabil</i> 2013; <b>25</b> (4): 405-417	<b>2a</b> : CMHC symptoms only, no diagnoses
359. Tureck K, Matson JL, May A, Whiting SE, Davis TEIII. Comorbid symptoms in children with anxiety disorders compared to children with autism spectrum disorders. <i>J Multihandicap Pers</i> 2014; <b>26</b> (1): 23-33	<b>2a</b> : CMHC symptoms only, no diagnoses
360. Tureck K, Matson JL, May A, Turygin N. Externalizing and tantrum behaviours in children with ASD and ADHD compared to children with ADHD. <i>Dev Neurorehabil</i> 2013; <b>16</b> (1): 52-57	<b>2a</b> : CMHC symptoms only, no diagnoses
361. Turygin N, Matson JL, & Tureck K. ADHD symptom prevalence and risk factors in a sample of toddlers with ASD or who are at risk for developmental delay. <i>Research in developmental disabilities</i> 2013; <b>34</b> (11): 4203-4209	<b>2b</b> : Autistic traits and CMHC symptoms only
362. Uren J, Richdale AL, Cotton SM, Whitehouse AJO. Sleep problems and anxiety from 2 to 8 years and the influence of autistic traits: a longitudinal study. <i>Eur Child Adolesc Psychiatry</i> 2019; published online, January 1. DOI: 10.1007/s00787-019-01275-y	<b>1e</b> : Not about autism population (sleep problems and anxiety)
363. Van Bakel MME, Delobel-Ayoub M, Cans C, Assouline B, Jouk PS, Raynaud JP, Arnaud C. Low but increasing prevalence of autism spectrum disorders in a French area from register-based data. <i>J Autism Dev Disord</i> 2015; <b>45</b> (10): 3255-3261	<b>4d</b> : Not about CMHCs (prevalence of autism only)
364. Van der Miesen AIR, De Vries AL, Steensma TD, Hartman CA. Autistic symptoms in children and adolescents with gender dysphoria. <i>J Autism Dev Disord</i> 2018; <b>48</b> (5): 1537-1548	<b>1c</b> : Not primary autism population (autistic traits in gender dysphoria)
365. Van der Miesen AIR, Hurley H, Bal AM, De Vries ALC. Prevalence of the wish to be of the opposite gender in adolescents and adults with autism spectrum disorder. <i>Arch Sex Behav</i> 2018; <b>47</b> (8): 2307-2317	<b>2a</b> : CMHC symptoms only, no diagnoses

366. Vannucchi G, Masi G, Toni C, Dell'Osso L, Marazziti D, Perugi G. Clinical features, developmental course, and psychiatric comorbidity of adult autism spectrum disorders. <i>CNS Spectrums</i> 2014; <b>19</b> (2): 157-164	<b>1d:</b> No prevalence information (methodology is not observational – review)
367. Van Steijn DJ, Richards JS, Oerlemans AM, et al. The co-occurrence of autism spectrum disorder and attention-deficit/hyperactivity disorder symptoms in parents of children with ASD or ASD with ADHD. <i>J Child Psychol Psychiatry</i> 2012; <b>53</b> (9): 954-963	<b>4b:</b> Combined autism+CMHC sample at outset
368. Vaskinn A, Abu-Akel A. The interactive effect of autism and psychosis severity on theory of mind and functioning in schizophrenia. <i>Neuropsychol</i> 2019; <b>33</b> (2): 195	<b>1c:</b> Not primary autism population (autistic traits in schizophrenia)
369. Verhoeff ME, Blanken LM, Kocavska D, et al. The bidirectional association between sleep problems and autism spectrum disorder: a population-based cohort study. <i>Mol Autism</i> 2018; <b>9</b> (1): 8	<b>2a:</b> CMHC symptoms only, no diagnoses
370. Ververi A, Vargiami E, Papadopoulou V, Tryfonas D, Zafeiriou DI. Clinical and laboratory data in a sample of Greek children with autism spectrum disorders. <i>J Autism Dev Disord</i> 2012; <b>42</b> (7): 1470-1476	<b>4d:</b> Not about CMHCs (non-psychiatric conditions)
371. Vincent A, Da Fonseca D, Baumstarck K, Charvin I, Alcaraz-Mor R, Lehucher-Michel MP. The quality of life and the future of young adults with Asperger syndrome. <i>Disabil Rehabil</i> 2019: 1-18	<b>4d:</b> Not about CMHCs (quality of life in autism)
372. Virues-Ortega J, Lehnert K, Swan B, et al. The New Zealand minds for minds autism spectrum disorder self-reported cohort. <i>Res Autism Spectrum Disord</i> 2017; <b>36</b> : 1-7	<b>4c:</b> No information on individual CMHCs
373. Viscidi EW, Triche EW, Pescosolido MF, et al. Clinical characteristics of children with autism spectrum disorder and co-occurring epilepsy. <i>PloS One</i> 2013; <b>8</b> (7): e67797	<b>4d:</b> Not about CMHCs (a cohort of autism and co-occurring epilepsy)
374. Vissoker RE, Latzer Y, Stolar O, Rabenbach A, Gal E. Eating problems and patterns among toddlers and young boys with and without autism spectrum disorders. <i>Res Autism Spectrum Disord</i> 2019; <b>59</b> : 1-9	<b>2a:</b> CMHC symptoms only, no diagnoses
375. Von Gontard AV, Pirrung M, Niemczyk J, & Equit M. Incontinence in children with autism spectrum disorder. <i>J Pediatr Urol</i> 2015; <b>11</b> (5): 264 –e1	<b>4d:</b> Not about CMHCs (incontinence in autism)
376. Wang K, Wang C, Guo D, Van Wijngaarden M, Begeer S. Children with autism spectrum disorders from China and the Netherlands: age of diagnosis, gender and comorbidities. <i>Res Autism Spectrum Disord</i> 2018; <b>54</b> : 76-82	<b>2c:</b> Not DSM-IV, DSM-5, ICD-9 or ICD-10 diagnostic criteria <b>4d:</b> Not about CMHCs (non-psychiatric comorbidities)
377. Waris P, Lindberg N, Kettunen K, Tani P. The relationship between Asperger's syndrome and schizophrenia in adolescence. <i>Eur Child Adolesc Psychiatry</i> 2013; <b>22</b> (4): 217-223	<b>1c:</b> Not primary autism population (autism diagnoses in schizophrenia)
378. Wentz E, Lacey JH, Waller G, Råstam M, Turk J, Gillberg C. Childhood onset neuropsychiatric disorders in adult eating disorder patients. <i>Eur Child Adolesc Psychiatry</i> 2005; <b>14</b> (8): 431-437	<b>1c:</b> Not primary autism population (CMHCs, including autism, in eating disorders)

379. Westwood H, Mandy W, Simic M, Tchanturia K. Assessing ASD in adolescent females with anorexia nervosa using clinical and developmental measures: a preliminary investigation. <i>J Abnorm Child Psychol</i> 2018; <b>46</b> (1): 183-192	<b>1c:</b> Not primary autism population (autism diagnoses in anorexia)
380. White SG, Meloy JR, Mohandie K, Kielen K. Autism spectrum disorder and violence: threat assessment issues. <i>J Threat Assess Manag</i> 2017; <b>4</b> (3): 144-163	<b>4d:</b> Not about CMHCs (assessing violence and autism)
381. White SW, Roberson-Nay R. Anxiety, social deficits and loneliness in youth with autism spectrum disorders. <i>J Autism Dev Disord</i> 2009; <b>39</b> (7): 1006-1013	<b>2a:</b> CMHC symptoms only, no diagnoses
382. Whitehouse AJ, Durkin K, Jaquet E, Ziatas K. Friendship, loneliness and depression in adolescents with Asperger's Syndrome. <i>J Adolesc</i> 2009; <b>32</b> (2): 309-322	<b>4d:</b> Not about CMHCs (about friendship) <b>2a:</b> CMHC symptoms only, no diagnoses
383. Wijnhoven LA, Creemers DH, Vermulst AA, Granic I. Prevalence and risk factors of anxiety in a clinical Dutch sample of children with an autism spectrum disorder. <i>Front Psychiatry</i> 2018; <b>9</b> : 50	<b>2a:</b> CMHC symptoms only, no diagnoses
384. Wikramanayake WNM, Mandy W, Shahper S. Autism spectrum disorders in adult outpatients with obsessive compulsive disorder in the UK. <i>Int J Psychiatry Clin Pract</i> 2018; <b>22</b> (1): 54-62	<b>1c:</b> Not primary autism population (autism diagnoses in OCD)
385. Williams LW, Matson JL, Beighley JS, Rieske RD, Adams HL. Comorbid symptoms in toddlers diagnosed with autism spectrum disorder with the DSM-IV-TR and the DSM-5 criteria. <i>Res Autism Spectrum Disord</i> 2014; <b>8</b> (3): 186-192	<b>2a:</b> CMHC symptoms only, no diagnoses
386. Williams LW, Matson JL, Jang J, Beighley JS, Rieske RD, Adams HL. Challenging behaviors in toddlers diagnosed with autism spectrum disorders with the DSM-IV-TR and the proposed DSM-5 criteria. <i>Res Autism Spectrum Disord</i> 2013; <b>7</b> (8): 966-972	<b>2a:</b> CMHC symptoms only, no diagnoses
387. Winkler-Schwartz A, Garfinkle J, Shevell MI. Autism Spectrum Disorder in a term birth neonatal intensive care unit population. <i>Pediatric Neurol</i> 2014; <b>51</b> (6): 776-780	<b>1d:</b> No prevalence information (risk factors for autism in neonates)
388. Wise EA, Smith MD, Rabins PV. Aging and Autism Spectrum Disorder: A naturalistic, longitudinal study of the comorbidities and behavioral and neuropsychiatric symptoms in adults with ASD. <i>J Autism Dev Disord</i> 2017; <b>47</b> (6): 1708-1715	<b>2a:</b> CMHC symptoms only, no diagnoses
389. Won DC, Feldman HM, Huffman LC. Sleep problem detection and documentation in children with ASD and ADHD by developmental-behavioral pediatricians: A DBPNet Study. <i>J Dev Behav Pediatr</i> 2018; published online, Oct 18. DOI:10.1097/DBP.0000000000000624	<b>2a:</b> CMHC symptoms only, no diagnoses
390. Worley JA, Matson JL. Psychiatric symptoms in children diagnosed with an autism spectrum disorder: An examination of gender differences. <i>Res Autism Spectrum Disord</i> 2011; <b>5</b> (3): 1086-1091	<b>2a:</b> CMHC symptoms only, no diagnoses
391. Wozniak J, Biederman J, Faraone SV, et al. Mania in children with pervasive developmental disorder revisited. <i>J Am Acad Child Adolesc Psychiatry</i> 1997; <b>36</b> (11): 1552-1559	<b>1c:</b> Not primary autism population (consecutive referrals to a paediatric psychopharmacology clinic)

392. Xie S, Heuvelman H, Magnusson C, et al. Prevalence of autism spectrum disorders with and without intellectual disability by gestational age at birth in the Stockholm youth cohort: a register linkage study. <i>Paediatr Perinat Epidemiol</i> 2017; <b>31</b> (6): 586-594	<b>4d:</b> Not about CMHCs (none reported for autism population)
393. Young S, González RA, Mullens H, Mutch L, Malet-Lambert I, Gudjonsson GH. Neurodevelopmental disorders in prison inmates: comorbidity and combined associations with psychiatric symptoms and behavioural disturbance. <i>Psychiatry Res</i> 2018; <b>261</b> : 109-115	<b>1c:</b> Not primary autism population (neurodevelopmental disorders in prisoners)
394. Yoshida Y, Uchiyama T. The clinical necessity for assessing attention deficit/hyperactivity disorder (AD/HD) symptoms in children with high-functioning pervasive developmental disorder (PDD). <i>Eur Child Adolesc Psychiatry</i> 2004; <b>13</b> (5): 307-314	<b>2a:</b> CMHC symptoms only, no diagnoses
395. Zablotsky B, Bramlett MD, & Blumberg SJ. The co-occurrence of autism spectrum disorder in children with ADHD. <i>J Atten Disord</i> 2017; published online, June 14. DOI: 10.1177/1087054717713638	<b>4b:</b> Combined autism+CMHC sample at outset (autism+ADHD)
396. Zachor D, Yang JW, Itzhak EB, et al. Cross-cultural differences in comorbid symptoms of children with autism spectrum disorders: an international examination between Israel, South Korea, the United Kingdom and the United States of America. <i>Dev Neurorehabil</i> 2011; <b>14</b> (4): 215-220	<b>2a:</b> CMHC symptoms only, no diagnoses
397. Zauche LH, Mahoney AED, Higgins MK. Predictors of co-occurring neurodevelopmental disabilities in children with Autism Spectrum Disorders. <i>J Pediatr Nurs</i> 2017; <b>35</b> : 113-119	<b>4a:</b> Cannot disaggregate CMHCs – combined across categories
398. Zhou N, Wang J, Chasson GS. Psychiatric problems of Chinese college students with high autism traits. <i>Res Autism Spectrum Disord</i> 2018; <b>54</b> : 1-8	<b>2b:</b> Autistic traits and CMHC symptoms only
399. Zukerman G, Yahav G, Ben-Itzhak E. Increased psychiatric symptoms in university students with autism spectrum disorder are associated with reduced adaptive behaviour. <i>Psychiatry Res</i> 2019; <b>273</b> : 732-738	<b>2a:</b> CMHC symptoms only, no diagnoses

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