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Review Article

Epidemiology of Somatoform Symptoms and Disorders in Childhood and Adolescence: A Systematic Review and Meta-Analysis

Christina Vesterling, Jessica Schütz-Wilke, Neele Bäker, Tijs Bolz, Jule Eilts, Ute Koglin, Annika Rademacher, and Naska Goagoses

Department of Special Needs Education and Rehabilitation, Carl von Ossietzky University of Oldenburg, Ammerlaender Heerstr. 114-118, 26129 Oldenburg, Germany

Correspondence should be addressed to Christina Vesterling; christina.vesterling@uni-oldenburg.de

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The aim of the current systematic review and meta-analysis was to examine the prevalence and incidence of somatoform symptoms and disorders (also referred to as medically unexplained symptoms, psychosomatic symptoms, functional syndromes, somatization disorder, or somatic symptom disorder) in childhood and adolescence. The PRISMA guidelines were followed, and the review was registered prior to initiation (PROSPERO CRD42022339735). Fitting search terms were entered in Web of Science, Scopus, and PubMed in June, 2022. Included were articles, reports, book chapters, and conference papers that reported on the prevalence or incidence rates of somatoform symptoms and disorder in under-18-year-olds with empirical primary data; these needed to be published in English or German. Publications were excluded if they focused on abuse, trauma, serious illness, or hypochondria, as well as if they had a qualitative or experimental (intervention) study design. To be included in the meta-analysis, studies needed to report values suitable to calculate a pooled prevalence or incidence rate. After the full-text screening, 33 articles remained, of which 29 were used for the meta-analysis. The quality evaluation criteria proposed by Loney and colleagues (1998) were utilized for quality assessment. The pooled global prevalence rate was 31.0% for somatoform symptoms and 3.3% for somatoform disorders, yet heterogeneity remained high. The noteworthy prevalence rates have important implications for healthcare professionals, as well as school nurses and counselors.

1. Introduction

Children and adolescents may suffer from recurring medically unexplained or somatoform symptoms, such as headaches, abdominal pain, nausea, and dizziness, that significantly restrict their daily lives [1–5]. These physical symptoms, for which no sufficient organic cause could be found [6], were first summarized under the DSM-III psychiatric diagnosis category of somatoform disorders in 1980 [7, 8]. In the DSM-IV subgroups of somatoform disorders were described (i.e., somatization disorder, undifferentiated somatoform disorder, conversions disorder, pain disorder, hypochondriasis, body dysmorphic disorder, and somatoform disorders not otherwise specified), each of which differed in the required diagnostic criteria [9]. The DSM-5 altered the criteria for somatoform disorders, so that the absence of an organic reason for the physical complaints is no longer included, and instead, the presence of symptom-based impairments in daily life is required [10–14].

Somatoform symptoms and disorders have serious consequences at the individual, familial, and ultimately societal level [1, 2, 4, 15]. During childhood and adolescence, somatoform symptoms and disorders are linked with low self-efficacy, increased withdrawal behavior, and the avoidance of school and social recreational activities

[3, 5, 16, 17]. Due to repeated school absences, academic achievement decreases [18] and the children are often pushed into an outsider role, bullied, and stigmatized by their peers, which in turn reinforces the tendency to avoid school [19, 20]. Essentially, there is not only a decrease in the children's level of functional capabilities but also an increase in health-related burdens in affected families [3, 15, 21].

Parents stay away from work to care for their children, which can lead to stress and have consequences on parents' employment and financial security [22]. Furthermore, parents may begin to worry and get anxious about their child's reoccurring symptoms, and get overwhelmed by the need to provide adequate support [23]. Pediatricians are often the first contact point, but despite medical examinations, an organic cause to explain the symptoms may not be identified [3, 24–26]. As symptoms persist, parents may be concerned that a serious disease has been overlooked and engage in "doctor shopping" behavior with the desire for more extensive medical examinations [27]. This can be associated with excessive utilization and significant additional costs for the health care system or, if this does not exist, for the affected families themselves [3, 27, 28].

In the school setting, another first point of contact for children and adolescents with somatoform symptoms and disorders is school nurses or counselors [29]. There are a number of important tasks for school nurses in this context. These may include, for example, working with the children and their parents to identify possible school-related reasons for the frequent occurrence of physical complaints. It is equally important to ensure an organic diagnosis by the pediatrician. In addition, it may also be necessary to inform affected children and their parents about possible psychological causes of symptoms. This could eliminate uncertainties and promote acceptance or recognition of psychology-based symptoms [29].

2. Current Systematic Review and Meta-Analysis

As described above, somatoform symptoms and disorders have detrimental consequences for the children themselves and their parents [1, 2, 4, 15]. We maintain that the first step in assisting them, as well as pediatricians and school nurses/counselors, who are the nearest contact points, is to get an overview of the epidemiology of somatoform symptoms and disorders in childhood and adolescence. Furthermore, research in the field of medicine and psychology would also benefit from a systematic aggregation of prevalence and incidence rates to avoid over- or under-estimations of their occurrence [5, 30–35]. Hence, the aim of the current systematic review and meta-analysis was to aggregate study findings to answer the following question:

What are the prevalence and incidence rates of somatoform symptoms and disorders in under-18-year-olds?

As children and adolescents may suffer from somatoform symptoms but do not always meet the required diagnostic criteria for a somatoform disorder diagnosis [3, 30, 36], we separately examine the prevalence rates for somatoform symptoms and somatoform disorders. As the occurrence of somatoform symptoms could differ for females and males, due to early childhood attachment experiences, outdated educational attitudes, and biological differences, such as menstrual complaints [2, 3, 37], we examined potential sex differences in the prevalence rates for somatoform symptoms and somatoform disorders. Lastly, differences related to the methodological aspects of the studies were also examined (i.e., sample size, sample type, and aspects related to the assessment).

3. Methods

For the current systematic review and meta-analysis, we followed the PRISMA guidelines [38]. EPPI-Reviewer [39] and RStudio 2021 [40] were used to conduct our analysis. The review was registered in PROSPERO (CRD42022339735).

3.1. Search Strategy. To identify studies reporting on the prevalence and incidence rates of somatoform symptoms and disorders in under-18-year-olds, the following search terms were entered into the databases Web of Science, Scopus, and PubMed in June, 2022:

((somat* OR "medi cal* unexplained*" OR psychosomat* OR psycholog* OR psychogen* OR psychophysiol* OR "functional* pain*" OR nonspecific* OR nonorganic*) NEAR/1 (syndr ome* OR di sorde r* OR illness* OR symptom* OR neuro*)) AND (epide miolog* OR prevalence* OR incide nce*) AND (Child* OR ado lescent* OR pediatric* OR youth OR student* OR pupil*) NOT (hypochondria* OR maltreat* OR abuse* OR neglect* OR violenc* OR trauma)

The search terms for somatoform symptoms and disorders were entered at the title level, whilst the others were set at title-abstract-keywords (topic). To account for the varying somatoform terminologies, the search terms were created based on the comprehensive search criteria list published by Schaefert et al. [41]. In accordance with Creed's and colleagues' [30] assumptions that there are clear differences but also overlaps, in the sense that *somatoform disorders* can be seen as subgroups of the broadly diversified group of *medically unexplained symptoms* [30], the keywords in the meta-analysis were selected in such a way that all relevant operationalizations were captured in them.

3.2. Eligibility Criteria. To be included, records needed to (1) report prevalence and/or incidence rates of somatoform symptoms and disorders in under-18-year-olds (i.e., have this as one of their aims), (2) report primary data, (3) be published in a journal (i.e., article), a book (i.e., a chapter), or conference proceedings (i.e., short or full paper), and (4) be published in English or German. Regarding the definition of somatoform symptoms and disorders, we opted to rely on the declarations of the authors of the studies (i.e., authors' statements about their examination of somatoform symptoms and/or disorders). Records were excluded if they (1) focused on abuse, neglect, maltreatment, trauma, or violence, (2) focused on hypochondria, (3) had a qualitative or experimental study design, or were intervention or

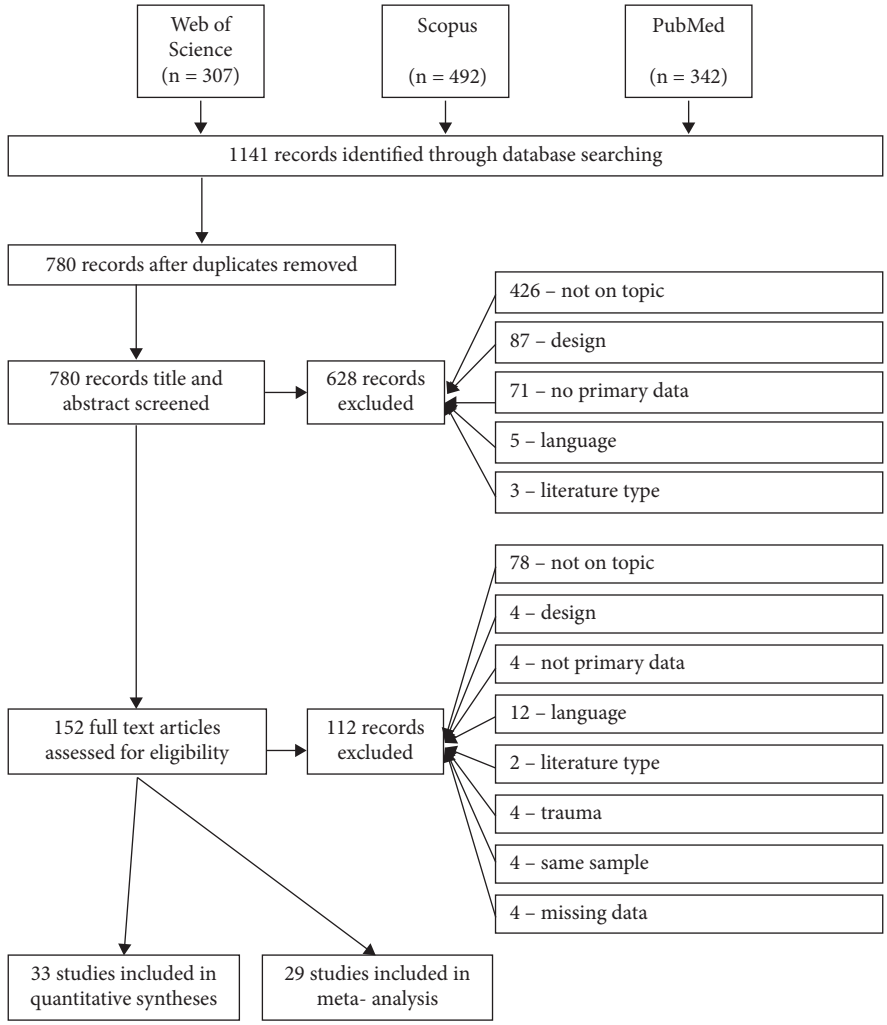

Figure 1: Flow diagram.

prevention studies, (4) reported secondary data (e.g., reviews and meta-analyses), and (5) were published as conference abstracts or posters, dissertations, letters, editorials, or full books. During the full-text screening, a focus on serious illness was added to the first exclusion criteria (amendment).

3.3. Article Selection and Data Extraction. A flow diagram depicting the article selection is displayed in Figure 1. After duplicate removal, a total of 780 articles remained. The eligibility criteria were applied by two independent coders in the title and abstract screening (90.4% agreement on inclusion/exclusion) and the full-text screening (92.2% agreement on inclusion/exclusion); an additional 24 articles were removed after team discussions. Furthermore, some articles relied on the same data [42–49], so we removed those with less information regarding our research question. Lastly, four articles [4, 50–52] were removed as vital data were missing (e.g., overall prevalence or general *N*). Three coders collaboratively extracted relevant data from the remaining articles, e.g., methodological characteristics of the studies, prevalence rates, and so on. If studies reported prevalence rates at multiple time points, we utilized those from T1, and if multiple respondents were included, we utilized the children's self-reports.

3.4. Meta-Analysis. To be included in the meta-analysis, studies must report at least one value that is suitable to calculate a pooled prevalence. For the meta-analytic calculations, two additional information were required, namely, (6) the general *N* and (7) *n* of events (number of people within the general *N* that have somatoform symptoms/disorders). The meta-analytical calculations were carried out in RStudio 2021 [40]. The statistical packages "meta" [53], "metafor" [54], "dmetar" [55], and "tidyverse" [56] were used. Random effects models were reported [57–60]. Additionally, we reported Chochran's Q and I^2 statistics [61] to test for heterogeneity. Since meta-analysis with pooled prevalence generally yields high I^2 values [62], which are not synonymous with high heterogeneity, prediction intervals were calculated as well (PI; [63]). Due to expected high

Table 1: Overview of the included studies.

Authors	Prevalence rates for	Year (s)	Country	Sample	*N*	Age (years)	Sex (female %)	Type of assessment	Quality assessment
Al Gelban [67]	Symptoms	2006-2007	Saudi Arabia	Community	545	14–19	100	Questionnaire/list	2
Alfvén [68]	Symptoms	NP	Sweden	Community	1333	7–15	NP	Questionnaire/list	2
Aro et al. [69]*	Symptoms	1981	Finland	Community	2246	14-15	48.8	Questionnaire/list	2
Balduzzi et al. [42]	Symptoms	2008	Sweden	Community	7757	13–18	50.1	Questionnaire/list	1
Belmaker [70]	Symptoms	NP	Israel	Community	239	9–14	100	Questionnaire/list and physical examination	3
Belmaker et al. [71]	Symptoms	1980	Israel	Community	456	12–14	55.0	Questionnaire/list	3
Berntsson and Köhler [72]	Symptoms	1984	Denmark, Finland, Iceland, Norway, Sweden	Community	2219, 2705, 1577, 1856, 1934	2–17	49.5	Questionnaire/list	2
Bisht et al. [73]	Symptoms and disorders	2004-2005	NP	Pediatric	20178	≤18	NP	Psychiatric evaluation	3
Cerutti et al. [74]	Symptoms	NP	Italy	Community	356	8–15	49.4	Questionnaire/list	1
Cohen et al. [75]	Symptoms	1983	USA	Community	760	9–18	NP	Interview	1
Cozzi et al. [76]	Disorders	2014-2015	Italy	Pediatric	306	7–17	41.5	Medical examination	2
Dhossche et al. [77]	Symptoms and disorders	1989	Netherlands	Community	707	12–16	NP	Questionnaire/list	1
Domènech-Llaberia et al. [78]	Symptoms	2000	Catalonia	Community	697	3–6	48.0	Questionnaire/list	1
Essau et al. [44]	Symptoms and disorders	1996-1997	Germany	Community	1035	12–17	59.3	Interview	2
Fawzy et al. [79]	Symptoms	2010	Egypt	Community	294	6–12	22.5	Questionnaire/list	3
Serra Giacobo et al. [80]	Symptoms	NP	Spain	Community	319	3–6	40.1	Questionnaire/list	2
Glozah and Pevalin [81]	Symptoms	NP	Ghana	Community	744	14–21	34.6	Questionnaire/list	2
Gupta et al. [82]	Symptoms and disorders	NP	India	Pediatric	3214	4–18	NP	Physical examination and mental health evaluation	3
Janiak-Baluch and Lehmkuh [83]	Disorders	2012	Germany	Pediatric	511	11–17	48.3	Questionnaire/list	1
Kingery et al. [84]	Symptoms	NP	USA	Community	114	14–19	50.0	Questionnaire/list	2
Larsson [85]*	Symptoms	NP	Sweden	Community and Pediatric	539	13–18	57.5	Questionnaire/list	1
Linna et al. [86]	Symptoms	NP	Finland	Community	1101	8	48.4	Questionnaire/list	2
Rask et al. [48]	Symptoms	2007	Denmark	Community	105	5–10	NP	Interview	2
Rask et al. [46]	Symptoms	2005–2007	Denmark	Community	1327	5–7	50.3	Interview	1
Rehna et al. [87]	Symptoms	2014	Pakistan	Community	663	12–16	34.4	Questionnaire/list	2
Romero-Acosta et al. [88]	Symptoms	2006-2007 and 2010	Spain	Community	2558	8–16	50.7	Questionnaire/list	1
Santalahi et al. [89]*	Symptoms	1989	Finland	Community	1677	8	46.5	Questionnaire/list	2
Silverstein et al. [90]	Symptoms	NP	NP	Community	297	NP	100	Questionnaire/list	3
Steinhausen and Metzke [91]*	Symptoms	1994	Switzerland	Community	593	6–17	52.1	Questionnaire/list	2
Suvinen et al. [92]	Symptoms	NP	Finland	NP	128	15	53.1	Questionnaire/list	3

Table 1: Continued.

Authors	Prevalence rates for	Year (s)	Country	Sample	*N*	Age (years)	Sex (female %)	Type of assessment	Quality assessment
Tamminen et al. [93]	Symptoms	NP	Finland	Community	1000	8	49.5	Questionnaire/list	2
van Geelen et al. [94]	Symptoms and disorders	2011	Sweden	Community	2476	$M_{age} = 16$	51.0	Questionnaire/list	1
Vanaelst et al. [95]	Symptoms	2009-2010	Belgium, Cyprus, Estonia, Germany, Hungary, Italy, Spain, and Sweden	Community	343, 469, 763, 337, 643, 520, 520, 472, and 519	4–11	50.3	Questionnaire/list	1

*Excluded from the meta-analysis; NP: not provided; quality assessment: category 1 consists of scores 7-8, category 2 consists of scores 4.5–6.5, and category 3 consists of scores 0–4.

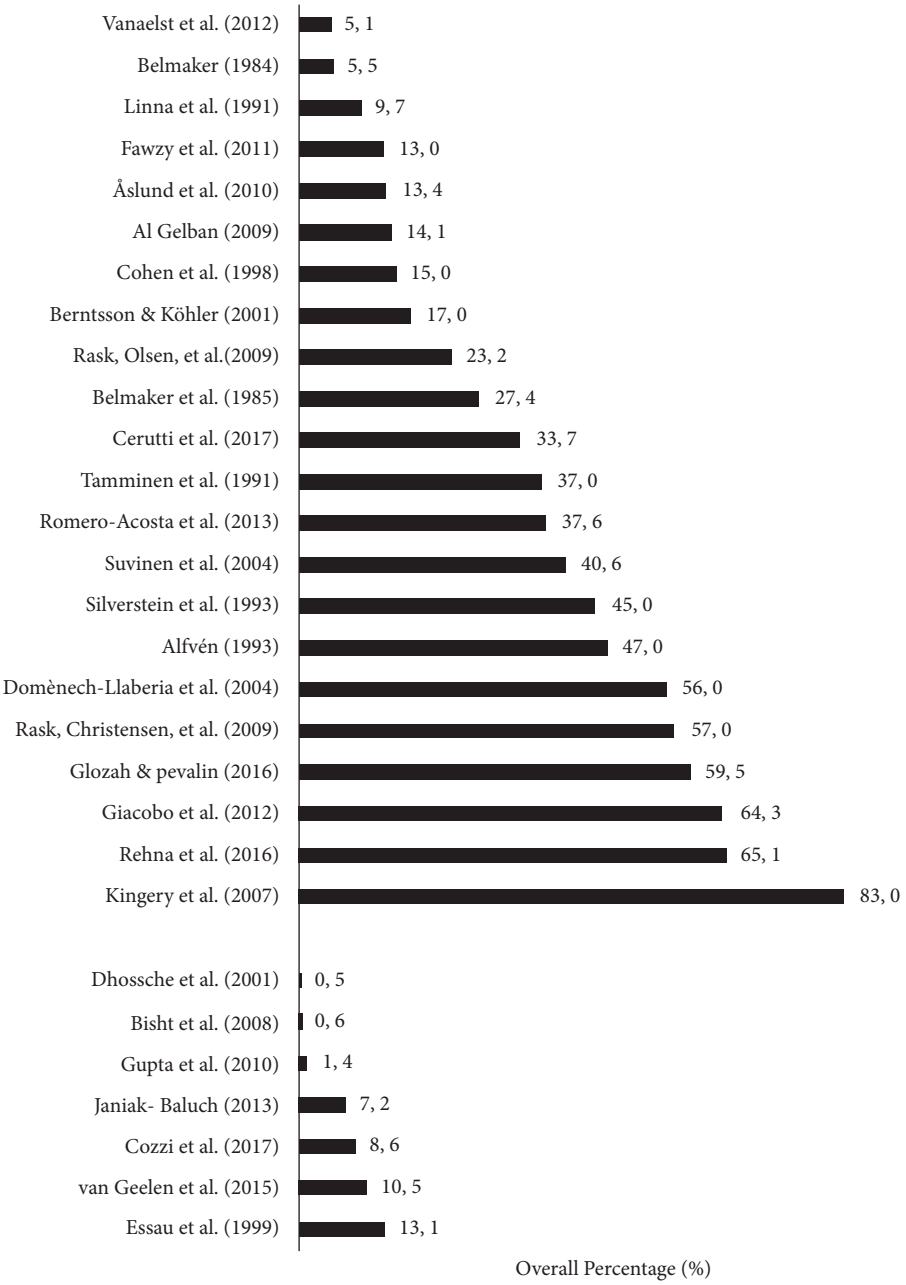

Figure 2: Overall prevalence rates of somatoform symptoms (top) and disorders (bottom). *Note.* Only studies included in the meta-analysis are presented here.

heterogeneity, subgroups were investigated [57]. Additionally, outlier analysis, influence diagnoses, and Baujat plots were analyzed [55, 64]. The exclusion did not change the heterogeneity; therefore, the outliers were included in all analyses.

3.5. Quality Assessment. We used the criteria proposed by Loney et al. [65] to assess the methodological quality of the included studies. The 8-item checklist assesses whether studies use objective and suitable measurement criteria for assessing health outcomes, whether the data on prevalence and incidence rates were subdivided according to subgroups and presented with an indication of confidence intervals, and the use of an appropriate sampling method [65, 66]. The quality assessment was completed by two independent coders, with the inter-rater agreement for the 33 laying at $\kappa = 0.65$, which indicates the proportion of agreement exceeded chance ($z = 5.99$, $p = 0.215$). The quality assessment was divided into three categories to evaluate the quality of the studies. The score 8 indicates the highest quality to be assessed on the basis of the available criteria. Category 1 consists of scores 7-8, category 2 consists of scores 4.5–6.5, and category 3 consists of scores 0–4. The scores were averaged from the ratings of the two raters of the quality assessment.

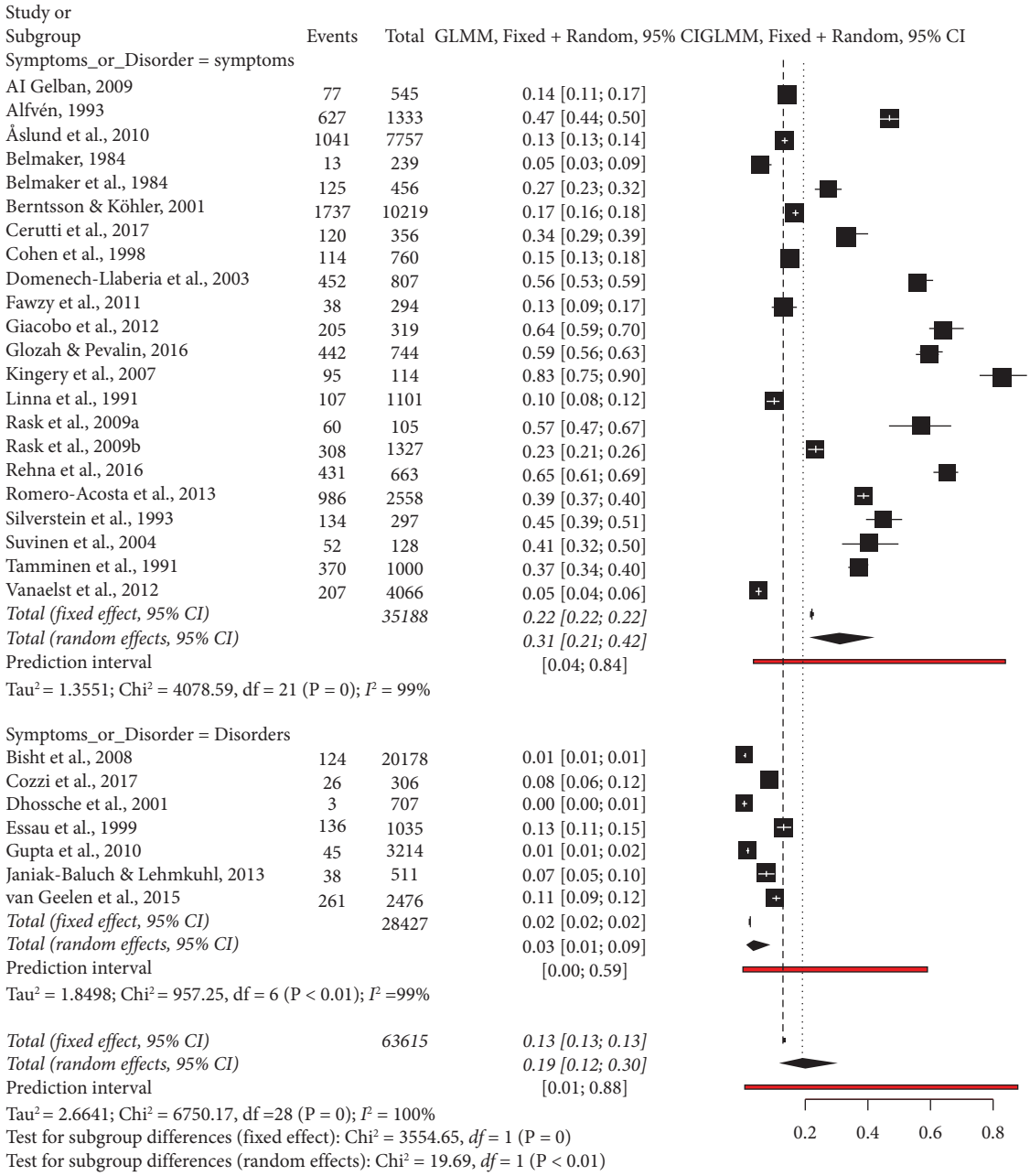

Figure 3: Forrest plot general model. *Note.* The included articles report an overall pooled prevalence of 19% (CI = 12%; 30%; PI = 1%; 88%) with high heterogeneity ($Q = 6750.17^{***}$, $I^2 = 99.6\%$). Subgroup analysis showed a significant difference in overall symptoms and disorders (contrast $Q = 19.69$; $p < 0.001$).

Table 2: Prevalence rates of somatoform symptom types (percentage).

Author (s)	Abdominal pain	Headache	Dizziness	Fatigue	Leg/arm/ back pain
Alfvén [68]	19.2	26.6	—	—	—
Belmaker et al. [71]	55.1	60.5	29.5	52.0	38.0
Domènech-Llaberia et al. [78]	38.8	16.7	2.2	20.4	17.0
Serra Giacobo et al. [80]	44.8	17.6	1.9	26.0	14.2
Linna et al. [86]	2.4	2.8	—	—	—
Rask et al. [46]	23.1	18.8	—	—	40.3
Romero-Acosta et al. [88]	38.8	48.3	19.4	28.4	—
Santalahi et al. [89]	11.9	11.9	—	—	—
Steinhausen and Winkler Metzke [91]	3.0	5.9	1.2	3.0	—
Mean	26.3	23.2	10.8	26.0	27.4

Table 3: Subgroup analyses for somatoform symptoms.

	k	N	%	95% CI	Q	τ^2	I^2	PI	Contrast Q	Contrast p
Sex									0.80	0.372
Female	9	11815	38.93	0.28; 0.51	684.36**	0.56	98.8	0.09; 0.80		
Male	9	12306	29.34	0.16; 0.48	1611.43***	1.48	99.5	0.02; 0.90		
Sample size									0.24	0.623
<300	6	1177	36.01	0.15; 0.64	227.33**	2.07	97.8	0.01; 0.98		
>300	16	34011	29.04	0.20; 0.41	3771.19***	1.08	99.6	0.04; 0.80		
Number of symptoms needed									2.97	0.085
One	17	24747	35.26	0.24; 0.49	2909.25***	1.32	99.4	0.04; 0.87		
Multiple	5	10441	16.33	0.09; 0.34	810.24**	0.89	99.5	0.01; 0.86		
Enumerator									9.10	0.003
Healthcare professional	2	784	9.22	0.05; 0.18	11.45**	0.24	91.3	—		
Other	7	12056	39.47	0.20; 0.63	1294.86**	1.65	99.5	0.02; 0.96		
Period of occurrence									2.24	0.135
<6 months	11	17745	34.14	0.21; 0.51	1509.39**	1.33	99.3	0.03; 0.89		
≥6 months	3	35188	15.53	0.05; 0.37	221.47**	1.06	99.1	0.00; 1.00		
Consideration of criteria									0.04	0.832
Yes	10	7221	29.67	0.18; 0.44	616.22**	1.04	98.5	0.03; 0.83		
No	12	27967	31.89	0.19; 0.49	2936.68***	1.61	99.6	0.02; 0.90		

If $k = 1$ the calculation is not possible; PI: prediction interval, studies that did not provide information on the respective subgroup (N.A.) were excluded for the respective analysis.

4. Results

Table 1 provides an overview of the 33 included studies. The studies encompassed samples from North America ($n_{samples} = 2$), Africa ($n_{samples} = 2$), Asia ($n_{samples} = 5$), and Europe ($n_{samples} = 33$), mainly from Scandinavia ($n_{samples} = 17$). The majority of the studies included a community sample (e.g., recruited at schools or through public registries), whilst only a few included a pediatric sample (e.g., patients from hospitals and in- and out-patients at pediatric practices). Ten studies assessed prevalence rates during adolescence (12 years and older) and eight studies during childhood (3 to 11 years); the other 15 studies varied across the whole age range (≤18 years). 26 studies reported prevalence rates of somatoform symptoms and 7 of somatoform disorders. No studies provided data on incidence rates, and only one reported lifetime prevalence [44]. In total, 26 studies utilized a questionnaire or list to assess somatoform symptoms or disorders. Quality assessment shows by means of subdivision of the scores obtained by both raters that 11 studies can be assigned to category 1, 15 studies to category 2, and 7 studies to category 3.

The overall prevalence rates of somatoform symptoms and disorders reported by the studies are displayed in Figure 2. The meta-analysis included $k = 29$ ($N = 63615$) articles. The results of the general analysis are depicted in the forest plot in Figure 3.

4.1. Prevalence Rates of Somatoform Symptoms. Of the 26 studies that examined somatoform symptoms, 22 studies provided overall prevalence rates, which ranged between

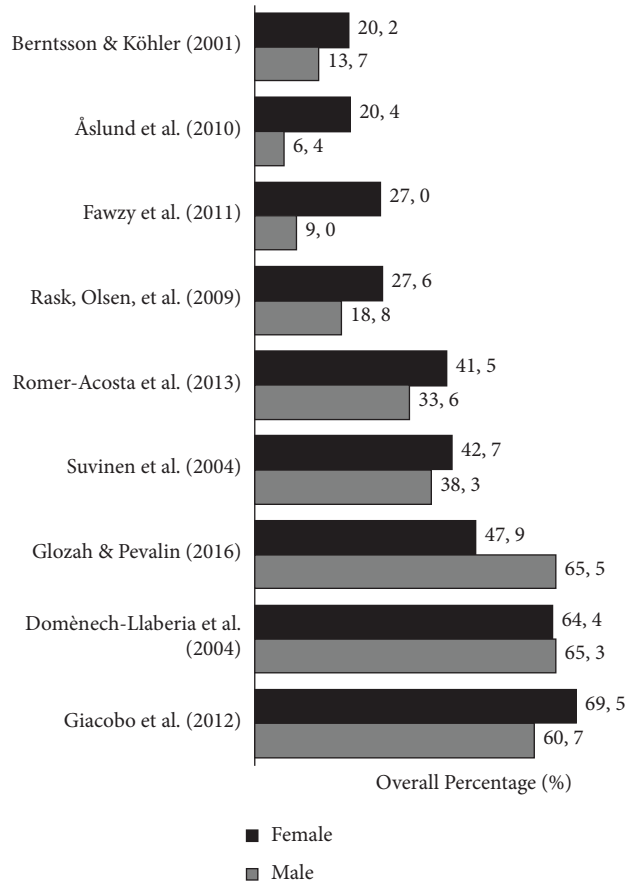

Figure 4: Prevalence rates of somatoform symptoms for females and males.

Table 4: Examined methodological characteristics for studies reporting on somatoform symptoms.

Authors	Sample size (subgroup)	*Assessment*				
		Number of symptoms assessed	Number of symptoms needed	Consideration of criteria	Enumerator	Period of occurrence
Al Gelban [67]	>300	12	More	No	University students and staff	1 week
Alfvén [68]	>300	6	One	No	Teacher and school nurse	NP
Aro et al. [69]*	>300	12	NP	No	Research team	4 months
Balduzzi et al. [42]	>300	5	More	No	NP	NP
Belmaker [70]	<300	5	One	Yes	Medical doctor	NP
Belmaker et al. [71]	>300	7	One	Yes	NP	Daily
Berntsson and Köhler [72]	>300	6	One	No	NA (postal)	3 months
Cerutti et al. [74]	>300	24	One	Yes	NP	2 weeks
Cohen et al. [75]	>300	NP	One	Yes	NP	12 months
Domènech-Llaberia et al. [78]	>300	5	One	Yes	NP	2 weeks
Fawzy et al. [79]	<300	35	More	Yes	NP	2 weeks
Serra Giacobo et al. [80]	>300	5	One	Yes	Research team	2 weeks
Glozah and Pevalin [81]	>300	8	More	No	NP	NP
Kingery et al. [84]	<300	12	One	No	Graduate research assistants	2 weeks
Larsson [85]*	>300	23	NP	No	Graduate students	2 weeks
Linna et al. [86]	>300	5	More	No	Teachers	Once a week
Rask et al. [48]	<300	18	One	Yes	Clinical assessor (i.e., a physician)	3 months
Rask et al. [46]	>300	18	One	Yes	Lay interviewers	2 weeks
Rehna et al. [87]	>300	4	One	No	NP	NP
Romero-Acosta et al. [88]	>300	5	One	Yes	NP	3 months
Santalahi et al. [89]*	>300	4	NP	No	NP	12 months
Silverstein et al. [90]	<300	3	One	No	NP	NP
Steinhausen and Metzke [91]*	>300	9	More	Yes	NP	6 months
Suvinen et al. [92]	<300	17	One	No	NP	6 months
Tamminen et al. [93]	>300	4	One	No	NP	NP
Vanaelst et al. [95]	>300	4	One	No	NP	6 months

*Excluded from the meta-analysis; reported values are those used for the meta-analysis (e.g., T1); NP: not provided; occurrence indicates which time frame was assessed (e.g., participants indicating the occurrence in the past 2 weeks).

Table 5: Subgroup analyses for somatoform disorders.

	k	N	%	95% CI	Q	τ^2	I^2	PI	Contrast Q	Contrast p
Sex									15.03	<0.001
Male	4	2078	7.22	0.06; 0.08	5.24	0.01	42.7	0.04; 0.12		
Female	4	2250	12.99	0.10; 0.16	8.31*	0.03	63.9	0.05; 0.28		
Type of sample									0.18	0.675
Community	3	28427	4.23	0.01; 0.22	39.21**	2.52	94.9	0.00; 1.00		
Pediatric	4	24209	2.71	0.01; 0.08	274.67**	1.29	98.9	0.00; 0.87		

If $k = 1$ the calculation is not possible; PI: prediction interval.

5.1% and 83.0%. The meta-analysis revealed a pooled prevalence of 31.0% (CI = 21%; 42%; PI = 4%; 84%) with high heterogeneity ($Q = 4078.59^{***}$, $I^2 = 99.5\%$) in the $k = 22$ ($N = 35188$) articles. Nine of the studies reported prevalence rates per type of somatoform symptom. Table 2 shows the prevalence rates of the somatoform symptom types most commonly assessed in the studies (i.e., abdominal pain, headache, dizziness, fatigue, and leg/arm/back pain). Aligning with our aims to consider sex differences and methodological aspects that may influence the reported prevalence rates, various subgroups were examined (see Table 3).

4.1.1. Sex Differences. Figure 4 depicts the prevalence rates for females and males from the nine studies which examined these separately; with the exception of two studies, most reveal higher prevalence rates for females. For females, the prevalence rates for somatoform symptoms ranged from 20.2% to 69.5%, whilst for males, they ranged from 6.4% to 65.5%. The meta-analysis revealed a pooled prevalence of 38.9% for females and 29.3% for males (see Table 3).

4.1.2. Methodological Examinations. The subgroup analysis revealed pooled prevalence rates of (1) 36.0% when studies had sample sizes smaller than 300, and 29.0% when the sample size was greater than 300, (2) 35.3% when only one symptom needed to be present for participants to be considered as having somatoform symptoms, and 16.3% when more than one symptom was needed, and (3) 34.1% when symptoms were present in the last six months, and 15.5% when they were present prior to the last six months (see Tables 3 and 4); nonetheless, the heterogeneity was not reduced by these subgroups. The heterogeneity was however reduced while examining the enumerator, which revealed a pooled prevalence rate of 9.2% when somatoform symptoms were assessed by a healthcare professional, and 39.5% when assessed by other persons (see Tables 3 and 4). Lastly, we considered whether studies included relevant diagnostic criteria in addition to the symptoms when assessing the prevalence rates (As noted in the introduction, the DSM III and DSM-IV [7, 9, 96, 97] required medically unexplained symptoms (i.e., no sufficient organic cause), whilst the DSM-5 [10] discarded this criterion for the inclusion of symptom-based impairments in daily life. Depending on when the study was conducted, i.e., what version of the DSM was used, different criteria need to be considered in the assessment of somatoform symptoms). Only 11 out of the 26 studies assessed the necessary criteria, whilst the remaining purely assessed symptoms (see Table 4). The meta-analysis revealed a pooled prevalence rate of 26.8% when the assessment included the relevant criteria and 36.1% when this was not considered (see Table 3).

4.2. Prevalence Rates of Somatoform Disorders. The seven studies which assessed somatoform disorders reported prevalence rates ranging from 0.5% to 13.1%. The meta-analysis revealed a pooled prevalence of 3.3% (CI = 1%; 9%; PI = 0%; 59%) with high heterogeneity ($Q = 957.25^{**}$, $I^2 = 99.4\%$) in the $k = 7$ ($N = 28427$) articles. Aligning with our aims to consider sex differences and methodological aspects that may influence the reported prevalence rates, subgroups were examined (see Table 5).

4.2.1. Sex Differences. Figure 5 depicts the prevalence rates for females and males from the four studies which examined these separately. For females, the prevalence rates for somatoform disorders ranged from 8.1% to 15.5%, whilst for males, they ranged from 5.6% to 6.7%. The meta-analysis revealed a pooled prevalence of 13.0% for females and 7.2% for males, with moderate heterogeneity (see Table 5).

4.2.2. Methodological Examinations. All of the seven studies that examined prevalence rates of somatoform disorders, had sample sizes greater than 300 and considered the necessary diagnostic criteria (see Table 6). Three studies spanned a time frame longer than the last six months, and five studies included assessment by a healthcare professional; as no information was provided for the other studies, subgroup analyses were not possible (see Table 6). A pooled prevalence rate of 4.2% was found for studies that assessed somatoform disorders in community samples, and a pooled prevalence rate of 2.7% was found for studies that assessed in pediatric samples (see Table 5).

5. Discussion

The aim of the current systematic review and meta-analysis was to examine the prevalence and incidence rates of somatoform symptoms and disorders in under-18-year-

olds. Searching three databases with extant search terms and applying relevant selection criteria, we found no studies that reported incidence rates and 33 studies that reported prevalence rates. Pooled prevalence rates for somatoform symptoms lay at 31.0%, indicating that about one-third of children and adolescents exhibit symptoms such as headaches, dizziness, fatigue, as well as abdominal, limb, and back pains. The pooled prevalence rates for children and adolescents who do not only show symptoms but are also diagnosed with somatoform disorders lay at 3.3%. We further examined differences in prevalence rates for males and females and examined differences according to the methodological characteristics of the included studies. Nonetheless, heterogeneity stayed high, and various limitations emerged, having important implications for future research in the field.

The systematic review and meta-analysis highlights implications for both school and health professionals. As the majority of included articles were conducted in schools (i.e., community samples), they provide an indication of the prevalence in this setting and the need for school personnel to get involved. We recommend that school nurses and counselors receive (preservice) training to sensitize them towards detecting somatoform symptoms, as well as applying screening tools, as an initial step. Furthermore, our findings revealed that there might be a set of children and adolescents who exhibit somatoform symptoms but have not (yet) received a somatoform diagnosis; this is something that should be considered by healthcare professionals.

5.1. Sex Differences in Prevalence Rates. The majority of studies indicated that prevalence rates are high among females than males. For females, the pooled prevalence rates were 38.9% for somatoform symptoms and 13.0% for somatoform disorders; in contrast, these lay at 29.3% and 7.2% for males. Although this is a finding which has often been highlighted, the focus has remained mainly on puberty, which marks the onset of menstrual pains in females (e.g., [36, 98]). Although a clear distinction between developmental age ranges and control for menstruation could not be undertaken for the current systematic review and meta-analysis, the results do seem to indicate sex differences emerge across various ages.

5.2. Limitations of Included Articles and Implications for Research. The subgroup analyses (focusing on sample and measurement) and the quality assessment highlighted multiple limitations and implications for future research. In the quality assessment, most of the articles did not score points in the evaluation of the sample ($N > 300$) and in the indication of the use of standardized, verified measurement instruments. The nonuse of appropriate standardized questionnaires and the lack of similarity in measuring somatoform symptoms in the included articles are seen as problematic. For one, it cannot be ruled out that instead of truly measuring somatoform symptoms, the questionnaires, and checklists may have assessed only physical symptoms (e.g., children report having had a stomachache but due to a gastrointestinal infection). This is the fallacy that is exacerbated by the lack of coassessing relevant diagnostic criteria (i.e., symptoms without medical cause, symptom-caused functional impairment in daily life) and may also account for found differences regarding enumerators. We strongly urge researchers conducting studies on somatoform symptoms in childhood and adolescence to utilize measurement instruments that include both symptoms and relevant diagnostic criteria. Furthermore, there are additional methodological aspects that can lead to an overestimation or underestimation in reported prevalence rates, which make meaningful comparisons difficult. For example, some articles calculated prevalence rates when just one symptom was present, which according to the DSM-5 is sufficient [10]. Another important aspect is the period of occurrence, with the DSM-5 stipulating that symptoms should persist for more than 6 months. In terms of interviewing children, this could be classified as a questionable criterion. Depending on the age of the child, estimating a time (i.e., 6 months) could lead to excessive demands, which in turn could lead to response bias. In addition, prevalence rates may also differ depending on whether somatoform symptoms were assessed via self-report or parent-report (e.g., [74, 77]). In order to get as comprehensive a picture as possible of the presence of symptoms, we suggest that in future research both children and parents and teachers be interviewed. In this way, a response bias could be counteracted, and an additional indication of how parents and teachers perceive/observe the issue may contribute to further insight.

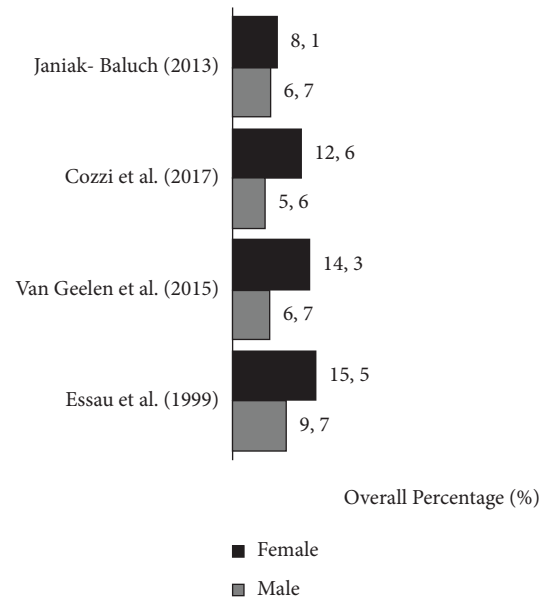

Figure 5: Overall percentage of somatoform disorders for females and males.

5.3. Limitations of Current Systematic Review and Meta-Analysis. For the current systematic review and meta-analysis, we only included articles published in English or

Table 6: Examined methodological characteristics for studies reporting on somatoform disorders.

Authors	Sample size	Sample type	*Assessment*		
			Consideration of criteria	Enumerator	Period of occurrence
Bisht et al. [73]	>300	Pediatric	Yes	Psychiatrist	NP
Cozzi et al. [76]	>300	Pediatric	Yes	Pediatricians and neuropsychiatrist	NP
Dhossche et al. [77]	>300	Community	Yes	NP	6 months
Essau et al. [44]	>300	Community	Yes	University students and clinical personal	Lifetime
Gupta et al. [82]	>300	Pediatric	Yes	Mental health professionals	NP
Janiak-Baluch and Lehmkuhl [83]	>300	Pediatric	Yes	Medical, technical assistant	NP
van Geelen et al. [94]	>300	Community	Yes	Research team	Last year

Reported values are those used for the meta-analysis (e.g., T1); NP: not provided; occurrence indicates which time frame was assessed (e.g., participants indicating the occurrence in the past 2 weeks).

German; however, the practical significance of prevalence data may lead authors who conduct such research to publish in local journals in their national language, so that healthcare professionals have easy access. Hence, more prevalence data on somatoform symptoms and disorders might be available, that were not found or included with the current inclusion criteria. Furthermore, we included articles in which the authors described data as prevalence rates, without enforcing additional epidemiological criteria (e.g., [99]). For the meta-analysis, we pooled data despite great differences in the assessment of somatoform symptoms, and heterogeneity remained high. The results of the meta-analysis should therefore be viewed with caution.

6. Conclusion

Aligning with the aim of this systematic review and meta-analysis, we examined 33 articles, of which 29 were included in the meta-analysis. We found a pooled global prevalence rate of 31.0% for somatoform symptoms and 3.3% for somatoform disorders. Furthermore, general trends indicate higher prevalence rates for females than males. Careful consideration of methodological aspects in the operationalization and assessment of somatoform symptoms and disorders is needed in future research. In sum, the findings of the current systematic review and meta-analysis indicate worrisome prevalence rates for somatoform symptoms and disorders in under-18-year olds and should receive adequate attention from relevant professionals within interdisciplinary networks under public health governance.

Data Availability

The data supporting this systematic review and meta-analysis are from previously reported studies and datasets, which have been cited. The processed data are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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