Research review: A meta-analysis of the international prevalence and comorbidity of mental disorders in children between 1 and 7 years

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Background: Children younger than 7 years can develop mental disorders that might manifest differently than in older children or adolescents. However, little is known about the prevalence of mental disorders at this early age. **Methods:** We systematically searched the literature in the databases Web of Science, PsycINFO, PSYNDEX, MEDLINE, and Embase to identify epidemiological studies of community samples published between 2006 and 2020. A series of meta-analyses was conducted to estimate the pooled worldwide prevalence of mental disorders in general, specific mental disorders, and comorbidity in young children. **Results:** A total of ten epidemiological studies reporting data on N = 18,282 children (12–83 months old) from eight countries met the inclusion criteria. The pooled prevalence of mental disorders in general was 20.1%, 95% CI [15.7, 25.4]. Most common disorders were oppositional defiant disorder (4.9%, 95% CI [2.5, 9.5]) and attention-deficit hyperactivity disorder (4.3%, 95% CI [2.5, 7.2]). The prevalence of any anxiety disorders was 8.5%, 95% CI [5.2, 13.5], and of any depressive disorders was 1.1%, 95% CI [0.8, 1.6]. Comorbidity was estimated at 6.4%, 95% CI [1.3, 54.0]. **Conclusions:** The literature search reveals that the epidemiology of mental disorders in children younger than 7 years is still a neglected area of research. The findings also indicate that there are a significant number of young children suffering from mental disorders who need appropriate age-adapted treatment. **Keywords:** Mental disorder; comorbidity; preschool; prevalence; epidemiology.

Introduction

Children younger than 7 years can suffer from mental health symptoms that impair their further development and mental health throughout their life span (Angold & Egger, 2007). However, the investigation of mental disorder prevalence in very young children is still a neglected area of research (Lyons-Ruth et al., 2017). Better knowledge of the prevalence and comorbidity of mental disorders is essential for effective service planning and the optimization of treatments and assessment tools for this age group (Egger & Angold, 2006; Polanczyk, Salum, Sugaya, Caye, & Rohde, 2015).

There are several challenges facing the classification of mental disorders at this early age. Most arise from recognition of the first seven years of life as an important developmental stage. Due to the rapid physical, emotional, behavioral, and cognitive development that young children experience, their emotional and behavioral problems are often considered transient problems rather than mental disorders (Egger & Angold, 2006). It is also difficult to differentiate between interindividual variability in normal development and psychopathology. For instance, increasing oppositionality between the second and fourth years of age (also referred to as

'the terrible twos') is important for a child's autonomy and should not be classified as a mental disorder in the absence of functional impairment (Keenan & Wakschlag, 2000). Furthermore, young children regulate their emotions and behavior through their interactions with their caregivers (Lincoln, Russell, Donohue, & Racine, 2017). It is, therefore, often unclear whether the emotional and behavioral problems that a child manifests should be interpreted as individual psychopathology or as an expression of dysfunctional interpersonal caregiver-child relationship (von Klitzing, Dohnert, Kroll, & Grube, 2015).

To address challenges in the classification and diagnosis of mental disorders in young children, the Task Force Zero to Three developed the Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood (DC: 0–5; Zero to Three, 2016). The DC: 0–5 includes developmentally sensitive classification criteria for disorders in infants and young children through five years of age, considering age-specific manifestations, important predictors of normal and maladaptive development, and individual differences in development (Zeanah et al., 2017). The DC: 0–5 is designed to complement the diagnostic systems ICD (World Health Organization, 1992) and DSM (American Psychiatric Association, 2013). Despite adaptions to child development, the DC: 0–5 is still not widely used internationally (Lyons-Ruth et al.,

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2017). Instead, most diagnoses in young children rely on the standard ICD and DSM diagnostic systems. Moreover, they mainly include diagnoses which were introduced to describe symptoms as they become manifest in adults and do not account for developmental variations (Egger & Angold, 2006). Only recently was the first preschool subtype of a disorder previously exclusively based on symptoms in adults – the post-traumatic stress disorder (PTSD), preschool subtype – included in the DSM-5, which might be an important step toward more developmentally sensitive diagnostic criteria in the future (Vasileva, Haag, Landolt, & Petermann, 2018).

Despite challenges in diagnostics with very young children, few reviews have thus far estimated the prevalence of mental disorders at this age. In a systematic literature search, McDonnell and Glod (2003) identified seven studies that estimated the prevalence of specific mental disorders in children ages 1–6 years as ranging from 0.1% to 26.4%. The most common disorders observed were oppositional defiant disorder (ODD) and anxiety disorders. These estimates were based partly on samples from psychiatric settings which might lead to overestimation of prevalence for the general population. In another literature review of studies in community samples, Egger and Angold (2006) reported prevalence rates for any DSM mental disorder ranging from 14.0% to 26.4%. These findings were based on four studies published between 1982 and 2005. Average prevalence rates were highest for serious emotional disturbance and anxiety disorders. Both reviews indicated that approximately one quarter of children with a mental disorder showed one or more comorbid disorders. Based upon a more recently published selective literature search, von Klitzing et al. (2015) reported prevalence rates ranging from 16% to 18%. None of these reviews included a meta-analysis of the prevalence rates or investigated the sources of variability found between studies. For older children and adolescents ages 4–18 years, there is a meta-analysis estimating the worldwide pooled prevalence of any mental disorder at 13.4%, 95% CI [11.3, 15.9] (Polanczyk et al., 2015).

The present study

The aims of the present study were to update the literature review of epidemiological studies with children younger than 7 years since the review of Egger and Angold (2006), and to estimate the pooled worldwide prevalence of mental disorders in this age group. We focused on the prevalence of any mental disorder, as well as specific mental disorders in community samples. Furthermore, we estimated the comorbidity of mental disorders in very young children. Findings of this review and meta-analysis could guide future research, policy making, and treatment planning.

Methods
Search strategy

We followed PRISMA guidelines for conducting and reporting reviews and meta-analyses (Moher, Liberati, Tetzlaff, & Altman, 2009) and the strategy used for the previous meta-analysis of mental disorder prevalence rates in older children and adolescents (Polanczyk et al., 2015). A systematic literature search was conducted in the electronic databases Web of Science, PsycINFO, PSYNDEX, MEDLINE, and Embase. The search was limited to include records from 2006 onwards and was updated on February 21, 2020. Search terms included '(mental health or mental disorder) AND (preschool* or toddler*) AND (prevalence or epidemiology)'. This search yielded 3,027 potential studies (Figure 1). Additionally, the reference lists of all relevant empirical studies and reviews were scanned for potential publications and a further 25 studies were identified. After extracting 655 duplicates, titles and abstracts of 2,397 studies were screened independently by two authors (R. G. and M.V.). Subsequently, the authors (R. G. and M.V.) reviewed texts of potential epidemiological studies.

Inclusion criteria

Studies had to satisfy the following criteria to be included:

1. epidemiological study of community samples;
2. use of a standardized assessment procedure to diagnose at least three disorders according to DSM-IV/DSM-IV-TR/ DSM-5, ICD-9/ICD-10, or DC: 0–3/D-C: 0–5;
3. inclusion of children who are 12–83 months old;
4. publication year between 2006 and 2020.

Language of the publication was not an exclusion criterion.

Coding of studies

Each study was coded (by R. G.) according to study characteristics, population characteristics, sample characteristics, study methods, assessment methods, and effect size. Difficulties with coding of studies were discussed with the first author (M.V.). Study characteristics included information about the author(s), research affiliation, and year of publication. Characteristics of the population referred to country; the Human Development Index, according to the United Nations; and year of data collection. To describe the sample, we coded mean age, age range, and percentage of male participants. We also coded, if the sample included only children older than three years or younger children (age group). Study methods were coded according to location (country; urban size: large city area with 1,000,000 or more citizens, medium-sized city area with 500,000–999,999 citizens, or small area with less than 500,000 citizens), sampling strategy (kindergartens/schools, households, birth register, primary care including regular health check-ups or other) and study design (one-stage design with one assessment or two-stage design including screening and some further assessment of a subsample). Assessment methods were coded referring to diagnostic criteria, assessment instrument (DISC = Diagnostic Interview Schedule, Lucas, Fisher, & Luby, 1998; PAPA =Preschool Age Psychiatric Assessment, Egger & Angold, 2004; or other), and informant. We coded if functional impairment was required for the diagnosis ('no', 'yes', and 'yes/no' when it was required only for some diagnoses). The effect size was reported as the proportion of children with any mental disorder, a specific mental disorder, or one or more comorbid mental disorders relative to the whole sample.

In cases of longitudinal data, the first wave was considered to avoid bias due to dropouts. If several studies were based on
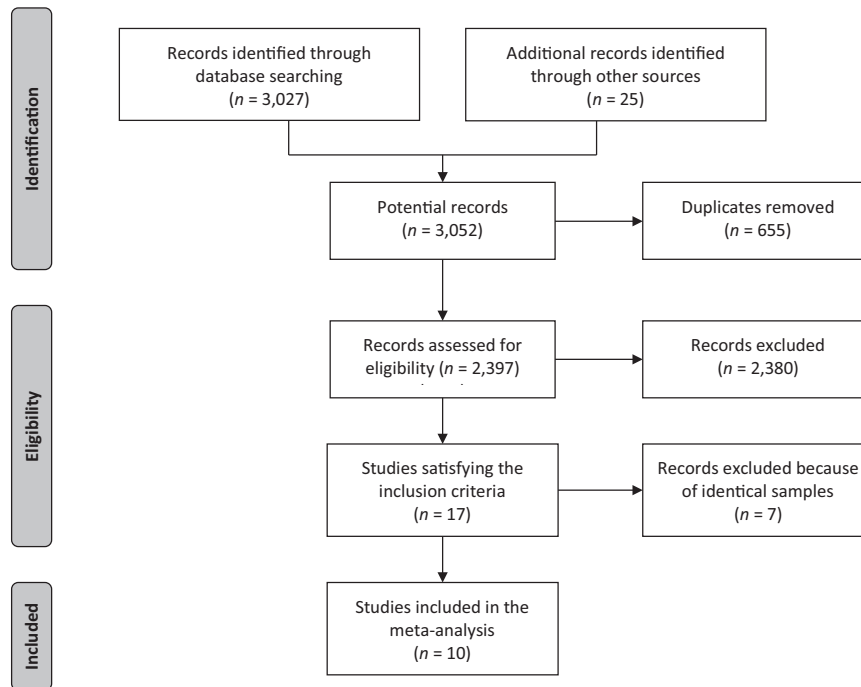
Figure 1 Flowchart of study selection in the systematic review (2006–2020)

the same data and reported the same outcomes, the study with the largest sample was included in the meta-analysis. In cases of two-stage data, the second sample was used to estimate the number of children with mental disorders and the initial sample was considered as base. In studies that included prevalence rates with and without the requirement of functional impairment, rates with a requirement of functional impairment were extracted. To ensure better comparison between studies, data were included for the meta-analysis regarding DSM-IV and the mother's report, if there were optional diagnostic criteria or informants.

Statistical analysis

The meta-analyses were performed using the metaphor package in R version 1.9-8 (Viechtbauer, 2010). Random-effects meta-analyses were conducted to estimate the pooled prevalence of any mental disorder, specific mental disorders, and comorbidity. Analyses on specific mental disorders were conducted for commonly reported diagnoses ($k \geq 4$ study samples). Extracted proportions were transformed into logits for more precise estimation (Lipsey & Wilson, 2001). If studies reported rates of 0%, we set these rates to 0.1% to define the logarithm. We calculated overall pooled effect sizes and the 95% confidence intervals, first including all studies and, next, excluding outliers. All values were then back-transformed using inverse logit transformation, to facilitate interpretation. Effects were considered outliers when their studentized deleted residuals were greater than 1.96 (Viechtbauer & Cheung, 2010). Outliers were extracted from the meta-analysis only if case deletion diagnostics showed that extraction of these effects would have an substantial effect on the fitted model (by analyzing Cook's distances) or on the variance–covariance matrix of the parameter estimates (by analyzing covariance ratios).

Using the restricted maximum likelihood method, we estimated heterogeneity with Cochrane's Q-test, the actual standard deviation on the logarithmic scale ($\hat{\tau}$), and I^2 statistics. Moderator analysis was conducted for the prevalence of any mental disorder. We included moderators identified as a significant source of variation in the previous meta-analysis by Polanczyk et al. (2015) as well as further predictors that might influence heterogeneity in the prevalence: location, sample frame, diagnostic instrument, study design, functional impairment (no or partly required vs. required for all disorders), number of diagnoses, and age group (older than three years vs. samples of younger children). We conducted univariate metaregression to analyze the effect of each predictor on heterogeneity.

Publication bias was tested with the two-tailed Egger's regression test that analyzes asymmetry in the funnel plot (Egger, Smith, Schneider, & Minder, 1997).

Results

The systematic review identified 17 studies encompassing $k = 10$ independent community samples. Studies of 18,282 children ages 12–83 months were included in the meta-analysis (Table 1). Symptoms were assessed using parent report referring to the present or recent past (up to 3 months). Studies often relied on birth registries ($k = 4$) or primary care practices ($k = 3$). Studies were conducted in eight countries – most of them in Western Europe ($k = 4$) or the USA ($k = 3$). Most studies were conducted in large city areas (Al-Jawadi & Abdul-Rhman, 2007; Ezpeleta, de la Osa, & Domenech, 2014; Gleason et al., 2011; Lavigne, LeBailly, Hopkins, Gouze, & Binns, 2009; Rijlaarsdam et al., 2015; Skovgaard et al., 2007). In two studies, data were collected in medium-sized cities (Petresco et al., 2014; Wichstrom et al., 2012), and further two studies in small cities (Bufferd, Dougherty, Carlson, & Klein, 2011; Carter et al., 2010).

Table 1 Description of studies identified by the systematic review

Study	Country	Years data collection	Frame	Study design	Response rate in %	Sample size	Age range in months (mean)	% male	Screening/diagnostic instrument	Diagnostic criteria	Number of diagnoses
Al-Jawadi and Abdul-Rhman (2007)	Iraq	2003/2004	Primary care	One-stage	95.4	829	12–48 (30.0)[b]	55.1	Interview form including DSM-IV criteria	DSM-IV	24
Bufferd et al. (2011)	USA	2004–2007	Commercial mailing lists	One-stage	66.4	541	36–50 (43.2)	54.1	PAPA	DSM-IV	14
Carter et al. (2010)	USA	2000–2004	Birth registers	Two-stage	89.1	1,329[a]	36–72 (54.0)[b]	49.6	ASBR, DISC-IV	DSM-IV	12
Ezpeleta et al. (2014)	Spain	2009/2010	Census of infant schools	Two-stage	58.7	1,341[a]	36–47 (45.6)	50.9	SDQ, DICA-PPC	DSM-IV	38
Gleason et al. (2011)	Romania	–	Primary care	Two-stage	69.5	1,003[a]	18–60 (41.2)	51.8	CBCL, PAPA	DSM-IV	18
Lavigne et al. (2009)	USA	–	Kindergarten, primary care	One-stage	47.5	796	47–60 (53.3)	49.1	DISC-YC	DSM-IV	8
Petresco et al. (2014)	Brazil	2004	Birth registers	One-stage	84.7	3,585	72–83 (81.6)	51.3	DAWBA	DSM-IV, ICD-10	28
Rijlaarsdam et al. (2015)	Netherlands	–	Birth registers	Two-stage	67.4	6,172[a]	60–83 (72.4)	50.0	CBCL, DISC-YC	DSM-IV	21
Skovgaard et al. (2007)	Denmark	2000	Birth registers	One-stage	65.0	211	17–19 (18.0)[b]	52.0	Interview with items from CBCL, CHAT, ITSCL, MEI and clinical judgment	DSM-IV, DC:0-3	10
Wichstrom et al. (2012)	Norway	2007/2008	Primary care	Two-stage	79.5	2,475[a]	46–63 (53.0)	49.1	SDQ, PAPA	DSM-IV	17

ASBR, Adaptive Social Behavior Ratings (Skovgaard et al., 2007); CBCL, Child Behavior Checklist (Achenbach & Rescorla, 2000); CHAT, Checklist for Autism in Toddlers (Baron–Cohen et al., 2000); DAWBA, Development and Well-Being Assessment (Goodman, Ford, Richards, Gatward, & Meltzer, 2000); DICA-PPC, The Diagnostic Interview of Children and Adolescents for Parents of Preschool Children (Ezpeleta et al., 2014); DISC-YC, Diagnostic Interview Schedule, Young Children (Lucas, Fisher, & Luby, 1998); ITSCL, The Infant–Toddler Symptom Checklist (DeGangi et al., 1995); MEI, Mannheim Eltern Interview (Esser et al., 1989); PAPA, Preschool Age Psychiatric Assessment (Egger & Angold, 2004); SDQ, Strengths and Difficulties Questionnaire (Goodman, 1997).
[a]In cases of two-stage design, only part of the sample was interviewed after screening the full sample.
[b]Estimated based on available data.

Since most studies assessed prevalence rates for any depressive disorder or combined rates for dysthymia and major depression, which were the most common diagnoses in this diagnostic group, we calculated the pooled prevalence for any depressive disorder and not for specific subcategories. We also calculated the prevalence of any anxiety disorder and of specific anxiety disorders.

Prevalence of any mental disorder

All 10 studies reported prevalence rates for any mental disorder (Figure 2). The overall pooled prevalence was 20.13%, 95% CI [15.72, 25.41]. There was substantial heterogeneity between the studies ($Q = 438.66$, $df = 9$, $p < .001$; $\hat{\tau} = 0.47$, 95%, CI [0.32, 0.88]; $I^2 = 98.28\%$). However, no study was identified as an outlier.

Specific disorders

Table 2 provides an overview of the pooled prevalence rates of specific disorders or groups of disorders (see Appendix S1 for forest plots of specific disorders). The highest pooled prevalence rates for a specific disorder were identified for attention-deficit hyperactivity disorder (ADHD: 2.73%–4.27%) and ODD (3.90%–4.90%; Table 2). Other common diagnoses were specific phobias (2.36%–3.23%), feeding disorders (1.36%–2.89%), and sleep disorders (1.65%–2.89%).

Most studies with effects that were detected as outliers identified lower rates than the remaining studies (Table 2; Al-Jawadi & Abdul-Rhman, 2007; Carter et al., 2010; Gleason et al., 2011; Petresco et al., 2014; Rijlaarsdam et al., 2015; Wichstrom et al., 2012). As regards to outliers with higher rates, the study by Al-Jawadi and Abdul-Rhman (2007) was identified as an outlier for PTSD and reactive attachment disorder. Bufferd et al. (2011) reported a substantially higher prevalence of social phobias and selective mutism than the remaining studies. The study by Ezpeleta et al. (2014) was also marked

as an outlier, with high prevalence rates for ADHD and sleep disorders. Even after excluding outliers, the heterogeneity of studies was substantial for almost all specific disorders, as indicated by the Q-test ($Q = 20.59$–446.99, $df = 3$–8, $p \le .001$). However, the Q-test showed no significant heterogeneity for reactive attachment disorder ($Q = 7.53$, $df = 3$, $p = .057$) or selective mutism ($Q = 1.78$, $df = 2$, $p = .412$). The percentage of variation across studies that is due to heterogeneity rather than chance was between $I^2 = 60.5$ and $I^2 = 98.98$. Tau ranged between $\hat{\tau} = 0.06$ and $\hat{\tau} = 1.27$.

Comorbidity

Seven studies assessed the prevalence of children having two or more diagnoses. The pooled prevalence of comorbidity was estimated at 5.51%, 95% CI [3.86, 7.80]. The study of Petresco et al. (2014) was identified as an outlier that exerted a substantial effect on the fitted model. Without this study, the pooled prevalence was 6.44%, 95% CI [1.33, 54.02]. Heterogeneity remained substantial ($Q = 20.59$, $df = 6$, $p = .001$; $\hat{\tau} = 0.25$, 95%, CI [0.12, 0.74]; $I^2 = 84.19\%$).

Metaregression

Metaregression analysis revealed no significant predictors of heterogeneity in the rates of any mental disorder (location: $QM = 0.61$, $df = 1$, $p = .433$; sample frame: $QM = 0.19$, $df = 1$, $p = .664$; diagnostic instrument: $QM = 1.91$, $df = 2$, $p = .384$; study design: $QM = 0.46$, $df = 1$, $p = .497$; requirement of functional impairment: $QM = 0.32$, $df = 1$, $p = .57$, number of diagnoses: $QM = 3.30$, $df = 2$, $p = .192$, age group: $QM = 0.01$, $df = 1$, $p = .877$).

Publication bias

For most analyses, Eggers' test was nonsignificant, indicating no publication bias ($|t| = 0.18$–2.69, $df = 3$–8, $p = .059$ $-.866$). There was significant
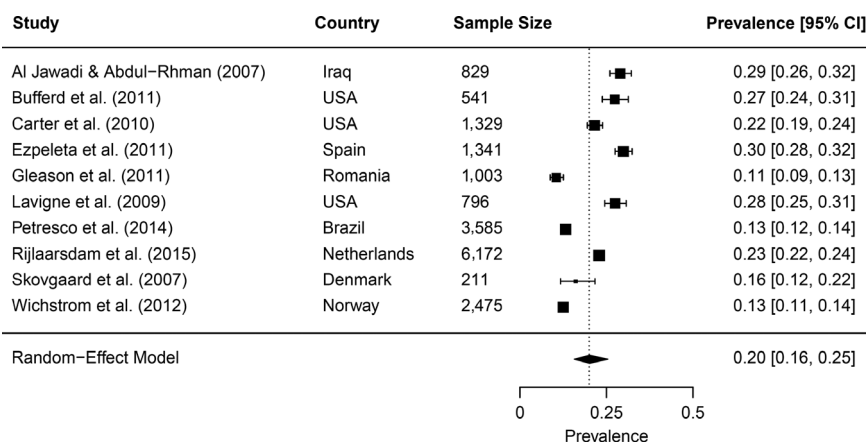

Study	Country	Sample Size	Prevalence [95% CI]
Al Jawadi & Abdul−Rhman (2007)	Iraq	829	0.29 [0.26, 0.32]
Bufferd et al. (2011)	USA	541	0.27 [0.24, 0.31]
Carter et al. (2010)	USA	1,329	0.22 [0.19, 0.24]
Ezpeleta et al. (2011)	Spain	1,341	0.30 [0.28, 0.32]
Gleason et al. (2011)	Romania	1,003	0.11 [0.09, 0.13]
Lavigne et al. (2009)	USA	796	0.28 [0.25, 0.31]
Petresco et al. (2014)	Brazil	3,585	0.13 [0.12, 0.14]
Rijlaarsdam et al. (2015)	Netherlands	6,172	0.23 [0.22, 0.24]
Skovgaard et al. (2007)	Denmark	211	0.16 [0.12, 0.22]
Wichstrom et al. (2012)	Norway	2,475	0.13 [0.11, 0.14]
Random−Effect Model			0.20 [0.16, 0.25]

Figure 2 Pooled prevalence of any mental disorders

Table 2 Pooled prevalence of specific mental disorders[a] and comorbidity

Diagnosis	Study prevalence (%)										Pooled prevalence (% [95% CI])	
	Al-Jawadi and Abdul-Rhman (2007)	Bufferd et al. (2011)	Carter et al. (2010)	Ezpeleta et al. (2014)	Gleason et al. (2011)	Lavigne et al. (2009)	Petresco et al. (2014)	Rijlaarsdam et al. (2015)	Skovgaard et al. (2007)	Wichstrom et al. (2012)	All studies	Without outliers
ADHD	0.0[b]	2.0	8.7	3.7	0.4[b]	12.8	2.6	8.0	2.4	1.9	2.7 [1.3, 5.8]	4.3 [2.5, 7.2]
ODD	0.4[b]	9.4	8.4	6.9	0.9	13.4	2.0	10.1	—	1.8	3.9 [1.8, 8.3]	4.9 [2.5, 9.5]
CD	0.8	—	1.2	1.4	0.2	—	0.6	0.2[b]	—	0.7	0.6 [0.4, 1.1]	0.8 [0.6, 1.2]
Depression	0.5	1.5	0.1[b]	3.4[b]	1.4	0.6	1.3	0.8	—	2.0	1.1 [0.7, 1.8]	1.1 [0.8, 1.6]
Any anxiety disorders	—	19.6	—	6.6	4.5	—	8.8	7.8	—	1.5[b]	6.4 [3.2, 12.4]	8.5 [5.2, 13.5]
Separation anxiety	0.8	5.4	2.2	2.2	1.3	—	3.2	0.9	—	0.3[b]	1.6 [0.8, 2.6]	1.9 [1.1, 3.2]
GAD	—	3.9	0.2	0.1	2.5	0.6	0.2	0.4	—	—	0.6 [0.2, 1.6]	—
Specific phobia	0.0[b]	9.1	9.0	3.7	0.3	—	5.4	6.1	—	0.7	2.4 [0.8, 6.7]	3.2 [1.3, 08.0]
Social phobia	—	4.4[b]	0.3	1.9	0.6	—	0.1[b]	1.2	—	0.5	0.8 [0.3, 1.9]	0.8 [0.4, 1.5]
PTSD	11.0[b]	—	0.3	0.0	0.2	—	0.8	0.1	—	—	0.5 [0.1, 2.0]	0.2 [0.1, 0.6]
RAD	6.5[b]	0.9	—	0.0	2.0	—	—	—	0.9	—	0.7 [0.2, 3.1]	0.4 [0.1, 1.1]
Feeding disorders	4.9	2.8	—	1.7	—	—	0.0[b]	—	2.8	—	1.4 [0.3, 6.3]	2.9 [1.7, 4.7]
Sleep disorders	—	—	—	13.3[b]	4.2	—	—	—	1.4	0.7	2.9 [0.8, 1.0]	1.7 [0.5, 4.5]
Selective mutism	0.1	1.5[b]	—	0.4	0.2	—	—	—	—	—	0.4 [0.1, 1.3]	0.3 [0.2, 0.6]
Tic disorders	1.2	—	1.7	2.1	—	—	0.4	0.0[b]	—	—	0.7 [0.2, 2.1]	0.1 [0.6, 2.4]
Comorbidity	—	9.2	5.8	7.5	3.9	6.4	2.2[b]	6.7	—	—	5.5 [3.9, 7.8]	6.4 [5.2, 7.9]

ADHD, attention-deficit hyperactivity disorder; CD, conduct disorder; GAD, generalized anxiety disorder; ODD, oppositional defiant disorder; PTSD, post-traumatic stress disorder; RAD, reactive attachment disorder.

[a]The table includes only mental disorders that were reported in at least four studies.

[b]Outliers with studentized deleted residuals ≥1.96 and covariance <1.

asymmetry in the funnel plot for ODD ($t = -2.42$, $df = 7$, $p = .046$) and reactive attachment disorder ($t = -7.17$, $df = 3$, $p = .006$). Especially for ODD, there was the tendency that large studies with small standard errors reported rather large effects while smaller studies reported smaller effects. Asymmetry was not more significant after excluding outliers (ODD: $t = -2.07$, $df = 6$, $p = .084$; reactive attachment disorder: $t = -1.65$, $df = 2$, $p = .241$). Overall, publication bias was not expected to be substantial, since the publication of epidemiological studies usually does not depend on significant results.

Discussion

The current meta-analysis aimed to estimate the worldwide prevalence of mental disorders and comorbidity in children younger than 7 years. Based on ten studies from eight countries, we found a 20.13%, 95% CI [15.72, 25.41] pooled prevalence of any mental disorder. This means that every fifth child suffers from a mental health problem that satisfies categorical diagnostic criteria. Except in one study (Al-Jawadi & Abdul-Rhman, 2007), functional impairment was required for all or part of the diagnoses. Furthermore, 6.44% of young children in community samples had two or more comorbid disorders. Hence, every third child with a mental disorder fulfills the criteria for at least one further psychiatric diagnosis, which might lead to higher functional impairment and more persistent symptoms (Egger & Angold, 2006).

Our findings are consistent with previous reviews estimating the prevalence of any mental disorder in very young children between 14.0% and 26.4% (Egger & Angold, 2006; von Klitzing et al., 2015). We found a slightly higher prevalence of any mental disorder than a meta-analysis of older children and adolescents, which identified a prevalence of 13.4%, 95% CI [11.3, 15.9] (Polanczyk et al., 2015). Comparing the results of the two meta-analyses of younger and older children is difficult because there were a different number of diagnoses investigated for the different age groups and the diagnostic criteria for young children have been criticized to be insensitive to detect symptoms in this age group. The prevalence in the current meta-analysis usually referred to the past three months while studies of older children and adolescents used different tame frames (current, 6-month, or 12-month prevalence). However, the slightly higher prevalence compared to older children and adolescents could be because some disorders typically manifest in younger children (e.g., sleep disorders and separation anxiety). From a developmental psychopathological point of view, children who deviate from normal development at an early stage can still achieve adequate adaptation and return to normal using their resources (Sroufe, 1997). It is also possible that previous or ongoing psychotherapy in older children and adolescents had positive effects and reduced rates of mental disorders (Weisz et al., 2017). Furthermore, there could be informant bias: symptoms were reported by the parents in our meta-analysis, while older children and adolescents rated their symptoms on their own in the previous meta-analysis of Polanczyk et al. (2015).

The prevalence of specific disorders was similar for young and older children and adolescents for ADHD, ODD, and any anxiety disorder (Polanczyk et al., 2015). One potential explanation for the similar prevalence rates could be a strong genetic risk for these disorders (Demontis et al., 2019; Shimada-Sugimoto, Otowa, & Hettema, 2015). On the other hand, the findings might be interpreted in the context of very early-onset environmental determinants of child psychopathology (Koss & Gunnar, 2018).

In the current meta-analysis, we found lower prevalence rates for conduct disorder and depression than previously reported for older children and adolescents (Polanczyk et al., 2015). For conduct disorder, these discrepancies might be associated with increased rates of adolescence-limited antisocial behavior in the older sample (Moffitt, 1993). The higher rates of depression in older children and adolescents could be due to the progressing socioemotional and cognitive development that is associated with internalizing symptoms (Kilford, Garrett, & Blakemore, 2016).

Although there was substantial heterogeneity between single study effects, we could not find significant sources of variation. In contrast, Polanczyk et al. (2015) identified study location, data frame, diagnostic instrument, and requirement of functional impairment as accounting for a significant proportion of the heterogeneity between studies. Especially requirement of functional impairment has been recognized important in the diagnostics of mental disorders in preschool children (Egger & Angold, 2006). Our literature review showed that most epidemiological studies of young children have also included functional impairment as critical aspect to differentiate normal variation in child behavior from mental disorders that might require therapeutic help.

We detected few studies as outliers showing possible reasons for variation. For example, Al-Jawadi and Abdul-Rhman (2007) conducted an epidemiological study in Iraq and found high prevalence rates for trauma- and stress-related disorders compared to the remaining studies. These findings are most likely associated with children's high exposure to violence and deprivation, due to the political and humanitarian situation in that country (AlObaidi, Jeffrey, Scarth, & Albadawi, 2009). Another outlier effect that substantially changed the pooled prevalence of sleep disorders was found in the study of Ezpeleta et al. (2014) in Spain. The higher prevalence

there might indicate potential cultural or environmental effects. Although the previous meta-analysis of the prevalence of mental disorders in older children and adolescents did not detect any cultural influence (Polanczyk et al., 2015), we could not preclude such an effect, because only eight countries were represented.

Limitations

There were certain limitations that should be considered when interpreting our results. We selected only papers that reported multiple diagnoses and excluded potential studies that estimated the prevalence of a single diagnosis. Some epidemiological studies did not report prevalence rates for less-frequent disorders. Therefore, we could not calculate pooled estimates for some disorders like mixed disorders of conduct and emotions. Furthermore, the small number of effects that were included in some meta-analyses, especially of specific disorders, could lead to imprecision in the prevalence estimates. In the metaregression, including only a few studies could lead to insufficient statistical power to detect small moderator effects on heterogeneity. We combined results for children younger and older than three years. Even though in our analysis younger age could not explain heterogeneity between studies, mental disorders are expected to manifest differently at different developmental stages. It should be acknowledged that, although our aim was to estimate worldwide prevalence, we could not conclude that the pooled prevalence based on studies from eight countries is representative of worldwide prevalence. Finally, our results were mainly based on DSM-IV and give no reference to DSM-5, ICD, or DC: 0-5.

Implications

The current results have important clinical and research implications. The high prevalence of mental disorders emphasizes the necessity of appropriate treatment. There are some effective interventions for young children that can be provided to children in need (von Klitzing et al., 2015). Most of the children with a mental disorder in our meta-analysis had a single diagnosis. Hence, early interventions might help to prevent mental problems from becoming more complex and developing comorbidity. On the other hand, one third of young children with mental disorders fulfilled the criteria for more than one diagnosis. These children might need more intensive help because comorbidity often complicates and even hinders the successful treatment (Weisz et al., 2017).

Our findings show that the epidemiology of mental health in young children is still a neglected area. While Polanczyk et al. (2015) found and synthesized prevalence rates from 198 studies of older children and adolescents, we only found ten studies on independent samples of children younger than 7 years. More research is needed in this area to estimate prevalence rates more precisely and specifically to each developmental stage (infants, toddlers, preschool children), and to detect potential sources of variability. Furthermore, future epidemiological studies should pay more attention to developmental peculiarities of this age such as heterogeneity in child development and dependence on caregivers to regulate emotions. Although the DC: 0–5 addresses developmental variations in the classification of disorders in young children, only one study used these criteria, while most were based on the DSM-IV. It should also be acknowledged that this review and meta-analysis is based on previously published studies and does not answer questions such as to what extend mental health problems in young children can be seen as disorders and if we have the reliable classification and diagnostic tools to assess such disorders. However, since this is the first meta-analysis of the prevalence of mental disorders in children younger than 7 years, the pooled prevalence rates we found could be used as benchmarks to compare against the future results of epidemiological studies.

Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article:

Appendix S1. Forest plots for the prevalence of specific disorders.

Acknowledgements

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Key points

- There are few previous reviews estimating the prevalence of mental disorders in children between 1 and 7 years. None has so far included a meta-analytical strategy.
- A meta-analysis based on ten epidemiological studies published between 2006 and 2020 estimated a 20.1% pooled prevalence for any mental disorder in children ages 12–83 months. The pooled prevalence for a specific disorder was between 0.1% and 4.9%, and 6.4% for comorbidity.
- More research with developmentally sensitive diagnostic criteria is needed to estimate prevalence rates more precisely and to detect sources of variability.
- There is a substantial number of young children who need appropriate treatment.

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