



The global prevalence of mental health disorders among runaway and homeless youth: A meta-analysis

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Abstract

A meta-analysis was performed to identify the pooled prevalence of mental health disorders (MHDs) among runaway and homeless youth (RHY). Relevant studies published between December 1, 1985, and October 1, 2023, were identified in the *PubMed*, *Scopus*, *Web of Science*, and *Cochrane Library* databases. A preliminary screening of 11,266 papers resulted in the inclusion of 101 studies. The pooled-prevalence estimates were obtained using a random-effects model. The findings showed varying lifetime prevalence rates of MHDs: 47% (conduct disorders and psychological distress), 43% (depression), 34% (major depressive disorders), 33% (post-traumatic stress disorder), 27% (personality disorders), 25% (attention-deficit/hyperactivity disorder), 23% (bipolar disorders), 22% (anxiety), 21% (oppositional defiant disorders), 15% (anorexia), 15% (adjustment disorders), 14% (dysthymia), 11% (schizophrenia), 9% (obsessive–compulsive disorders), and 8% (gambling disorder). The current prevalence rates were: 31% (depression), 23% (major depressive disorder), 23% (anxiety), 21% (post-traumatic stress disorder), 16% (attention-deficit/hyperactivity disorder), 15% (bipolar disorder), 13% (personality disorders), 13% (oppositional defiant disorders), 8% (schizophrenia), and 6% (obsessive–compulsive disorders). Regular screening and the implementation of evidence-based treatments and the promotion of integration and coordination between mental health services for adolescent minors and young adults with other service systems are recommended.

Keywords Mental health disorders · Runaway youth · Homeless youth · Meta-analysis

Introduction

Mental health disorders (MHDs) among runaway and homeless youth (RHY) have become a major public health issue worldwide [1]. RHY refers to individuals aged 12–24 years who either leave their homes without parental or legal guardian consent [2], lack a permanent dwelling, and reside in public spaces, shelters, with unfamiliar individuals, on the streets, with friends, in transitional housing, or other non-domicile settings [3].

The prevalence of RHY has increased in recent years [4]. Moreover, RHY are more likely to report co-occurring disorders, such as MHDs [5–7] and/or substance abuse [8, 9]. They also are more likely to report risky sexual behaviors [10] and experience trauma disorders [1]. While these findings highlight RHY as one of the most vulnerable populations globally, RHY culture can serve as a substitute for absent parental support, creating significant challenges for healthcare and human

services professionals working with this group [1]. Indeed, RHY often exhibit resistance to traditional methods of assistance, including substance use counseling, HIV prevention programs, and psychotherapy [1].

Youth experience homelessness or run away for various reasons. Some are compelled to leave their homes or voluntarily choose to depart due to family conflicts or dysfunction [11]. Homelessness can also result from inadequate discharge planning and a deficiency of support services for youth transitioning from child welfare or juvenile justice systems [12, 13]. Moreover, familial residential instability, familial poverty, and financial hardships significantly impact the lives of many RHY [14, 15].

Two previous meta-analyses have reported the prevalence of MHDs among homeless children (10%-26%) [16], or children and adolescents in the child welfare system (4%-27%) [17], but neither focused on RHY. As well as being almost a decade old, these studies: (i) only included homeless children (<18 years) [16] or children and adolescents in the child welfare system (7-17 years) [17]; (ii) only reported the pooled prevalence rate of some specific MHDs (i.e., they did not report the pooled prevalence rate of psychological distress, major depressive disorders, bipolar disorders, personality disorders, adjustment disorders, or schizophrenia); (iii) did not report the lifetime and current pooled prevalence rate of MHDs; (iv) did not compare two groups of RHY (adolescent minors vs. young adults); and (v) did not conduct any subgroup analyses and sensitivity analyses, or meta-regression to detect sources of heterogeneity [16].

To the best of the present authors' knowledge, there are no previous meta-analyses examining the lifetime and current pooled prevalence rates of a wide range of MHDs among RHY. Consequently, the present study is novel in its aim of estimating the pooled prevalence of MHDs in youth, encompassing both adolescents and young adults. The findings could enhance

researchers' understanding of the pooled prevalence rates of various MHDs, assisting practitioners and policymakers in targeting RHY with suitable interventions, developing adapted psychiatric services, providing professional training, and planning further research.

Methods

Registration and protocol

The present systematic review and meta-analysis was conducted based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [18]. The review protocol was registered on PROSPERO (Ref: CRD42023476261).

Search strategy

A thorough search of English-language published papers and abstracts from December 1, 1985, to October 1, 2023, was systematically conducted using the *Scopus*, *PubMed*, *Web of Science*, and *Cochrane Library* databases. Additionally, a search on *Google Scholar* was performed to locate any additional relevant studies. The search strategy, employing crucial Boolean operators (AND/OR), was developed and adjusted for diverse databases, utilizing the following initial keywords: “(mental disorders), (psychotic disorders), (mentally ill persons), (homeless youth), (homeless persons), (runaway youth), (adolescent), (young adult), (adult children)”. Furthermore, the bibliographies of the published studies included in the meta-analysis were examined to locate the presence of any additional relevant studies. If multiple studies presented findings on the same sample of RHY, the data providing the most comprehensive details regarding the prevalence of MHDs were used in the analysis. The specifics of the search strategy, encompassing the amalgamation of keywords employed across various electronic databases, are outlined in **Table 1**.

Table 1 here

Study eligibility and exclusion criteria

The eligibility criteria used for inclusion were: (a) RHY aged 12-24 years [2, 3]; (b) reporting original prevalence data on RHYs' MHDs, and life-time MHDs including ever having a MHD (at least one time) and current MHDs (defined as having MHDs within the past 30 days); and (c) any type of quantitative empirical study (e.g., cross-sectional, cohort, case-control, mixed-methods, and interventions with baseline data). The study excluded qualitative papers, secondary analyses without primary data, systematic reviews, meta-analyses, and unpublished theses (i.e., those not peer-reviewed, such as PhD theses and Master's theses).

Data extraction process

EndNote X7 software was utilized to eliminate duplicate papers. Subsequently, two authors (BA and JH) independently assessed the titles and abstracts in accordance with the study's inclusion and exclusion criteria. In instances of disagreement between the two reviewers, resolution was sought from a third author (RM). In the subsequent step, the full texts of the studies were examined based on the criteria for eligibility in the study. Two authors (BA and JH) independently conducted the extraction of data for the studies selected for inclusion in the meta-analysis. The extracted information encompassed details such as the study authors, participants' age, publication year, country where the data were collected, study design, sample size, population specifics, quality assessment of studies, and criteria for assessing MHDs. Where necessary, the authors of the selected studies were contacted to obtain additional information. The agreement between the two authors was assessed using Cohen's Kappa statistic. The degree of agreement was categorized into levels such as poor, slight, fair, moderate, substantial, and almost perfect. Corresponding numerical values were assigned as follows: 0, 0.01–0.02, 0.021–0.04, 0.041–0.06,

0.061–0.08, and 0.081–1.00, respectively [19]. Discrepancies between the two authors (comprising less than 10% of the total) were addressed through the intervention of a third author.

Risk of bias of studies

The Newcastle-Ottawa Scale (NOS) [20] was used to evaluate the quality of studies, encompassing three criteria: (i) the selection domain, which includes the representativeness of the exposed group, selection of the non-exposed group, and ascertainment of exposure (three items for cross-sectional studies and four items for cohort studies); (ii) the comparability domain, involving group comparability based on the study design or analysis (one item each for both cross-sectional and cohort studies); and (iii) the exposure/outcome domain, incorporating the assessment of outcome (one item for cross-sectional studies and three items for cohort studies) (**Table 2**). The studies were classified into four categories: unsatisfactory, satisfactory, good, or very good, with a potential maximum score of 8 for cohort and case-control studies. In assigning scores, studies with a total score of 0-2 were deemed “unsatisfactory,” those with scores of 3-4 were labeled “satisfactory,” 5-6 were considered “good,” and 7-8 were categorized as “very good.” In total, 23 studies received a high-quality rating, 41 were rated as good quality, and 37 were rated as satisfactory quality.

Table 2 here

Study selection process

Initially, 11,266 papers were found through the four database searches (**Figure 1**). After paper duplicates were excluded (n=6,358), the title and abstracts of 4,908 papers were screened. Of these, 845 were found to be related to the study’s aim. After a full text review, 744 studies were excluded. The main reasons for exclusion were as follows: 39 studies did not meet the quality appraisal score (5%), and 705 studies utilized a non-quantitative methodology or did not report

parametric measurements such as lifetime prevalence of suicidal behaviors, coefficients or odd ratios of relative risks of determinants of study outcomes (95%). Following these exclusions, 101 studies remained for meta-analysis [6, 21-119].

Figure 1 here

Data synthesis and statistical analysis

The analysis considered the lifetime or current prevalence of conduct disorders, psychological distress, depression, major depressive disorders, post-traumatic stress disorder (PTSD), personality disorders, attention-deficit/hyperactivity disorder (ADHD), bipolar disorders, anxiety, oppositional defiant disorders, anorexia, adjustment disorders, dysthymia, schizophrenia, obsessive-compulsive disorders, and gambling disorder as MHDs. Any reports of overall prevalence without mentioning the specific time period in the studies were considered as lifetime use for the purposes of the meta-analysis. The pooled-prevalence estimates were obtained using a robust random-effects model [120], which considered the various sampling methods employed in the studies. Additionally, the sources of heterogeneity among studies were evaluated through the application of Cochran's Q and I^2 tests. Subgroup analyses were performed to pinpoint the sources of heterogeneity, considering factors such as participants' age, year of publication, geographical location, quality assessment of studies, diagnosis criteria for MHDs, and sample size. For each subgroup analysis, a minimum of two studies reporting data on the variable of interest was necessary. A sensitivity analysis was performed using Baujat plots to assess the impact of the most significant study on overall heterogeneity and to exclude it during the evaluation of each specific study's effect on the overall estimate. Ultimately, a multivariate meta-regression analysis was undertaken to investigate the primary source of heterogeneity. Statistical significance was defined as a p -value < 0.05 , and the meta-analysis was performed using R 3.5.1 with the "meta" package.

Results

Study characteristics

Of 101 studies selected, 90 were from the America region (n=123,197 participants), one from African region (n=227 participants), five from the European region (n=541 participants), one from the Western pacific region (n=187 participants) and four from South-East Asia region (n=326 participants). The country with the highest number of included studies was the USA, with 82 studies (n=122,037) (**Table 3**). Considering country income level, 96 studies were conducted in high-income countries (n=123,925), four studies were conducted in a lower-middle-income country (n=532), and one was conducted in an upper-middle income country (n=21). Study sample size had a mean of 1232 participants, with 21 being the lowest sample size [55] and 76,596 being the largest sample size [70]. Response rates between the studies varied from 35% to 100%. Participants had a mean age of 18.43 years and were more likely to be male (mean 56%), varying from 0% to 100%. Moreover, 47% had adolescent minors as participants (12-17 years old) and 53% had young adults as participants (18-25 years). Almost all studies were cross-sectional (93%). Finally, 57 studies were published between 2010 and 2023 (56%), 73 studies used a standard scale/questionnaire to determine MHDs (72%), with the *Diagnostic and Statistical Manual of Mental Disorders (DSM)* being the most prevalent (22%), followed by the *Mini International Neuropsychiatry Interview (MINI)* and the *Center for Epidemiological Studies-Depression Scale (CES-D)* (both 19%).

Table 3 here

Pooled prevalence of life-time and current MHDs among RHY

The findings showed that lifetime MHDs most frequently reported by RHY were conduct disorders (47%), psychological distress (47%), depression (43%), major depressive disorders (34%), post-traumatic stress disorder (PTSD) (33%), personality disorders (27%), ADHD (25%), bipolar disorders (23%), anxiety (22%), oppositional defiant disorders (21%), anorexia (15%), adjustment disorders (15%), dysthymia (14%), schizophrenia (11%), obsessive-compulsive disorders (9%), and gambling disorder (8%) (**Table 4 and Supplementary Files 1-26**). In addition, the data showed that the current MHDs most frequently reported by RHY were depression (31%), major depressive disorder (23%), anxiety (23%), PTSD (21%), ADHD (16%), bipolar disorder (15%), personality disorders (13%), oppositional defiant disorders (13%), schizophrenia (8%), and obsessive-compulsive disorders (6%).

Table 4 here

Subgroup analysis

Several subgroup analyses were conducted to determine the primary factor causing heterogeneity in the pooled odds of MHDs (**Supplementary Files 27–105**). The factors considered included participants' age, year of study publication, geographical location, quality assessment of studies, diagnostic criteria for MHDs, and sample size. Subgroup analyses detected some source of heterogeneity in some specific MHDs (see next two sections).

Subgroup analyses of pooled prevalence of life-time and current MHDs based on age of participants among RHY

The participants were divided into two groups based on their age, and a subgroup analysis was conducted with those aged: (i) 12-17 years (adolescent minors) and (ii) 18-24 years (young adults) (**Table 4 and Supplementary Files 27-41**). Results showed that as age increased, the (i)

lifetime and current prevalence of depression, bipolar disorder, anxiety and PTSD increased, (ii) lifetime prevalence of schizophrenia and major depressive disorders increased, (iii) lifetime and current prevalence of personality disorders decreased, (iv) lifetime prevalence of ADHD, conduct disorders, and obsessive-compulsive disorders decreased, and (v) current major depressive disorders decreased. The lifetime prevalence of adjustment disorders in these specific ages was stable. The findings also show that externalizing disorders were predominantly prevalent among adolescent minors (with the exception of current major depressive disorders), while internalizing disorders were more prevalent among young adults.

Subgroup analyses of pooled prevalence of life-time and current MHDs based on time of study publication among RHY

The studies were divided into two groups based on the year of publication for each study and a subgroup analysis was conducted by classifying the studies into two different time periods: (i) ≤ 2010 and (ii) > 2010 (**Table 4 and Supplementary Files 42-58**). This analysis showed several trends: (i) an increase in the lifetime and current prevalence of depression, major depressive disorders, PTSD, and schizophrenia; (ii) an increase in the lifetime prevalence of anxiety, ADHD, personality disorders, conduct disorders, and psychological distress; (iii) an increase in the lifetime prevalence of bipolar disorders; (iv) a decrease in the lifetime prevalence of bipolar disorders, oppositional defiant disorders, and obsessive-compulsive disorders; and (v) no difference in the lifetime prevalence of adjustment disorders over time.

Sensitivity analysis

Sensitivity analysis utilizing Baujat plots was conducted to evaluate influential effects. Effects on the right-hand side of the plots indicate studies with higher levels of heterogeneity (**Supplementary Files 106–147**). The sensitivity analysis was able to decrease the heterogeneity

between studies for lifetime prevalence of anorexia (Cutuli [2018] [82] made the most significant contribution to heterogeneity), dysthymia (Feitel et al. [1992] [87] made the most significant contribution to heterogeneity), gambling disorders (Taylor et al. [2006] [116] made the most significant contribution to heterogeneity), and psychological distress (Narendorf et al. [2020 and 2023] [40, 112] made the most significant contributions to heterogeneity). The test did not detect heterogeneity between studies for other lifetime prevalence of MHDs. The sensitivity analysis reduced the heterogeneity between studies for current prevalence of anxiety and schizophrenia (Middleton et al. [2018] [102] made the most significant contributions to heterogeneity), but was unable to decrease the heterogeneity between studies for other current prevalence of MHDs.

Meta-regression

Multivariate meta-regression analysis was conducted to further investigate the sources of heterogeneity (**Table 5**). The meta-regression results indicated that the age of participants may contribute to the heterogeneity between the included studies in terms of the lifetime prevalence of depression, conduct disorders, and obsessive-compulsive disorders. Additionally, it found that the year of study publication may contribute to the heterogeneity between the included studies for (i) the current prevalence of depression and (ii) the lifetime prevalence of anxiety and ADHD. Moreover, diagnostic criteria for MHDs may contribute to the heterogeneity among the included studies on lifetime bipolar and obsessive-compulsive disorders. Finally, the quality assessment of studies may contribute to the heterogeneity among the included studies on the lifetime prevalence of conduct disorders.

Table 5 here

Moderator analysis

Subgroup analyses confirmed that (i) age was a statistically significant moderator for current depression, current major depressive disorders, lifetime adjustment disorders, and lifetime obsessive-compulsive disorders; (ii) year of study publication was a statistically significant moderator for current depression, lifetime adjustment disorders, and current schizophrenia; (iii) geographical location was a statistically significant moderator for current anxiety, current bipolar, lifetime bipolar, and lifetime obsessive-compulsive disorders; (iv) the quality assessment of studies was a statistically significant moderator for current major depressive disorders, lifetime obsessive-compulsive disorders, lifetime personality disorders, current PTSD, and lifetime psychological distress; (v) diagnostic criteria for MHDs were statistically significant moderators for lifetime depression, lifetime adjustment disorders, lifetime schizophrenia, lifetime obsessive-compulsive disorders, and lifetime personality disorders; and (vi) sample size was as a statistically significant moderator for current depression and lifetime obsessive-compulsive disorders.

Multivariate meta-regression analysis found that the year of study publication was a statistically significant moderator for the current pooled prevalence of depression. Additionally, the (i) age of participants was a statistically significant moderator for the lifetime pooled prevalence of depression, conduct disorders, and obsessive-compulsive disorders; (ii) year of study publication was a statistically significant moderator for the lifetime prevalence of anxiety and ADHD; (iii) diagnostic criteria for MHDs were statistically significant moderators for the lifetime prevalence of bipolar and obsessive-compulsive disorders; and (iv) quality assessment of studies was a statistically significant moderator for the lifetime prevalence of conduct disorders. Older age (younger adults) was associated with a higher prevalence of depression, while younger age (adolescent minors) was associated with a higher prevalence of conduct and obsessive-compulsive disorders ($p < .05$). Publishing a study after 2010 was associated with a higher prevalence of current

depression and lifetime prevalence of anxiety and ADHD ($p<.05$). Diagnostic criteria for MHDs other than DSM and MINI were associated with a higher prevalence of lifetime bipolar and obsessive-compulsive disorders ($p<.05$). Studies of lower quality were associated with a higher prevalence of conduct disorders ($p<.05$).

Discussion

The present meta-analysis estimated the pooled prevalence rates of MHDs among RHY. As far as the present authors are aware, no previous meta-analyses have ever been conducted estimating the pooled prevalence of MHDs among RHY. Findings from the present study indicated that the lifetime pooled prevalence of MHDs among RHY ranged from 8% to 47%, while the current pooled prevalence ranged from 6% to 31%. It was expected that the lifetime pooled prevalence of MHDs among RHY would be higher than the current pooled prevalence rate and this was the case. The prevalence in the present study was higher than the pooled prevalence rate of MHDs in previous meta-analyses among general population of children and adolescent (13%) [121], homeless children (10%-26%) [16], and children and adolescents in the child welfare system (4%-27%) [17]. A possible reason for this may be that RHY face several challenges and have multiple health issues [122, 123], leading to a higher rate of MHDs. Additionally, adverse experiences such as maltreatment and serious neglect among RHY [124-126] may contribute to an increased prevalence of MHDs among RHY.

Regarding the most common MHDs among RHY, psychological distress and conduct disorders had the highest lifetime pooled prevalence rates (both 47%), while depression had the highest current pooled prevalence rate (31%). These rates are higher than those reported in previous meta-analyses among children and adolescents in the child welfare system or general

population of children and adolescents for conduct disorders (6%-20%) [17, 121] and depression (3%-18%) [17, 121]. To the best of the present authors' knowledge, no previous study that has reported the pooled prevalence rate of psychological distress among RHY.

The elevated prevalence of psychological distress among RHY can be attributed to various factors. Firstly, as indicated by prior studies, psychological distress is associated with several adverse behaviors, including substance abuse, conduct problems, and engaging in sexual risk behavior [6-10], behaviors that may all be present among RHY. Secondly, this heightened psychological distress might stem from a lack of self-determination within the RHY population [127]. Lastly, the intricate dynamics of loneliness and social support may contribute to this phenomenon [128]. While 'close' relationships can offer some degree of support, they simultaneously expose individuals to potential victimization and challenging interactions with other distressed RHY [129].

According to previous studies, RHY are more likely to have conduct disorders than peers who reside in stable housing [24, 76]. Research also indicates that conduct disorder diagnoses are typically feasible until the age of 18 years, with a noticeable decline in prevalence among young adults aged 18 to 25 years [130, 131]. This could be due to the fact that aggression and impulsivity can have negative effects on RHYs' abilities to reside in housing and shelter systems, reducing access to mental health support and potentially increasing the odds that they will experience homelessness [132]. Another explanation could be the fact that the presence of conduct disorder heightens the likelihood of initiating substance use by age 15 years, particularly illicit substances, with this risk persisting until 18 years if age [131]. Moreover, the probability of initiating cocaine, amphetamines, inhalants, and club drugs remains notably elevated up to the age of 21 years [133].

Also, RHY may experience a high level of neighborhood violence, have violent and criminal peers, and be involved with gangs [4]. For everyone, whether housed or not, adolescence may be a challenging period characterized by self-doubt and low self-esteem [122]. RHY may experience various forms of physical and sexual abuse, leading to diminished self-worth [134]. Additionally, facing abuse in the streets, from passers-by or the police, contributes to a reduction in their self-image, potentially leading to increased depression [134].

Examining other MHDs as reported in previous meta-analyses, the prevalence rates were notably higher among RHY. More specifically, 22% had anxiety, 25% had ADHD, 21% exhibited oppositional defiant disorders, and 33% had PTSD, each of these much higher the rates observed among the general population of children and adolescents (6.5% for anxiety, 3.4% for ADHD) [121]. Additionally, the rates in the present study were higher than those found among children and adolescents within the child welfare system (18% for anxiety, 12% for oppositional defiant disorders, 11% for ADHD, and 4% for PTSD) [17].

Another important finding was the increasing prevalence of MHDs over time. However, there is no previous study reporting the prevalence of MHDs among RHY over time. According to a previous meta-analysis there had been a minor increase of MHDs between the 1980s and the 2000s among general adolescent population [135]. There have been noticeable indications of parallel trends among general adolescent populations, including a rise in symptoms related to MHDs [136]. Furthermore, there has been an increase in the utilization of health services for the diagnosis and treatment of both psychosomatic health complaints and MHDs in high-income countries [137]. These trends broadly align with the findings from the present review. However, it is important to note that not all findings were equally consistent.

Another novel finding of the present study was that internalizing disorders (e.g., anxiety disorders, depression, PTSD) were more prevalent among young adults, while externalizing disorders (e.g., conduct disorders, ADHD) were more prevalent among adolescent minors. This finding is in line with previous studies with US and Swedish adolescents [138, 139] which reported that there is a trend of increasing internalizing symptoms and decreasing externalizing symptoms among general adolescents. One possible explanation for this finding could be that young adults with MHDs may engage in substance use concurrently [140], experience family conflicts [141] and increased violence [142] and/or have limited access to therapeutic and supportive care in the community [143], leading to an increase in internalizing symptoms among this cohort. Moreover, internalizing symptoms, linked to adverse social and health outcomes in young adults [144], hold clinical significance. Given that these symptoms can progress to psychiatric disorders among a subset of young adults [145], clinicians should be vigilant about the rising prevalence of internalizing symptoms among young adults. Finally, the trend of the rise in internalizing symptoms and the decline in externalizing symptoms suggests a shift more closely associated with the natural evolution of psychiatric disorders rather than homelessness.

Finally, the current meta-analysis identified several sources of heterogeneity between studies through meta-regression and moderator analysis. Similar levels of heterogeneity have been observed in previous meta-analyses conducted within the general adolescent population [121]. Heightened heterogeneity can be influenced by several factors, including country variations, mean age, sample size, year of publication, diagnostic criteria, and the quality assessment of studies. These aspects may contribute to methodological challenges and should be considered in future studies. In the present study, there was a lower estimate of the lifetime pooled prevalence of major depressive disorders and obsessive-compulsive disorders with increasing age. This finding is

unexpected, as an inverse relationship was anticipated. This should be examined in the future studies. It was also found that studies published after 2010 were associated with a higher prevalence of current depression, as well as lifetime prevalence of anxiety and ADHD. This association could be due to increased numbers of studies carried out post-2010, leading to more comprehensive assessments of MHDs among RHY. There were also variations in the diagnostic criteria which could have led to discrepancies in the prevalence rates, aligning with findings from prior meta-analyses [17, 121]. In an older study examining two prominent nosological systems, the DSM-IV-TR consistently categorized a higher number of children and adolescents as having an anxiety disorder compared to the ICD-10 [146]. Moreover, it was observed that studies of lower quality exhibited a higher prevalence of conduct disorders. This highlights the importance of acknowledging that studies with lower quality may yield elevated prevalence rates compared to those with higher quality data. This consideration should be taken into account in future epidemiological studies.

Limitations

The present meta-analysis has several limitations that should be noted. First, nine-tenths of the studies were carried out in the US and Canada (89%), and the distribution of MHDs was unequally dispersed across the 101 included studies. Therefore, the authors were unable to create a distribution map for each MHD in each country or continent. Second, almost all studies (95%) were conducted in high-income countries, and the findings may not be generalizable to other countries. Third, there was inconsistency in defining MHDs across various studies. For instance, some studies relied on self-reporting rather than adhering to standardized criteria. Fourth, some studies did not specify the duration (whether it was lifetime or current) of MHDs. Fifth, in some studies, the type of MHD was not specified (i.e., they reported MHDs without specifying the

particular type of MHD. Therefore, these studies were excluded from the analysis. Sixth, several important pieces of data were not available from studies (e.g., age at the first episode of homelessness or runaway, co-occurring disorders such as substance use, and receiving treatment). Therefore, these trends could not be investigated with these crucial covariates. For example, according to a study from 2005 to 2018, only one-fifth of adolescents received MHD treatment [147], and receiving treatment might affect MHD trends. Finally, excluded from consideration were gray literature sources such as dissertations, research and committee reports, government reports, conference papers, ongoing research, manuscripts, and unpublished studies. The decision to exclude these sources was based on the research team's inability to adequately assess their quality and the fact that they had not been peer-reviewed.

Conclusion

The present study is the first meta-analysis to estimate the lifetime and current pooled prevalence rate of MHDs among RHY. Several innovative subgroup analyses, such as trends of MHDs over time and comparisons of MHDs among adolescent minors vs. young adults, were conducted. Additionally, to the best of the authors' knowledge, the present study is the first to perform meta-regression and moderator analysis to detect potential contributing factors to the heterogeneity of studies on the lifetime and current pooled prevalence rate of MHDs among RHY. The findings suggest that RHY had significantly higher prevalence of MHDs compared to other high-risk populations reviewed. Regular screening and the implementation of evidence-based treatments, and the promotion of integration and coordination between mental health services for adolescent minors and young adults with other service systems are recommended.

Based on the present results, externalizing symptoms were observed among adolescent minors, while internalizing symptoms were evident among young adults. Tailoring mental health

services based on the type of symptoms and age is crucial, because adolescent minors and young adults may require distinct interventions for internalizing and/or externalizing symptoms. Future research should investigate the causal factors driving the observed difference between internalizing and externalizing symptom trends among adolescent minors and young adults. Moreover, it is imperative to formulate and implement effective brief and low-intensity psychological interventions [148, 149], including cognitive-behavioral therapy [150], for mitigating internalizing disorders among young adults. Additionally, it is recommended to incorporate selective parent training, family support, and school-based programs [151] for addressing and reducing externalizing disorders among adolescent minors.

Abbreviations

ADHD: Attention-deficit/hyperactivity disorder

MHDs: Mental health disorders

NOS: Newcastle-Ottawa Scale

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

PTSD: Post-traumatic stress disorder

RHY: Runaway and homeless youth

Declarations

Ethics approval and consent to participate

The present study was an analysis of preexisting literature and did not use human participants.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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Author contributions

BA. Conceived the study BA. collected all data. RM, and BA analyzed and interpreted the data. BA, JH and AGHP drafted the manuscript. BA, AL and MDG revised the first draft and was responsible for all final editing. All authors commented on the drafts of the manuscript and approved the final copy of the paper for submission.

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Table 1. Characteristics of the 101 studies identified for review

Author s (year)	Years (y) of data collect ions (numb er)	Countr y	Sam ple at basel ine	Final sampl e (respo nse rate %)	Stu dy desi gn	Qualit y assess ment	Me an age (yr s)	Type of youth	M ale %	Fem ale %	Trans/o ther %
Narend orf et al. (2023)	2016- 17 (2 y)	USA	892	892 (100)	Cro ss- secti on	Very good	20. 97	Young adult	55	45	
Burke et al. (2023)	2020-1 (2 y)	USA	140	140 (100)	Cro ss- secti on	Good	20. 9	Young adult	57	42	1
Dunn et al. (2023)	2023 (1y)	USA	114	114 (100)	Cro ss- secti on	satisfac tory	21. 4	Young adult	70	30	
Jain et al. (2022)	2017- 18 (2 y)	USA	100	100 (100)	Cro ss- secti on	Very good	22	Young adult	67	33	
Bagley et al. (2021)	2016- 18 (3 y)	USA	148	148 (100)	Coh ort	Very good	21	Young adult	60	40	
Hao et al. (2021)	2017- 18 (2 y)	USA	100	100 (100)	Cro ss- secti on	Good	21. 7	Young adult	67	33	
Tucker et al. (2020)	2020 (1 y)	USA	90	90 (100)	Cro ss- secti on	Good	21. 9	Young adult	72	28	
DiGuis eppi et al. (2020)	2011- 13 (3 y)	USA	1032	1032 (100)	Cro ss- secti on	Very good	21. 3	Young adult	71	27	2
Narend orf et al. (2020)	2020 (1 y)	USA	1426	1426 (100)	Cro ss- secti on	Very good	20. 88	Young adult	58	35	7
Winiars ki et al. (2020)	2016- 18 (3 y)	USA	77	77 (NR)	Cro ss- secti on	Very good	19. 1	Young adult	60	38	2

Santa Maria et al. (2020)	2014 (1 y)	USA	434	416 (96)	Cross-section	Good	20	Young adult	54	46	
Labelle et al. (2020)	2020 (1 y)	Canada	76	76 (100)	Cross-section	Satisfactory	15.5	Adolescent minor	44	56	
Hogan et al. (2020)	2015 (1 y)	USA	194	68 (35)	Cross-section	Very good	21.24	Young adult	51	44	5
Gewirtz O'Brien et al. (2020)	2016 (1 y)	USA	3368	3368 (100)	Cross-section	Satisfactory	15.5	Adolescent minor	43	57	
Prock and Kennedy. (2020)	2011-18 (8 y)	USA	101	101 (100)	Cross-section	Very Good	17.54	Adolescent minor	51	49	
Doré-Gauthier et al. (2019)	2012-15 (4 y)	Canada	42	42 (100)	Cohort	Very good	23.4	Young adult	93	7	
Bounds et al. (2019)	2008-15 (10 y)	USA	362	151 (42)	Cross-section	Very good	14.84	Adolescent minor	4	96	
Siconolfi et al. (2019)	2017-18 (2 y)	USA	183	183 (100)	Cross-section	Very good	21.73	Young adult	48	52	
Tyler et al. (2019)	2014-15 (2 y)	USA	150	150 (100)	Cross-section	Good	19.4	Young adult	49	51	
Narendorf et al. (2018)	2014 (1 y)	USA	380	374 (98)	Cross-section	Good	20.7	Young adult	54	41	5
Crosby et al. (2018)	2011-13 (3 y)	USA	937	525 (56)	Cross-section	Very good	21.42	young adult	77	21	2
Barman - Adhikari et al. (2018)	2011-13 (3 y)	USA	911	911 (100)	Cross-section	Satisfactory	21.31	Young adult	74	26	

Pederse n et al. (2018)	2018 (1 y)	USA	278	273 (98)	Cro ss- secti on	Very good	21. 6	Young adult	71	29	
Cutuli (2018)	2013 (1 y)	USA	1280	1280 (NR)	Cro ss- secti on	Good	15	Adoles cent minor	52	48	
Middlet on et al. (2018)	2016 (1 y)	USA	131	131 (100)	Cro ss- secti on	Good	19. 65	Young adult	47	48	5
Moore et al. (2017)	2012- 13 (2 y)	USA	1169	1169 (100)	Cro ss- secti on	Good	16. 5	Adoles cent minor	74	26	
Pagare Bhat et al. (2017)	2017 (1 y)	India	129	119 (92)	Cro ss- secti on	Good	12. 7	Adoles cent minor	10 0	0	
Harris et al. (2017)	2011- 13 (3 y)	USA	1046	966 (80)	Cro ss- secti on	Good	21. 09	Young adult	71	29	
Peterin g et al. (2017)	2012- 13 (2 y)	USA	495	495 (100)	Cro ss- secti on	Very Good	21. 32	Young adult	70	30	
Begun et al. (2016)	2016 (1 y)	USA	601	601 (NR)	Cro ss- secti on	Satisfa ctory	20. 5	Young adult	64	36	
Ko et al. (2016)	2016 (1 y)	The Republi c of Korea	187	187 (100)	Cro ss- secti on	Satisfa ctory	17. 85	Adoles cent minor	57	43	
Peterin g (2016)	2012- 13 (2 y)	USA	505	505 (100)	Cro ss- secti on	Very Good	21. 4	Young adult	72	23	
Fulginit i et al. (2016)	2011- 12 (2 y)	USA	406	384 (94)	Cro ss- secti on	Good	21. 4	Young adult	72	28	
Kozloff et al. (2016)	2009- 11 (3 y)	Canada	156	156 (100)	Cro ss- secti on	Good	21. 5	Young adult	39	61	

Oppong Asante et al. (2015)	2013 (1 y)	Ghana	227	227 (NR)	Cross-section	Good	12.58	Adolescent minor	54	46	
Winetrobe et al. (2015)	2013 (1 y)	USA	125	125 (100)	Cross-section	Very good	21.78	Young adult	71	29	
Ferguson et al. (2015)	2010-11 (2 y)	USA	601	601 (100)	cross-section	Good	20.1	Young adult	64	36	
Hodgson et al. (2015)	2015 (1 y)	UK	116	90 (74)	Cohort	Good	17.74	Adolescent minor	43	57	
Rhoades et al. (2015)	2012 (1 y)	USA	398	398 (100)	Cross-section	Very good	21.32	Young adult	71	27	2
Brown et al. (2015)	2015 (1 y)	USA	201	201 (100)	Cross-section	Very good	19.9	Young adult	64	36	
Narendorf et al. (2015)	2014 (1 y)	USA	434	416 (96)	Cross-section	Very good	20	Young adult	57	43	
Saddichha et al. (2014)	2014 (1 y)	Canada	82	82 (100)	Cross-section	Good	21.5	Young adult	45	55	
Bender et al. (2014)	2010-11 (2 y)	USA	601	601 (100)	Cross-section	Very good	20.5	Young adult	64	36	
Rhoades et al. (2014)	2012-13 (2 y)	USA	451	435 (96)	Cross-section	Good	21.49	Young adult	69	28	3
Yohannes et al. (2014)	2014 (1 y)	USA	73	73 (100)	Cross-section	Good	20.46	Young adult	51	49	
Hodgson et al. (2014)	2011-12 (2 y)	UK	121	90 (74)	Cross-section	Satisfactory	17.7	Adolescent minor	44	56	
Castro et al. (2014)	2011-12 (2 y)	USA	66	66 (100)	Cross-	Good	19.3	Young adult	44	56	

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Thornton et al. (2012)	2012 (1 y)	Canada	219	219 (100)	Cross-section	Satisfactory	19.15	Young adult	39	61	
Ferguson et al. (2012)	2009 (1 y)	USA	40	36 (90)	Cross-section	Good	21.3	Young adult	69	31	
Quimby et al. (2012)	2012 (1 y)	USA	87	87 (NR)	Cross-section	Satisfactory	20.1	Young adult	58	42	
Gupta et al. (2012)	2012 (1 y)	India	36	36 (100)	Cross-section	Satisfactory	16.02	Adolescent minor	0	100	
Ferguson et al. (2011)	2005-9 (5 y)	USA	238	238 (NR)	Cross-section	Good	20.37	Young adult	64	32	
Crawford et al. (2011)	2011 (1 y)	USA	222	222 (100)	Cross-section	Satisfactory	17.2	Adolescent minor	0	100	
Kirst et al. (2011)	2005-6 (2 y)	Canada	150	150 (100)	Cross-section	Good	18.5	Young adult	50	50	
Keller et al. (2010)	2002 (1 y)	USA	770	732 (95)	Cohort	Very good	17.4	Adolescent minor	48	52	
Bender et al. (2010)	2005-8 (4 y)	USA	146	146 (100)	Cross-section	Good	20.3	Young adult	67	33	
Thompson et al. (2010)	2005-8 (4 y)	USA	146	146(NR)	Cross-section	Very Good	20.2	Young adult	68	32	
Courtney and Zinn (2009)	1993-2003 (11 y)	USA	14282	14282 (100)	Cross-section	Very good	15	Adolescent minor	51	49	
Merscham et al. (2009)	2003-5 (2 y)	USA	182	182 (100)	Cross-section	Satisfactory	20.2	Young adult	58	42	

Nyamat hi et al. (2009)	2009 (1 y)	USA	156	156 (100)	Cro ss- secti on	Good	18. 5	Young adult	74	26	
Gwadz et al. (2009)	2009 (1 y)	USA	80	80 (100)	Cro ss- secti on	Good	19. 1	Young adult	51	49	
Solorio et al. (2008)	2001-2 (2 y)	USA	261	261 (100)	Coh ort	Good	15. 5	Adoles cent minor	40	60	
Busen et al. (2008)	2008 (1 y)	USA	95	95 (100)	Cro ss- secti on	Satisfa ctory	20. 5	Young adult	NR	NR	
Toro et al. (2008)	1992– 1994 and 2000– 2002 (8 y)	USA	468	468 (100)	Coh ort	Satisfa ctory	15	Adoles cent minor	48	52	
Kushel et al. (2007)	2002-3 (2 y)	USA	185	185 (100)	Cro ss- secti on	Satisfa ctory	17. 5	Adoles cent minor	52	48	
Whitbe ck et al. (2007)	2007 (1 y)	USA	455	429 (94)	Cro ss- secti on	Good	17. 4	Adoles cent minor	44	56	
Gwadz et al. (2007)	2000 (1 y)	USA	85	85 (100)	Cro ss- secti on	Good	20. 4	Young adult	51	49	
Techak asem and Kolkijk ovin (2006)	1994- 2003 (10 y)	Thailan d	21	21 (NR)	Cro ss- secti on	Satisfa ctory	13. 76	Adoles cent minor	33	67	
Chen et al. (2006)	2006 (1 y)	USA	428	428 (100)	Cro ss- secti on	Good	17. 4	Adoles cent minor	44	56	
Solorio et al. (2006)	2001-2 (2 y)	USA	707	688 (97)	Cro ss- secti on	Good	16	Adoles cent minor	52	48	
Taylor et al. (2006)	2004-5 (2 y)	UK	150	150 (100)	Cro ss-	Good	19. 1	Young adult	53	47	

					secti on						
Johnson et al. (2005)	2005 (1 y)	USA	505	455 (90)	Cro ss- secti on	Good	17. 4	Adoles cent minor	44	56	
Robert et al. (2005)	1998- 99 (2 y)	Canada	218	218 (100)	Cro ss- secti on	Good	15. 68	Adoles cent minor	61	39	
Pottick et al. (2005)	1997 (1 y)	USA	7659 6	76596 (NR)	Cro ss- secti on	Satisfa ctory	15	Adoles cent minor	60	40	
Slesnic k and Prestop nik (2005)	2005 (1 y)	USA	226	226 (100)	Cro ss- secti on	Good	15	Adoles cent minor	46	54	
Whitbe ck et al. (2004)	2004 (1 y)	USA	455	428 (94.3)	Cro ss- secti on	Satisfa ctory	17. 4	Adoles cent minor	44	56	
Slesnic k and Toniga n (2004)	2004 (1 y)	USA	37	37 (100)	Cro ss- secti on	Good	15. 16	Adoles cent minor	49	51	
Stewart et al. (2004)	1995- 98 (4 y)	USA	394	374 (95)	Coh ort	Good	17. 1	Adoles cent minor	54	46	
Khuran a et al. (2004)	2001 (1 y)	India	150	150 (100)	cro s- secti on	Satisfa ctory	14	Adoles cent minor	10 0	0	
Baer et al. (2003)	2003 (1 y)	USA	198	198 (100)	Cro ss- secti on	Good	17. 18	Adoles cent minor	55	45	
Auslan der et al. (2002)	2002 (1 y)	USA	343	343 (NR)	Cro ss- secti on	Satisfa ctory	16. 35	Adoles cent minor	45	55	
Rohde et al. (2001)	1994- 97 (4 y)	USA	523	523 (NR)	Cro ss- secti on	Good	17. 8	Adoles cent minor	59	41	
Embry et al. (2000)	1981 and 1987	USA	86	83 (96)	Cro ss-	Good	15. 9	Adoles cent minor	54	46	

	(2 y)				secti on						
Whitbe ck et al. (2000)	1995- 96 (2 y)	USA	602	602 (100)	Cro ss- secti on	Satisfa ctory	17	Adoles cent minor	23	77	
Cauce et al. (2000)	2000 (1 y)	USA	364	362 (99)	Cro ss- secti on	Satisfa ctory	16. 4	Adoles cent minor	58	42	
Ryan et al. (2000)	1991- 93 (3 y)	USA	422	329 (78)	Cro ss- secti on	Good	16. 44	Adoles cent minor	58	42	
Yoder (1999)	1999 (1 y)	USA	602	527 (87)	Cro ss- secti on	Satisfa ctory	16	Adoles cent minor	40	60	
Sleeger s et al. (1998)	1994 (1 y)	Netherl ands	53	50 (94)	Cro ss- secti on	Satisfa ctory	18	Young adult	88	12	
McCas kill et al. (1998)	1993- 94 (2 y)	USA	118	118 (100)	Cro ss- secti on	Satisfa ctory	14. 5	Adoles cent minor	NR	NR	
Craig and Hodson (1998)	1993- 94 (2 y)	UK	161	161 (100)	Cro ss- secti on	Satisfa ctory	17	Adoles cent minor	63	27	
Yates et al. (1998)	1985 (1 y)	USA	110	110 (100)	Cro ss- secti on	Satisfa ctory	18	Young adult	37	63	
Booth and Zhang (1997)	1997 (1 y)	USA	219	219 (100)	Coh ort	Satisfa ctory	17. 4	Adoles cent minor	54	46	
Unger et al. (1997)	1994- 95 (2 y)	USA	515	432 (84)	Cro ss- secti on	Satisfa ctory	17. 5	Adoles cent minor	65	35	
Adlaf et al. (1996)	1996 (1 y)	Canada	217	217 (100)	Cro ss- secti on	Satisfa ctory	19. 5	Young adult	74	26	
Dadds et al. (1993)	1993 (1 y)	USA	117	117 (100)	Cro ss- secti on	Satisfa ctory	16	Adoles cent minor	57	43	

Feitel et al. (1992)	1990-91 (2 y)	USA	169	150 (89)	Cross-section	Satisfactory	18.45	Young adult	65	35	
Cohen et al. (1991)	1988-89 (2 y)	USA	637	637 (100)	Cross-section	Satisfactory	18	Young adult	57	43	
Kurtz et al. (1991)	1985-88 (4 y)	USA	349	349 (NR)	Cross-section	Satisfactory	15.8	Adolescent minor	57	43	
Warheit and Biafora (1991)	1991 (1 y)	USA	100	100 (NR)	Cross-section	Satisfactory	14.5	Adolescent minor	74	26	
Yates et al. (1991)	1988-89 (2 y)	USA	467	467 (100)	Cross-section	Satisfactory	17	Adolescent minor	47	53	
Powers et al. (1990)	1986-87 (2 y)	USA	223	223 (100)	Cross-section	Satisfactory	15.6	Adolescent minor	39	61	

NR= not reported

Table 2. Pooled prevalence of life-time and current prevalence of mental health disorders among runaway and homeless youth

Type of mental health disorder	Number of studies	N	Lifetime pooled prevalence (95% CI)	Number of studies	N	Current pooled prevalence (95% CI)
Depression	50	18246	43% (37-49%)	5	1306	31% (18-44%)
Major depressive disorders	26	7632	34% (28-40%)	7	1403	23% (15-30%)
Dysthymia	3	466	14% (0-36%)	NA	NA	NA
Anxiety	28	94239	22% (16-28%)	4	411	23% (8-37%)
Bipolar disorders	23	80375	23% (16-30%)	7	3475	15% (3-26%)
Adjustment disorders	4	76767	15% (15-15%)	NA	NA	NA
Conduct disorders	19	96178	47% (35-59%)	NA	NA	NA
Schizophrenia	16	18280	11% (7-16%)	4	368	8% (6-11%)
Oppositional defiant disorders	4	588	21% (9-33%)	2	271	13% (8-18%)
Obsessive-compulsive disorders	9	1588	9% (3-15%)	2	140	6% (2-11%)
Personality disorders	10	1381	27% (14-41%)	2	221	13% (3-23%)
ADHD	17	80905	25% (17-34%)	2	221	16% (0-42%)

PTSD	41	11966	33% (26-40%)	9	3370	21% (15-27%)
Anorexia	3	1596	15% (0-35%)	NA	NA	NA
Gambling disorder	3	1352	8% (1-14%)	NA	NA	NA
Psychological distress	5	3524	47% (37-57%)	NA	NA	NA

Table 3. Subgroup analyses of pooled prevalence of life-time and current mental health disorders by age of participants among street-involved children and youth

Pooled prevalence (95% CI)	Type of mental health disorder	Adolescent minor	Young adult
Lifetime pooled prevalence (95% CI)	Depression	34% (25-42%)	48% (41-56%)
	Major depressive disorders	26% (19-33%)	39% (30-48%)
	Dysthymia	NA*	NA*
	Anxiety	19% (11-28%)	24% (16-31%)
	Bipolar disorders	19% (4-34%)	24% (16-32%)
	Adjustment disorders	15% (15-15%)	15% (9-21%)
	Conduct disorders	53% (40-65%)	27% (3-50%)
	Schizophrenia	8% (0-16%)	14% (9-18%)
	Oppositional defiant disorders	NA*	NA*
	Obsessive-compulsive disorders	18% (5-30%)	3% (1-4%)
	Personality disorders	29% (10-48%)	27% (8-45%)
	ADHD	26% (8-44%)	25% (16-34%)
	PTSD	32% (19-45%)	34% (25-42%)
	Anorexia	NA*	NA*
	Gambling disorder	NA*	NA*
Psychological distress	NA*	NA*	
Current pooled prevalence (95% CI)	Depression	22% (12-32%)	46% (41-51%)
	Major depressive disorders	24% (11-36%)	22% (14-30%)

	Dysthymia	NA*	NA*
	Anxiety	NA*	NA*
	Bipolar disorders	10% (0-23%)	19% (0-37%)
	Adjustment disorders	NA*	NA*
	Conduct disorders	NA*	NA*
	Schizophrenia	NA*	NA*
	Oppositional defiant disorders	NA*	NA*
	Obsessive-compulsive disorders	NA*	NA*
	Personality disorders	NA*	NA*
	ADHD	NA*	NA*
	PTSD	19% (10-29%)	22% (14-31%)
	Anorexia	NA*	NA*
	Gambling disorder	NA*	NA*
	Psychological distress	NA*	NA*

* Not applicable

Table 4. Pooled prevalence of life-time and current prevalence of mental health disorders, subgroup analyses of pooled prevalence of life-time and current mental health disorders by age of participants, and time of study publication among street-involved children and youth

Pooled prevalence (95% CI)	Type of mental health disorder	Number of studies	N	Pooled prevalence (95% CI)	Adolescent minors	Young adults	≤2010	>2010
Lifetime pooled prevalence (95% CI)	Depression	50	18246	43% (37-49%)	34% (25-42%)	48% (41-56%)	40% (30-50%)	45% (38-52%)
	Major depressive disorders	26	7632	34% (28-40%)	26% (19-33%)	39% (30-48%)	31% (23-39%)	36% (26-46%)
	Dysthymia	3	466	14% (0-36%)	NA*	NA*	NA*	NA*
	Anxiety	28	94239	22% (16-28%)	19% (11-28%)	24% (16-31%)	12% (7-16%)	27% (20-35%)
	Bipolar disorders	23	80375	23% (16-30%)	19% (4-34%)	24% (16-32%)	30% (16-43%)	20% (12-28%)
	Adjustment disorders	4	76767	15% (15-15%)	15% (15-15%)	15% (9-21%)	15% (15-15%)	15% (9-21%)
	Conduct disorders	19	96178	47% (35-59%)	53% (40-65%)	27% (3-50%)	45% (31-58%)	54% (28-81%)
	Schizophrenia	16	18280	11% (7-16%)	8% (0-16%)	14% (9-18%)	10% (3-17%)	13% (7-18%)
	Oppositional defiant disorders	4	588	21% (9-33%)	NA*	NA*	21% (7-35%)	20% (0-47%)
	Obsessive-compulsive disorders	9	1588	9% (3-15%)	18% (5-30%)	3% (1-4%)	10% (0-21%)	6% (2-10%)
	Personality disorders	10	1381	27% (14-41%)	29% (10-48%)	27% (8-45%)	25% (1-49%)	28% (10-46%)
	Attention-deficit/hyperactivity disorder (ADHD)	17	80905	25% (17-34%)	26% (8-44%)	25% (16-34%)	16% (6-25%)	31% (19-42%)
	Post-traumatic stress disorder (PTSD)	41	11966	33% (26-40%)	32% (19-45%)	34% (25-42%)	30% (16-44%)	35% (27-42%)
	Anorexia	3	1596	15% (0-35%)	NA*	NA*	NA*	NA*
	Gambling disorder	3	1352	8% (1-14%)	NA*	NA*	NA*	NA*

	Psychological distress	5	3524	47% (37-57%)	NA*	NA*	NA*	NA*
Current pooled prevalence (95% CI)	Depression	5	1306	31% (18-44%)	22% (12-32%)	46% (41-51%)	22% (12-32%)	46% (41-51%)
	Major depressive disorders	7	1403	23% (15-30%)	24% (11-36%)	22% (14-30%)	19% (13-25%)	33% (13-53%)
	Dysthymia	NA	NA	NA	NA*	NA*	NA*	NA*
	Anxiety	4	411	23% (8-37%)	NA*	NA*	NA*	NA*
	Bipolar disorders	7	3475	15% (3-26%)	10% (0-23%)	19% (0-37%)	13% (1-24%)	18% (0-44%)
	Adjustment disorders	NA	NA	NA	NA*	NA*	NA*	NA*
	Conduct disorders	NA	NA	NA	NA*	NA*	NA*	NA*
	Schizophrenia	4	368	8% (6-11%)	NA*	NA*	8% (4-12%)	9% (5-13%)
	Oppositional defiant disorders	2	271	13% (8-18%)	NA*	NA*	NA*	NA*
	Obsessive-compulsive disorders	2	140	6% (2-11%)	NA*	NA*	NA*	NA*
	Personality disorders	2	221	13% (3-23%)	NA*	NA*	NA*	NA*
	Attention-deficit/hyperactivity disorder (ADHD)	S	221	16% (0-42%)	NA*	NA*	NA*	NA*
	Post-traumatic stress disorder (PTSD)	9	3370	21% (15-27%)	19% (10-29%)	22% (14-31%)	7% (12-21%)	25% (14-35%)
	Anorexia	NA	NA	NA	NA*	NA*	NA*	NA*
	Gambling disorder	NA	NA	NA	NA*	NA*	NA*	NA*
Psychological distress	NA	NA	NA	NA*	NA*	NA*	NA*	

* Not applicable

Table 5. Multivariate meta-regression of the lifetime and current pooled prevalence of mental disorders among runaway and homeless youth (RHY) by age, sample size, publication year, quality assessment of studies, geographic location, and diagnosis criteria

Pooled prevalence	Type of mental health disorder	Covariates	β coefficient	SE^a	<i>p</i>-value	Heterogeneity <i>I</i>²%	Adj. R²%^b	
Lifetime pooled prevalence	Depression	Age of participants						
		Adolescent minor (reference)	-	-	-			
		Young adults	0.1402	0.06	0.020*			
		Sample size						
		≤200 (reference)	-	-	-	85.04	78.38	
		>200	0.0777	0.06	0.196			
		Diagnosis criteria for mental disorders				98.47	13.28	
		DISC ^c (reference)	-	-	-			
		DSM ^d	0.1614	0.17	0.343			
		MINI ^e	0.0869	0.18	0.630			
	Other criteria	0.2000	0.14	0.179				
	Major depressive disorders	Age of participants					96.62	18.42
		Adolescent minor (reference)	-	-	-			
		Young adults	0.1295	0.08	0.111			
		Geographic location						
		Europe (reference)	-	-	-			
		North America	0.1227	0.10	0.222			
		Diagnosis criteria for mental disorders						
		DISC ^c (reference)	-	-	-			
		DSM ^d	-0.1093	0.11	0.338			
		MINI ^e	-0.0435	0.11	0.709			
Other criteria	0.0569	0.10	0.593					
Personality disorders	Diagnosis criteria for mental disorders					96.75	0	
	DSM ^d (reference)	-	-	-				
	MINI ^e	-0.0395	0.19	0.840				
	Other criteria	-0.2318	0.19	0.236				
	Year of publication of studies					99.67	18.42	

Anxiety	≤2010 (reference)	-	-	-		
	>2020	0.1336	0.06	0.037*		
	Sample size					
	≤200 (reference)	-	-	-		
	>200	-0.0387	0.07	0.602		
PTSD	Diagnosis criteria for mental disorders				98.75	1
	DISC ^c (reference)	-	-	-		
	DSM ^d	-0.0922	0.16	0.568		
	MINI ^e	-0.1037	0.13	0.428		
	Other criteria	0.0296	0.11	0.803		
	Quality assessment of studies					
	Very good	0.0067	0.08	0.935		
	Good (reference)	-	-	-		
Satisfactory	-0.1122	0.09	0.239			
Conduct disorders	Age of participants				0	100
	Adolescent minor (reference)	-	-	-		
	Young adults	0.2644	0.04	0.001**		
	Quality assessment of studies					
	Very good	0.0337	0.05	0.522		
	Good (reference)	-	-	-		
	Satisfactory	0.1598	0.04	0.001**		
Schizophrenia	Age of participants				98.51	2.89
	Adolescent minor (reference)	-	-	-		
	Young adults	0.0518	0.04	0.260		
	Geographic location					
	Europe (reference)	-	-	-		
North America	0.0369	0.05	0.527			
ADHD	Year of publication of studies				85.16	82.15
	≤2010 (reference)	-	-	-		
	>2020	0.2274	0.06	0.001**		
	Sample size					
	≤200 (reference)	-	-	-		
	>200	-0.0782	0.06	0.227		
Bipolar disorders	Geographic location				97.27	32.23
	North America	0.1399	0.08	0.115		
	Europe (reference)	-	-	-		
	Diagnosis criteria for mental disorders					
	DSM ^d (reference)	-	-	-		

		MINI ^e	0.0073	0.07	0.920	0	100	
		Other criteria	0.1705	0.07	0.021*			
	Obsessive-compulsive disorders	Age of participants						
		Adolescent minor (reference)	-	-	-			
		Young adults	-0.2697	0.04	0.001**			
		Diagnosis criteria for mental disorders						
		DISC ^c (reference)	-	-	-			
		DSM ^d	0.1878	0.03	0.001**			
		MINI ^e	0.2362	0.03	0.001**			
		Other criteria	0.1799	0.02	0.001**			
		Geographic location						
		North America	-0.0078	0.01	0.635			
		Europe (reference)	-	-	-			
		Sample size						
		≤200 (reference)	-	-	-			
>200	0.0142	0.04	0.730					
Current pooled prevalence	Depression	Year of publication of studies						
		≤2010 (reference)	-	-	-			
		>2020	0.2403	0.06	0.001**	85.04	78.38	
	PTSD	Year of publication of studies					94.08	0
		≤2010 (reference)	-	-	-			
		>2020	0.0226	0.09	0.812			
		Quality assessment of studies						
		Satisfactory	-0.0669	0.10	0.512			
		Good	0.0352	0.09	0.709			
	Very good (reference)	-	-	-				
	Bipolar disorders	Geographic location					92.15	24.87
		North America	0.1172	0.07	0.109			
		Europe (reference)	-	-	-			

^a SE: Standard error

^b Adj.R²: Adjusted R squared

^c Center for Epidemiological Studies Depression Scale

^d Diagnostic and Statistical Manual of Mental Disorders

^e Mini International Neuropsychiatric Interview

* $p < 0.05$

** $p < 0.01$

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s00787-024-02519-2>

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Supplementary File 127. The current pooled prevalence of schizophrenia among runaway and homeless youth, after removing Middleton et al., 2018 (the study that had the most significant contribution to heterogeneity)

Supplementary File 128. Baujat plot for the life-time pooled prevalence of schizophrenia. The studies on the right hand side showed the most significant contribution to the heterogeneity

Supplementary File 129. The life-time pooled prevalence of schizophrenia among runaway and homeless youth, after removing Narendorf et al., 2020, Toro et al., 2008 (the studies that had the most significant contribution to heterogeneity)

Supplementary File 130. Baujat plot for the life-time pooled prevalence of oppositional defiant disorders. The studies on the right hand side showed the most significant contribution to the heterogeneity

Supplementary File 131. The life-time pooled prevalence of oppositional defiant disorders among runaway and homeless youth, after removing Robert et al., 2005 (the study that had the most significant contribution to heterogeneity)

Supplementary File 132. Baujat plot for the life-time pooled prevalence of obsessive-compulsive disorders. The studies on the right hand side showed the most significant contribution to the heterogeneity

Supplementary File 133. The life-time pooled prevalence of obsessive-compulsive disorders among runaway and homeless youth, after removing Solorio et al., 2006 (the study that had the most significant contribution to heterogeneity)

Supplementary File 134. Baujat plot for the life-time pooled prevalence of personality disorders. The studies on the right hand side showed the most significant contribution to the heterogeneity

Supplementary File 135. The life-time pooled prevalence of personality disorders among runaway and homeless youth, after removing Ferguson et al., 2015 (the study that had the most significant contribution to heterogeneity)

Supplementary File 136. Baujat plot for the life-time pooled prevalence of ADHD. The studies on the right hand side showed the most significant contribution to the heterogeneity

Supplementary File 137. The life-time pooled prevalence of ADHD among runaway and homeless youth, after removing Narendorf et al., 2020 (the study that had the most significant contribution to heterogeneity)

Supplementary File 138. Baujat plot for the current pooled prevalence of PTSD The studies on the right hand side showed the most significant contribution to the heterogeneity

Supplementary File 139. The current pooled prevalence of PTSD among runaway and homeless youth, after removing Pedersen et al., 2018 (the study that had the most significant contribution to heterogeneity)

Supplementary File 140. Baujat plot for the life-time pooled prevalence of PTSD. The studies on the right hand side showed the most significant contribution to the heterogeneity

Supplementary File 141. The life-time pooled prevalence of PTSD among runaway and homeless youth, after removing Whitbeck et al., 2007 (the study that had the most significant contribution to heterogeneity)

Supplementary File 142. Baujat plot for the life-time pooled prevalence of anorexia. The studies on the right hand side showed the most significant contribution to the heterogeneity

Supplementary File 143. The life-time pooled prevalence of anorexia among runaway and homeless youth, after removing Cutuli, 2018 (the study that had the most significant contribution to heterogeneity)

Supplementary File 144. Baujat plot for the life-time pooled prevalence of gambling disorders. The studies on the right hand side showed the most significant contribution to the heterogeneity

Supplementary File 145. The life-time pooled prevalence of gambling disorders among runaway and homeless youth, after removing Taylor et al., 2006 (the study that had the most significant contribution to heterogeneity)

Supplementary File 146. Baujat plot for the life-time pooled prevalence of psychological distress. The studies on the right hand side showed the most significant contribution to the heterogeneity

Supplementary File 147. The life-time pooled prevalence of psychological distress among runaway and homeless youth, after removing Narendorf et al., 2023 (the study that had the most significant contribution to heterogeneity)

