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Global prevalence of depression and elevated depressive symptoms among adolescents: A systematic review and meta-analysis

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Objective. Adolescence is a formative and turbulent phase where physiological, psychosocial, and cognitive changes leave adolescents vulnerable to psychological disorders. Given the lack of reviews that consolidate and compare worldwide prevalence of depression among adolescents, this review aims to examine the global prevalence of major depressive disorders, dysthymia, and elevated depressive symptoms among adolescents.

Methods. A systematic review and meta-analysis was conducted. Six databases were searched for studies published from 2001 to December 2020. Seventy-two studies were included. Subgroup analysis were performed for year of publication, geographical region, gender, and assessment tools used.

Results. The global point prevalence rate of elevated self-reported depressive symptoms from 2001 to 2020 was 34% (95% CI: 0.30–0.38). Point prevalence for major depressive disorder (MDD) and dysthymia was 8% (95% CI: 0.02–0.13) and 4% (95% CI: 0.01–0.07), respectively. The pooled one-year prevalence and lifetime prevalence for MDD were 8% (95% CI: 0.05–0.12) and 19% (95% CI: 0.12–0.26). Point prevalence of elevated depressive symptoms among adolescents increased from 24% (95% CI: 0.19–0.28) between 2001 and 2010 to 37% (95% CI: 0.32–0.42) between 2011 and 2020. The Middle East, Africa, and Asia have the highest prevalence of elevated depressive symptoms, and female adolescents were reported to have a higher prevalence of elevated depressive symptoms than male adolescents.

Conclusion. Besides targeting those with existing clinical depression, research and policies should also focus on educational and supportive mitigation efforts to curb depressive symptoms among adolescents before escalation. The findings encourage future research to develop more gender-specific and culturally relevant intervention programmes.

Practitioner points

- 34% of adolescents globally, aged 10-19 years, are at risk of developing clinical depression, which exceeds the reported estimates of individuals aged 18 to 25 years. Practitioners are highly encouraged to prioritize depression screening and intervention implementation for individuals in this age group.

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- Female adolescents and adolescents from Middle East, Africa, and Asia have the highest risk of developing depression. This urges practitioners and researchers to develop more gender-specific and culturally relevant intervention programmes.

Adolescence is a turbulent transitory period involving drastic physiological, psychosocial, and emotional changes (e.g., enhanced cognition, need for autonomy) (Gilmore & Meersand, 2019). This whirlwind of changes and adaptation increase adolescents' vulnerability to mental health disorders such as anxiety, mood disorders, eating disorders, and personality disorders. Mental health disorders account for 16% of the global burden of disease and injury among adolescents, with depression being the fourth leading cause of illness and disability (World Health Organisation, 2018). Fifty per cent of mental health disorders usually occur by the age of 14, but many cases are often left undetected, untreated, or overlooked due to common misattributions to normal stress or being seen as a transient stage that adolescents go through (World Health Organisation, 2018).

Overlooking elevated depressive symptoms can lead to tragic outcomes and high mortality as depression is highly associated with most suicides (Ferrari, Charlson, Norman, Flaxman, et al., 2013), the second leading cause of death among adolescents (World Health Organisation, 2018). Adolescent depression also has high comorbidity with other mental disorders (i.e., anxiety, substance abuse, and conduct disorders) (Lewinsohn, Rohde, & Seeley, 1998) and is often associated with risky behaviours (e.g., unsafe sexual practices), non-suicidal self-harm, academic difficulties, social challenges (e.g., having difficulty relating to peers and increased tendency to get into physical fights), and poorer physical health that can lead to work impairment (Brooks, Harris, Thrall, & Woods, 2002; Keenan-Miller, Hammen, & Brennan, 2007; Weissman et al., 1999). Early onset of depression during adolescence presents a more severe depression in adulthood (i.e., longer episodes, higher recurrence rates, and more residual symptoms) (Clayborne, Varin, & Colman, 2019; Fergusson, Boden, & Horwood, 2007; Gollan, Raffety, Gortner, & Dobson, 2005; Liu et al., 2015; Weissman et al., 1999; Zisook et al., 2004), and adverse psychosocial outcomes such as lower subsequent educational attainments, unemployment, lower perceived social support, higher divorce rates, and earlier pregnancies (Clayborne et al., 2019; Fergusson et al., 2007; Wickersham et al., 2021; Zisook et al., 2004).

The clinical and diagnostic criteria of major depressive disorder (MDD) is defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) as a cluster of somatic and non-somatic symptoms (presenting at least five symptoms) such as sleeplessness, change in appetite, psychomotor retardation, suicidal ideation, anhedonia, or depressed feelings of worthlessness that lead to functional impairment for at least two weeks (American Psychiatric Association, 2013). These debilitating symptoms impair adolescents' educational, occupational, and social functioning. However, paediatric MDD is often underdiagnosed and undertreated, with only 50% of adolescents diagnosed before reaching adulthood (Mullen, 2018). Moreover, those who received treatment and recovered are still at high risk of recurring episodes within two years with 70% reported incidence reported, and a large number continue to present MDD in adulthood (Mullen, 2018). Gender difference in rate of MDD diagnosis also exists after puberty, with female adolescents being at higher risk of depression primarily due to exogenous risk factors (Nolen-Hoeksema & Girgus, 1994).

On the contrary, dysthymia, also known as persistent depressive disorder, is a chronic depressive condition that is continuously present for two years (American Psychiatric Association, 2013). Diagnosis of dysthymia is rarer, affecting only 0.6-4.6% of children and

1.6-8.0% of adolescents (Nobile, Cataldo, Marino, & Molteni, 2003). Symptoms of dysthymia usually include poor appetite or overeating, insomnia or hypersomnia, fatigue, low self-esteem, poor concentration and decision-making, and feelings of hopelessness (American Psychiatric Association, 2013). Although the symptoms are less severe than those observed in MDD, the longer lasting depressive symptoms may result in long-term disabling consequences on social skill learning and psychosocial functioning, which may increase the risk of developing MDD subsequently (Nobile et al., 2003). While clinical depression (MDD and dysthymia) is often diagnosed using clinical interviews, in research, screening for elevated depressive symptoms is often determined based on cut-off scores of reliable and valid self-assessment tools, which are useful for identifying potential or high-risk individuals. Without a clinical diagnosis, these high-risk adolescents are classified as individuals with elevated depressive symptoms.

Viewing depression as a neuropsychological problem and adopting the American Psychiatric Association or International Statistical Classification of Diseases and Related Health Problems (ICD), diagnostic criteria to medicalize depression are commonly seen in the Western countries. Other cultures may perceive such depressive symptoms as normal reactions to external situations (Chentsova-Dutton, Ryder, & Tsai, 2014). Therefore, further research is needed to examine the prevalence of depression across different cultural contexts.

In epidemiology, prevalence is a useful measure of the burden of disease that informs the planning of health policies, prevention, and support services (Stein, 1981); therefore, it is crucial to pool existing prevalence data on adolescent depression. Prevalence can be quantified as the proportion of the population with a particular condition either at a specific point of time (point prevalence), at a given period (period prevalence; usually 12 months), or at some point in life (lifetime prevalence) (National Institute of Mental Health, 2017). All three types of prevalence will be examined in this review depending on the availability of evidence.

Currently, several reviews have reported the prevalence of depression, anxiety, and mental disorders among adolescents (Dachew, Bifftu, Tiruneh, Anlay, & Wassie, 2019; Pacheco et al., 2017; Yuen, Liu, & Tse, 2019; Zarafshan, Mohammadi, & Salmanian, 2015). However, most of these reviews are region-specific or targeted at university and college students, especially those in the medicine or health care faculties. Polanczyk, Salum, Sugaya, Caye, and Rohde (2015) reported the estimated prevalence rates of 2.6% for any depressive disorders and 1.3% for major depressive disorders in both regional and global children and adolescents. However, Polanczyk et al.'s review only included studies that reported at least three disorders (e.g., mood disorder, anxiety disorder, attention-deficit/hyperactivity disorder, conduct disorder, and oppositional defiant disorder), which may have resulted in the exclusion of many potential studies (Polanczyk et al., 2015). Polanczyk et al.'s review also included children younger than ten years, which therefore did not give an accurate representation of depression prevalence among adolescents (Polanczyk et al., 2015). An older review by Costello, Erkanli, and Angold (2006) revealed a depression prevalence rate of 5.6% among adolescents aged 13 to 18 years. The review only included primary studies that formally diagnosed psychiatric disorders in adolescents using interview methods, which excluded potential and high-risk adolescents who could have been identified through self-report assessments. To our knowledge, there are currently no other reviews that examined the prevalence of depression (MDD and dysthymia) and depressive symptoms among adolescents using both self-reported and clinical interview methods, which incentivizes our need for this review.

Additionally, due to wide variability between self-reported depression scales in terms of measurement range, cut-off scores used, and ease of meeting cut-offs, further analysis may be ideal in identifying potential differences in reported prevalence between different self-reported depression scales (Lambert et al., 2015). Based on the 2015 Global Burden of Disease (GBD) study (Vos et al., 2016), the global rate of depression has increased by 18.4% between 2005 and 2015, and according to the 2017 GBD study (Liu et al., 2020), the incidence of depression cases worldwide has increased by 49.86% between 1990 and 2017. The prevalence of depressive disorders was also observed to be the highest in the North America and African region, especially among female adolescents (James et al., 2018; Ritchie & Roser, 2018). Furthermore, previous research has discovered higher depression rates among female adolescents due to their biological, psychological, and cognitive vulnerabilities (e.g., genetic factors, hormonal differences) and cultural factors (Chentsova-Dutton et al., 2014; Liu et al., 2015; Nolen-Hoeksema & Girgus, 1994). As such, to investigate whether these trends also hold true to the adolescent population, this review aims to i) examine the global prevalence of major depressive disorders, dysthymia, and elevated depressive symptoms among adolescents, and ii) compare depression prevalence based on time, gender, geographical regions, and assessment tool used.

Methods

Search strategy

The systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines (Liberati et al., 2009). A systematic search was conducted on five electronic databases (CINAHL, Embase, PsycINFO, PubMed, and Scopus) for studies that were published in English from 2001 to December 2020. Grey literature was searched in ProQuest Dissertation and Theses, and the bibliographies of relevant studies were hand-searched to include potential articles. The primary key terms used were as follows: ("child" or "adolescent" or "teen") and ("prevalence" or "epidemiology" or "incidence") and ("depression" or "depressive" or "mental disorder" or "mood disorder" or "psychological disorder"). The detailed search strategies of each database can be found in Table S1.

Inclusion and exclusion criteria

The inclusion and exclusion criteria were generated prior to the identification of relevant studies. According to World Health Organization (2019), adolescents fall in the 10 to 19 years age group. Studies were included if: i) the study sample consisted of adolescents aged between 10 and 19 years, ii) the prevalence rates of depression were determined using standardized validated instruments, self-reported questionnaires, or clinically structured interviews, and (iii) the study provided sufficient information for the authors to calculate the aggregated prevalence of depression or elevated depressive symptoms. Study designs such as cohort, case–control, and cross-sectional studies were included. Studies reporting point prevalence, one-year prevalence, or lifetime prevalence were included.

Studies were excluded if: i) it consisted of a patient sample, ii) it focused on a specific sample group (e.g., ethnic minority, children with developmental or psychological disorders, bullied victims, or children exposed to trauma), and/or iii) the study did not use a validated and reliable tool or used parent-reported measures. Studies where the sample

age range overlapped but did not neatly fit 10 to 19 years were excluded. Qualitative studies were excluded. Studies examining the effectiveness of depression treatments and the validation of assessment tools were also excluded.

Study selection

The study selection process is shown in the PRISMA flow chart in Figure 1. The initial search yielded 37,609 articles. Another 1,529 articles were identified from grey literature and bibliographies. The EndNote X9 program (Clarivate Analytics, Philadelphia) was used to import articles and find duplicates. After the removal of duplicates, the title and abstracts of 20,837 articles were screened for relevance. Two hundred and thirty-nine articles were shortlisted for full-text and language screening, which resulted in 72 studies being finalized and included in the meta-analysis. Two reviewers screened the eligibility of each study and appraised the quality of each study independently. In case of any discrepancy, a third reviewer was consulted.

Data extraction

Based on the PRISMA checklist, relevant data (e.g., author, year of publication, sample characteristics, study type, outcome measures, and cut-offs) were extracted and presented in a table (Table S2). Studies that reported prevalence based on the clinical diagnostic criteria (i.e., ICD-10, DSM-III, DSM-IV) for depression usually through clinical interviews were often classified as MDD or dysthymia, in which their respective prevalence was extracted. Data from studies that reported prevalence based on self-reported screening tools' cut-off scores, termed as elevated depressive symptoms, were also extracted.

For the analysis, when both standard error (SE) values and 95% confidence intervals (CIs) were not provided, SE was calculated using the formula ($SE = \sqrt{P} \times (1 - P)/N$), where P is the proportion of the cases reported, and N is the denominator of the prevalence estimate (Ferrari, Charlson, Norman, Patten, et al., 2013).

Quality assessment

The quality of each included study was appraised using the Joanna Briggs Institute's Critical Appraisal Checklist for Studies Reporting Prevalence Data (Munn, Moola, Lisy, Riitano, & Tufanaru, 2015). All 72 quantitative studies were evaluated based on sampling techniques, setting description, valid identification method of condition, and the appropriateness of statistical analysis. Of 72 studies, 82% used an appropriate sample frame to address the target population, which reduces the chance of overgeneralization of results. Most of the studies (74%) adopted a suitable sampling method (e.g., stratified multistage random cluster sampling) or used data from existing nationwide surveys. All studies had adequate sample sizes ranging from 88 to 95,8856 participants. Studies with smaller sample size were either pilot studies or studies focused on a specific age group. Many studies did not report details on data collection procedures (39%) and overall response rate (28%), and most studies did not report the 95% CI for prevalence (67%). As the studies met at least 60% of the predefined appraisal criteria, all 72 studies were included in this review (Cuttilan, Sayampanathan, & Ho, 2016). The quality assessment of each included study is presented in Table S3.

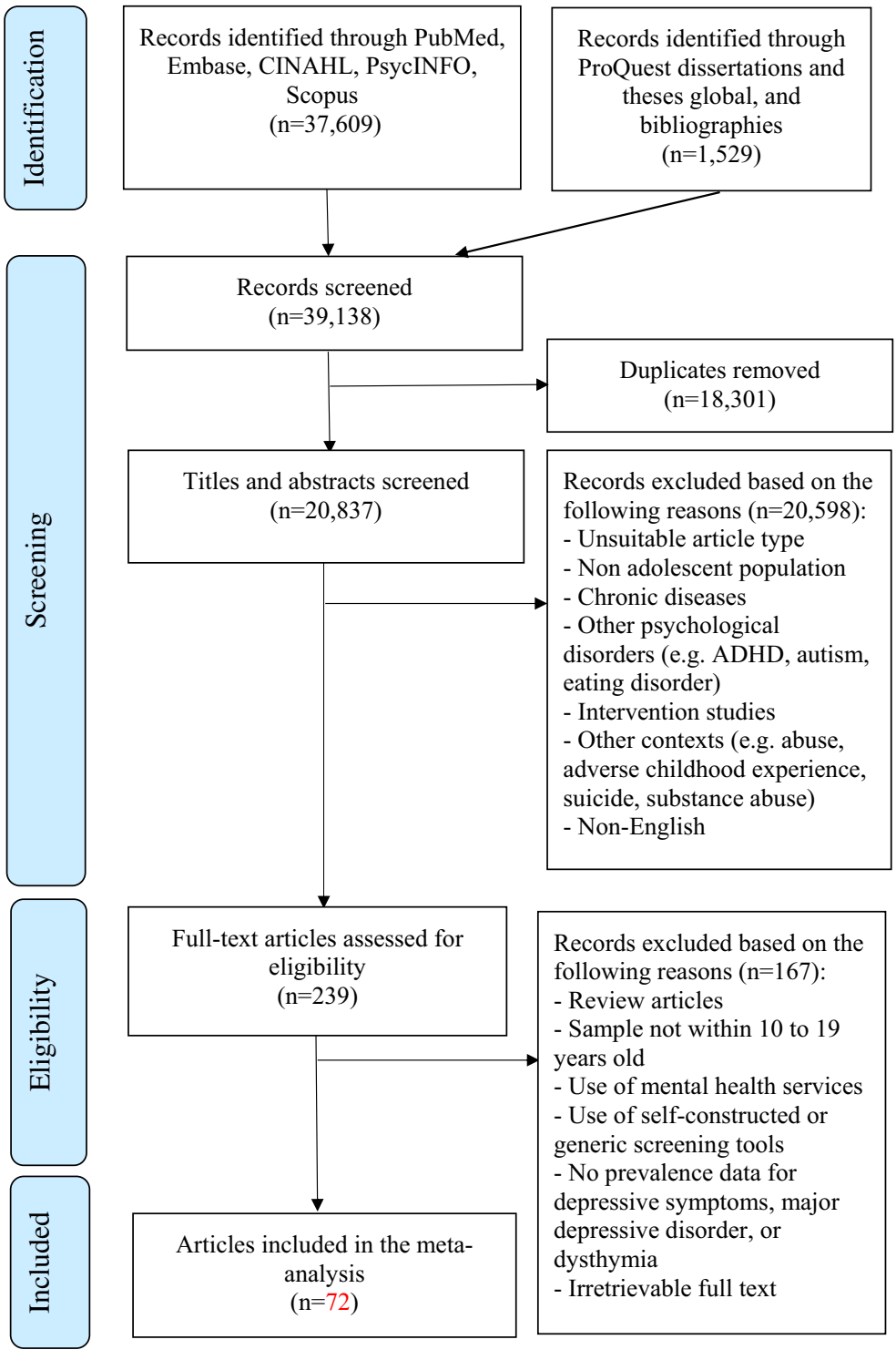

Figure 1. PRISMA flow diagram.

Statistical analyses

Depression and elevated depressive symptoms were reported as a dichotomous variable (presence versus absence) in all studies. Therefore, for studies that provided a stratified prevalence based on severity (i.e., normal, mild, moderate, severe, and extremely severe) without an overall prevalence, prevalence estimates were derived from adding the prevalence in the 'mild' to 'extremely severe' categories. As the aim of this review was to investigate the long-term prevalence of depression, only the prevalence from the most recent screening of longitudinal studies was included.

A meta-analysis was conducted using Review Manager Version 5.4. A random-effects model was used as it took into consideration multiple sources of heterogeneity (e.g., methodological quality, measures used) and led to a highly conservative null hypothesis (Han & Eskin, 2011). Prevalence estimates were used instead of log odds ratio as these were readily available in all studies. The heterogeneity of the studies was assessed using I^2 statistics and Cochran's Q-test (Chi^2), where heterogeneity was indicated through significant Cochran's Q statistic ($p < 0.05$) and an elevated I^2 value ($I^2 > 50\%$) (Higgins, Thompson, Deeks, & Altman, 2003). The results of the meta-analyses were presented in a forest plot that displayed the effect size and 95% CI for each study.

Subgroup analyses were performed for point prevalence of elevated depressive symptoms to investigate the effect of gender (i.e., male, female), geographical regions (i.e., Asia, Africa, Europe, Middle Eastern, and Oceania), and measurement tools used (i.e., Beck's Depression Inventory (BDI), Children's Depression Inventory (CDI), Depression, Anxiety, and Stress Scale (DASS), and Center for Epidemiological Studies Depression (CES-D) on the prevalence of elevated depressive symptoms). Studies from Middle Eastern countries were differentiated from other Asian countries based on differences in cultural practices such as implementation of religious law (Arnove, 2013). Given the constant changes in societal structures, subgroup analysis of studies published from 2001 to 2010 and 2011 to 2020 was conducted to compare the difference in depression prevalence over the past two decades. Although there is evidence on the dramatic increase in depression prevalence after age 15 (Hankin & Abramson, 2001), the lack of stratification of prevalence data by age in existing studies disallowed to conduct subgroup analysis based on the age. Subgroup analyses were not performed for period prevalence and point prevalence of clinical depression (MDD and dysthymia) due to the availability of few studies.

Results

Study characteristics

Among 72 studies, 11 were on clinical depression (MDD and dysthymia) and 61 were on elevated depressive symptoms, covering a total of 324,859 adolescents aged 10 to 19 years. The included studies were published between 2001 and 2020. When stratified according to geographical region, the studies were mostly published in Asia ($n = 28$), followed by Europe ($n = 15$), Africa ($n = 9$), North America ($n = 7$), Middle East ($n = 6$), Oceania ($n = 4$), and South America (Brazil, $n = 3$). Thirty-six studies reported point prevalence estimates for elevated depressive symptoms in each gender. Only seven studies reported period prevalence (one-year or lifetime) for MDD or dysthymia. Clinical depression was determined through clinical interviews or questionnaires based on the DSM or ICD diagnostic criteria, while elevated depressive symptoms were screened via various self-reported instruments. The majority of the studies used the BDI ($n = 13$), CES-

D (n = 14), DASS (n = 9), the Patient Health Questionnaire (n = 7), and the CDI (n = 5). The characteristics of the included studies are provided in Table S2.

Point prevalence of elevated depressive symptoms, MDD, and dysthymia

Based on the random-effects model, the pooled prevalence for elevated depressive symptoms among adolescents was 34% (95% CI: 0.30–0.38; Z = 17.36, df = 54, T^2 = 0.02, I^2 = 100%). A forest plot of the 55 studies that reported the prevalence of elevated depressive symptoms is shown in Figure 2.

The pooled prevalence for MDD was 8% (95% CI: 0.02–0.13; Z = 2.78, df = 5, T^2 = 0.00, I^2 = 99%) across six studies, whereas the pooled prevalence for dysthymia was 4% (95% CI: 0.01–0.07; Z = 2.63, df = 6, T^2 = 0.00, I^2 = 97%) across four studies. Forest plots of the estimates for MDD and dysthymia are provided in Figures 3 and 4, respectively.

Period prevalence of MDD and dysthymia

The pooled one-year prevalence for MDD was 8% (95% CI: 0.05–0.12; Z = 4.49, df = 4, T^2 = 0.00, I^2 = 100%) and lifetime prevalence was 19% (95% CI: 0.12–0.26; Z = 5.07, df = 4, T^2 = 0.01, I^2 = 100%). These pooled period prevalence estimates only included data from Europe and North American countries as data from other regions were unavailable.

Only three studies reported period prevalence for dysthymia (Avenevoli, Swendsen, He, Burstein, & Merikangas, 2015; Ormel et al., 2015; Sund, Larsson, & Wichstrøm, 2011). Due to limited studies, a meta-analysis was not conducted. The one-year prevalence reported in studies by Avenevoli et al. (2015) and Ormel et al. (2015) was 1.3% and 1.6%, respectively. The lifetime prevalence of dysthymia ranged from 1.5% to 5.4% across three studies.

Subgroup analyses

A significant difference in prevalence estimates for elevated depressive symptoms was found between studies published from 2001 to 2010 and 2011 to 2020 (Z = 17.36, p < 0.001). The pooled prevalence for the former decade was 24% (95% CI: 0.19–0.28) and 37% (95% CI: 0.32–0.42) for the latter, indicating an increase in risk of depression among adolescents.

Based on a subgroup analysis, the prevalence estimates for elevated depressive symptoms were statistically significant (Z = 17.44, p < 0.001) when stratified by geographical regions, with the Middle East having the highest prevalence rate of 64% (95% CI: 0.53–0.74), followed by Africa (45%, 95% CI: 0.19–0.72), Asia (40%, 95% CI: 0.32–0.48), North America (20%, 95% CI: 0.15–0.24), Europe (16%, 95% CI: 0.13–0.19), South America (15%, 95% CI: 0.07–0.23), and Oceania (14%, 95% CI: 0.08–0.20).

There was also significant difference in prevalence between gender (Z = 22.41, p = 0.001), with female adolescents having a higher estimate of 32% (95% CI: 0.28–0.35) than male adolescents (24%, 95% CI: 0.21–0.27).

Analyses conducted by the type of measurement tool used also showed borderline statistical difference between groups (Z = 17.54, p = 0.02). Reported prevalence for elevated depressive symptoms were the highest when DASS-21 (50%, 95% CI: 0.24–0.75) was used, followed by BDI-II (39%, 95% CI: 0.24–0.53), Patient Health Questionnaire

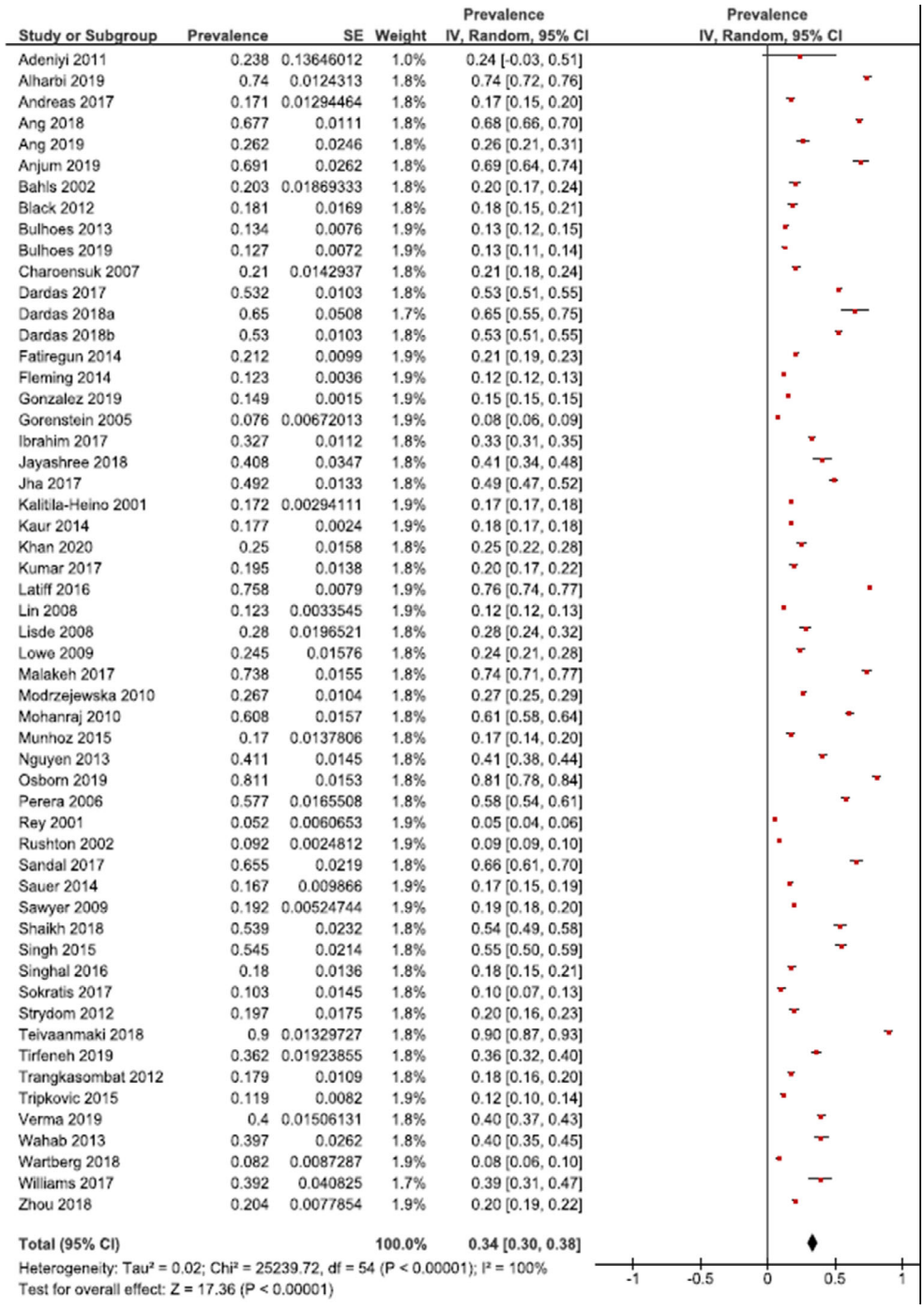

Figure 2. Forest plot of prevalence estimates of depressive symptoms.

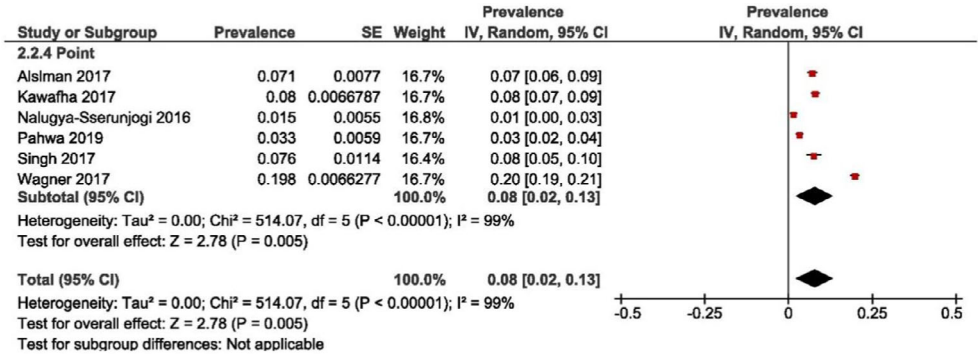

Figure 3. Forest plot of prevalence estimates of major depressive disorder.

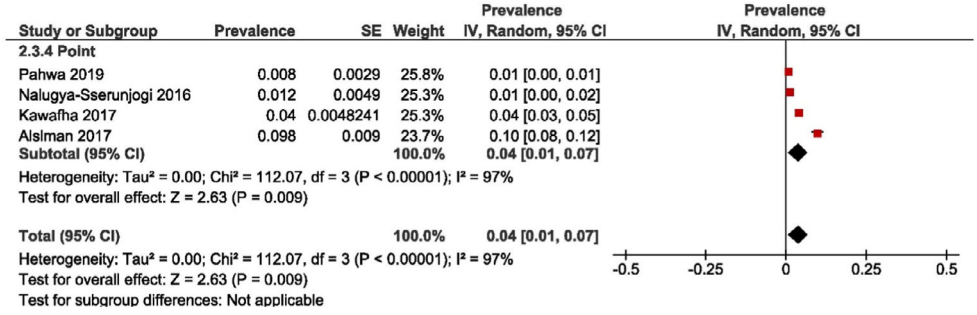

Figure 4. Forest plot of prevalence estimates of dysthymia.

(PHQ-9) (38%, 95% CI: 0.21–0.55), CES-D (26%, 95% CI: 0.22–0.31), BDI (27%, 95% CI: 0.17–0.38), and CDI (20%, 95% CI: 0.14–0.25).

A test for publication bias was determined by a funnel plot that was generated using RevMan 5.4. The slight asymmetry in funnel plot in Table S4 indicated the possibility of publication bias.

The authors confirm that they have reported all measures collected (refer to Table S2) and reasons for data exclusion (refer to Figure 1).

Discussion

The aim of this systematic review was to summarize and examine the global prevalence of depression (MDD and dysthymia) and elevated depressive symptoms among adolescents. Overall, our results revealed a point prevalence of 8%, 4%, and 34% for MDD, dysthymia, and elevated depressive symptoms among adolescents aged 10 to 19 years. The pooled one-year prevalence and lifetime prevalence for MDD were 8% and 19%. There is also a 14% increase in prevalence of elevated depressive symptoms among adolescents between the decades 2001-2010 and 2011-2020. Female adolescents have a higher prevalence of elevated depressive symptoms than male adolescents, and adolescents from the Middle East, Asia, and African regions were found to have a higher prevalence of elevated depressive symptoms.

Prevalence of MDD and dysthymia

The meta-analytic results demonstrated a point prevalence of 8% and 4% for MDD and dysthymia among adolescents, respectively. However, the studies that contributed to the pooled analysis were mainly from the Middle East and India; hence, these estimates could not be generalized globally. Similarly, only studies from Europe and North America provided data for one-year and lifetime prevalence of MDD, resulting in a pooled prevalence of 8% and 19% for one-year and lifetime prevalence of MDD, respectively. These estimates fell short of the prevalence reported in a national survey from the United States, where the 12-month prevalence for MDD among adolescents was 13.1% (Bernaras, Jaureguizar, & Garaigordobil, 2019). However, the period prevalence estimates of MDD among adolescents exceeded the estimates in previous cross-national studies examining MDD among the general population, which reported an average 12-month prevalence of 6% (ranged from 0.3% to 10%) (Kessler & Bromet, 2013) and a lifetime prevalence range of 1.0% to 16.9% (Anade et al., 2003). Depression development in adolescents is more likely to be affected by significant life events occurring in close contacts, including grandparents, parents, siblings, and friends (Williamson et al., 1998). As a result, adolescents may internalize the life events of people around them and perceive them as their own experience and life events, and this could account for the heightened prevalence of MDD among adolescents as compared to adults (Williamson et al., 1998). Overall, the findings indicate a higher prevalence of MDD among adolescents than the general global population, but the paucity of adolescent-specific epidemiology studies on MDD across all regions warrants more research.

Prevalence of elevated depressive symptoms

Additionally, our findings for elevated depressive symptoms revealed a point prevalence rate of 34% among adolescents aged between 10 and 19 years. Although evidence showed that individuals aged 18 to 25 years had the highest rate of depression with an average age of onset at 25 years (National Institute of Mental Health, 2019; Nihalani, Simionescu, & Dunlop, 2009), our estimate exceeded the previous reported estimates for elevated depressive symptoms among university medical students (27%) (Tam, Lo, & Pacheco, 2019) and university students (30.4%) (Ibrahim, Kelly, Adams, & Glazebrook, 2012). Furthermore, a survey by the World Health Organization discovered that almost 50% of mental health conditions start by age 14, but most of these cases go undetected and untreated (Kessler et al., 2007). These findings highlighted the increased vulnerability of adolescents aged 10 to 19 years to depressive disorders. Since early onset of depression leads to adverse consequences in adulthood, it is necessary to implement early interventions, which target this age group who face a heightened risk of depression in comparison with young adults.

Rising prevalence of elevated depressive symptoms

Unique to this review, the prevalence of elevated depressive symptoms was further stratified based on decade, geographical region, gender, and the type of assessment tool used. A comparison of pooled prevalence from studies published in 2001 to 2010 and 2011 to 2020 showed an increase in elevated depressive symptoms among adolescents globally from 24% to 38% in the recent decade. Similarly, a national survey conducted in the United States from 2005 to 2017 reported an increase in major depressive episodes from 8.7% to 13.2% among adolescents aged 12 to 18 years (Twenge, Cooper, Joiner,

Duffy, & Binau, 2019). This increase was concurrent with the rise in the use of mobile electronic communication and social media in the mid-2000s, as well as a decline in sleep duration and an increase in suicide-related outcomes, hence suggesting that the cultural trends in the last decade may have a larger effect on suicide and mood disorder among adolescents as compared to older adults (Twenge et al., 2019).

Sociodemographic index and cultural factors

All geographical regions were represented in this review, with the highest coverage in Asia (n = 28) and the least coverage in North America (n = 4), Oceania (n = 4), and South America (n = 3). Oceania consists of mainly less-developed Polynesian and Micronesian countries, resulting in only four studies from Australia and New Zealand. The South American region consisted of a few studies from Brazil. Like Polancyzk et al.'s review (2015), prevalence data for South America were greatly underrepresented due to a general lack of epidemiological studies in low- and middle-income countries. This may be attributed to the lack of educational, financial, and health care resources, which lead to the de-prioritization of mental illnesses in less-developed countries (Baxter, Patton, Scott, Degenhardt, & Whiteford, 2013). The lack of representative global epidemiological data on depression and elevated depressive symptom prevalence among adolescents, especially in less-developed countries, hinders the implementation of effective measures for the prevention of early-onset depression. The lack of prevalence studies from Oceania and North America warrants an investigation to better understand adolescent depression in these regions.

Statistically significant differences between geographical regions were found for the prevalence of elevated depressive symptoms among adolescents, with the Middle East, Africa and Asia having a higher prevalence than Europe, North America, and Oceania. This finding corresponds to the Global Burden of Disease Study in 2010 and 2017, where higher rates of depression in the Middle East, North Africa, South Asia, and America were observed (Ferrari, Charlson, Norman, Patten, et al., 2013; James et al., 2018; Ritchie & Roser, 2018). In contrast, a study by Chiao and Blizinsky (2010) found that although 80% of the population in East Asia are genetically susceptible to depression, the interplay between genes and a collectivistic environment resulted in a lower prevalence of depression than in the United States and Europe. Our findings contradict the assumption that the promotion of group cohesion and interdependence in collectivistic cultures provide individuals with strong social support systems that help alleviate depressive symptoms (Chiao & Blizinsky, 2010). Instead, a collectivistic or a communal culture that focuses on relationships may serve as a double-edged sword that could exacerbate the development of depressive symptoms. In a collectivistic culture, the individual exists in a matrix of relationships; therefore, both risk and protective factors are closely related to the quality of an individual's relationship rather than one's own ability to overcome challenges and achieve personal goals (Stewart et al., 2004). In this review, the included studies from Middle East, Africa, and Asia highlighted cohabitation with parents, having large number of siblings, a single-parent family, loss of parents, family abuse, family conflict, poor family function, harsh parenting, and unsatisfactory peer relationships as significant risk factors for depression (Fatiregun & Kumapayi, 2013; Latiff, Tajik, Ibrahim, Abubakar, & Ali, 2016; Lin et al., 2008; Nalugya-Sserunjogi et al., 2016; Nguyen Thi Khanh et al., 2020; Shaikh, Doke, & Gothankar, 2018). On the contrary, these relationship-based risk factors were rarely or not reported in the included studies from Europe, North America, and Oceania.

Female susceptibility to elevated depressive symptoms

This review also highlighted a significant difference in elevated depressive symptoms between gender; female adolescents reported a higher prevalence of elevated depressive symptoms (32%) than male adolescents (24%). This finding corresponds to previous reviews and studies (Costello et al., 2006; Magklara et al., 2015; Mullen, 2018; Nolen-Hoeksema & Girgus, 1994). Across many cultural contexts, female adolescents have a predisposition to develop depression mainly due to biological vulnerabilities (e.g., genetic factors, hormonal differences) and psychological and cultural factors (e.g., gender roles) (Chentsova-Dutton et al., 2014; Liu et al., 2015; Nolen-Hoeksema & Girgus, 1994). According to Hankin and Abramson's cognitive vulnerability-transactional stress theory of depression (2001), female adolescents' greater cognitive vulnerabilities to depression, coupled with greater exposure and reactivity to stress, result in a higher likelihood of elevated depressive symptoms. Compared with male adolescents, female adolescents' emphasis on body image and weight-related concerns are also positively associated with depressive symptoms (Vaughan & Halpern, 2010).

Limitations

This review has few limitations. The pooling of data despite high heterogeneity between studies may obscure the true effects and reduces the generalizability of results; therefore, the results should be interpreted with caution. High heterogeneity between studies may be attributed to the failure to consider the psychometric properties and cut-off scores used for various translated versions of the screening instruments during the meta-analysis. In addition, the process of language translation may give rise to issues that might affect data accuracy and respondents' understanding of measures (Weeks, Swerissen, & Belfrage, 2007). Some common translational issues include international societal differences, uses of inappropriate language levels, inconsistencies in terminology definition, and grammar and sentence construct variations (Weeks et al., 2007). Another limitation of this review was the inclusion of studies that were only published in English, which may have resulted in the exclusion and underrepresentation of studies from South America where Portuguese and Spanish are the dominant languages. Furthermore, given the stringent eligibility criteria of the review, studies with sample whose age range overlaps but did not neatly fit 10-19 years were excluded; therefore, relevant studies might have been missed. In this review, subgroup analysis for age was also not possible as primary studies usually only reported overall prevalence in a sample of adolescents and did not further stratify depression prevalence by specific age.

Limitations of the included epidemiological studies may have also affected the quality of this meta-analysis. Since the response rates for many included studies were unreported, the validity of these studies remains questionable. The lack of details on data collection procedures also questions whether the outcome measures were assessed in a standard and reliable manner. The use of self-reported measures in most studies may also increase the risk of underreporting by adolescents, which may affect our pooled estimate. Few included studies have used the gold standard diagnostic instruments, which limits our attempt to pool existing data for MDD and dysthymia. Additionally, most of the included studies were cross-sectional in nature and had limited follow-up data. Furthermore, limited studies for certain geographical regions (e.g., South America, Oceania) resulted in a small study size that might have affected the overall results and contributed to comparison bias among regions. Therefore, the included studies may not necessarily be

representative of the entire region; hence, the findings would need to be interpreted with caution.

Implications for future research

This review provided the current overview of both global and regional prevalence of clinical depression and elevated depressive symptoms among adolescents. Research gaps such as the need for more adolescent-specific epidemiology studies on MDD and dysthymia, and studies from Oceania, and North and South American countries were identified. Future research should consider investigating the rising trend of elevated depressive symptoms among adolescents concurrently with rising cultural trends such as the use of social media. Regional and gender differences in depression prevalence suggest a need for health care professionals and researchers to develop culture-specific and gender-specific interventions. Additionally, due to high heterogeneity between studies and geographical regions, more localized research is warranted to identify needs and develop culture-specific actions to combat depression among adolescents. Future primary studies on adolescents are recommended to adhere to the age limits set by WHO, whereas future reviews may consider adopting a broader age group to allow subgroup analyses to be conducted to compare depression prevalence among adolescents and young adults.

Implications for future practice

The rising trend of elevated depressive symptoms and increasing number of at-risk adolescents suggest that clinicians and practitioners should be more vigilant and proactive in their outreach to raise awareness and increase accessibility and availability of services to this vulnerable population. While working with the at-risk for depression adolescents, clinicians and practitioners ought to understand cultural and gender differences in susceptibility to depressive symptoms and are recommended to adopt culturally and gender-appropriate approaches to assess and support these adolescents. Working with the parents, siblings, peers, and other stakeholders (e.g., school authorities) may seem to be necessary and timely supportive interventions to widen the outreach efforts by the clinicians and the practitioners. However, future rigorous trials are needed to evaluate the effectiveness of such supportive interventions.

Conclusion

This review presented the global and regional prevalence of elevated depressive symptoms among adolescents. Adolescents are often grouped with children aged 10 and younger and do not receive as much attention as the young adult population that is commonly believed to have the highest chance of onset of depression. However, our findings revealed that the prevalence of elevated depressive symptoms was similar or higher than in young adults thus highlighting the need to investigate the adolescent population. Moreover, this review also reported an increased risk for depression among female adolescents, and adolescents from Middle Eastern, African, and Asian countries. Besides targeting those with existing clinical depression, research, practices, and policies should also focus on educational and supportive mitigation efforts to curb depressive symptoms among adolescents before escalation. Overall, this review identified vulnerable subgroups among the adolescent population which urges future studies to develop and implement more culturally relevant and gender-specific interventions that increase

emotional resilience and equip adolescents with essential positive coping skills to reduce the adverse effects of depression.

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Conflict of interest

All authors declare no conflict of interest.

Author contributions

Celine Wong (Conceptualization; Writing – review & editing) Esperanza Debby Ng (Data curation; Formal analysis; Writing – original draft) Shefaly Shorey (Conceptualization; Data curation; Writing – review & editing).

Data availability statement

Data sharing is not applicable to this article as no data sets were generated or analysed during the current study.

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Supporting Information

The following supporting information may be found in the online edition of the article:

Table S1. Search strategy for each database.

Table S2. Characteristics of included studies

Table S3. Quality assessment of each included study (N = 72).

Table S4. Funnel plot of included studies.