



The Global Prevalence of Non-suicidal Self-injury, Suicide Behaviors, and Associated Risk Factors Among Runaway and Homeless Youth: A Meta-analysis

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Abstract

A meta-analysis was performed to determine pooled prevalence of non-suicidal self-injury (NSSI), suicide behaviors (including ideation, attempts), and associated risk factors among runaway and homeless youth (RHY). The databases *PubMed*, *Scopus*, *Web of Science*, and *Cochrane Library* were searched for relevant studies published from January 1995 to May 2023. Initially, 8465 papers were screened, resulting in 69 included studies. The results showed that among RHY, lifetime prevalence rates were 42% for NSSI, 38% for suicidal ideation, and 27% for suicide attempts. Lifetime prevalence of NSSI and suicide behaviors was higher among adolescent minors (aged 12–17 years) compared to young adults (aged 18–24 years). Also, NSSI and suicide behaviors were associated with having a childhood history of physical and sexual abuse. Developing an impactful community-based suicide prevention campaign tailored for RHY appears warranted. Peer groups and mentorship programs would provide invaluable support for young individuals, as supportive friendships protect against NSSI.

Keywords Non-suicidal self-injury · Suicidal behaviors · Runaway youth · Homeless youth · Physical abuse · Sexual abuse

Introduction

One of the most significant public health issues worldwide is suicide (Sher et al., 2023). Annually, nearly 700,000 individuals lose their lives to suicide (World Health Organization [WHO], 2022). Among individuals aged 15 to 29 years, suicide ranked as the fourth leading cause of death, based on 2019 data (World Health Organization [WHO], 2022). Extensive research has consistently demonstrated that homeless individuals face significantly worse physical and mental health compared to the general population, which may lead them to exhibit suicide behaviors (Ayano et al., 2019; Xiang et al., 2021). Based on a systematic review and meta-analysis that included 20 studies comprising 27,497 participants (Ayano et al., 2019), the authors reported that among homeless individuals, there was a combined current prevalence rate of 18% for suicidal ideation (ranging from 13% to 38%) and 9% for suicide attempts (ranging from 4% to 33%).

Previous studies have shown that several sociodemographic, clinical, and homelessness-related factors can lead to suicidal behaviors among runaway and homeless youth (RHY), such as being female (Hadland et al., 2012; Moskowitz et al., 2013), being of younger age (Moskowitz et al., 2013), having a lack of social support (Labelle et al., 2020), experiencing the death of a family member (Labelle et al., 2020), not living with family (Neiva-Silva et al., 2023), having mental disorders (Frederick et al., 2012; Fulginiti et al., 2022), having a history of physical and/or sexual abuse (Hadland et al., 2015; Neiva-Silva et al., 2023; Petering et al., 2017), being exposure to trauma (Fulginiti et al., 2022), experiencing a prolonged duration of homelessness, and experiencing stressful life events (Yohannes et al., 2023).

There are several studies that have reported the effectiveness of specific treatment or intervention for reducing suicidal behaviors among homeless individuals. The main approaches for reducing such behaviors are Cognitive Therapy for Suicide Prevention (Slesnick et al., 2020; Wu et al., 2020, 2022b), Housing First (Aquin et al., 2017), Housing First Combined with Suicide Treatment Education and Prevention (Chavez et al., 2021), and strategies to strengthen family relationships, communication skills, and develop coping skills (Murray et al., 2021). Moreover, studies have found that the main barriers to care among homeless individuals that may lead them to avoid suicidal interventions include stigma (Cernadas et al., 2021; Purkey et al., 2019), low personal capacities (Mar et al., 2023), an uncountable and inflexible healthcare system (Purkey et al., 2019), inability to afford treatment (Cernadas et al., 2021; Ramsay et al., 2019), lack of trust in healthcare providers, poor therapeutic relationships (Ramsay et al., 2019), negative prior health care experiences, competing priorities, and provider turnover (Thorndike et al., 2022).

In the past 20 years, there has been a growing concern among policymakers and social service providers regarding the escalating number of RHY who are residing autonomously on the

streets, in shelters, or in precarious circumstances (e.g., living on month-to-month rental leases, very poor housing conditions, etc.) (Narendorf et al., 2023). Youth run away or become homeless for numerous reasons. Some are forced out of their homes or choose to leave due to family conflicts or dysfunction (Morrow et al., 2023). Insufficient discharge planning and a lack of support services for youth transitioning from child welfare or juvenile justice systems can also contribute to homelessness (Castellanos, 2016; Verstraete et al., 2018). Additionally, familial residential instability and financial hardships play significant roles in the lives of many RHY (Giano et al., 2020).

Research consistently indicates that RHY face substantial health and mental health difficulties due to a multitude of challenging stressors while living on the streets (Neiva-Silva et al., 2023; Winiarski et al., 2021). Notably, RHY consistently report elevated levels of interconnected traumas, such as physical, sexual, and emotional abuse, both in their past and during their homelessness (McKinnon et al., 2023; Middleton et al., 2022). Studies have also shown a high prevalence of risky sexual behavior, which may include survival sex work (e.g., exchanging sexual practices for money, food, shelter, alcohol, or drugs) (Heerde et al., 2015), and high rates of sexually transmitted diseases/HIV infection among this cohort (Halverson et al., 2022; Madden et al., 2021). Substance use, including alcohol and drugs, is frequently resorted to or encountered by RHY, often resulting in patterns of abuse and, in some cases, clinical dependence (Armoon et al., 2023a; Armoon et al., 2023b). RHY may also resort to substance use as a means of coping with the distressing effects of trauma, re-victimization during homelessness, social displacement, and the adoption of behaviors necessary for daily survival (Heerde et al., 2015). In terms of mental health, studies have reported heightened levels of depressive symptoms,

psychological distress, and instances of suicidality and suicide attempts (Burke et al., 2023; Smith-Grant et al., 2022).

As far as the present authors are aware, only three meta-analyses have reported the combined occurrence rates of suicidal ideation and suicide attempts among homeless individuals (Armoon et al., 2023c; Ayano et al., 2019; Xiang et al., 2021). However, these prior meta-analyses (i) failed to report the combined prevalence of non-suicidal self-injury (NSSI), (ii) solely focused on homeless individuals across the whole lifespan rather than specifically examining RHY, and (iii) did not conduct any meta-regression analysis. Therefore, the present meta-analysis study aimed to identify the pooled prevalence of NSSI, suicide behaviors, and associated risk factors among RHY.

Materials and methods

Registration and protocol

The present meta-analysis was performed according to the Protocols of Systematic Reviews and Meta-Analyses (Page et al., 2021) with the review protocol was registered on PROSPERO (Ref: “CRD42023421909”).

Search strategy

Two of the co-authors (BA and RM) carried out an independent review of the relevant papers published in the period January 1, 1995, to May 30, 2023. A search was conducted across several databases, namely *PubMed*, *Scopus*, *Web of Science*, and *Cochrane Library*, to identify relevant studies. All fields present in the records were utilized. Medical Subject Headings (MeSH) terms were employed in the databases to broaden the search. The initial keywords used in the search also included “(*suicidal ideation*), (*suicide attempts*), (*suicidal behaviors*), (*homeless youth*), (*homeless individuals*), (*runaway youth*), (*adolescent*), (*children adult*)”. Using essential

Boolean operators (AND/OR), the authors formulated and modified the search strategy specific to each database. Subsequently, the authors manually searched the references of the included papers to determine if any additional relevant studies could be identified (**Supplementary File 1**).

Inclusion and exclusion criteria

All the papers that were selected fulfilled the PECOS criteria (population, exposures, comparison, outcome, and study design) (Morgan et al., 2018). For “population” RHY were included. Runaway refers to individuals aged 12 to 24 years who absent themselves from home without the consent of their parents or legal guardians (Ennett et al., 1999). Homeless individuals between the ages of 12 and 24 years who do not possess a permanent dwelling, and resided in a public space, shelter, with an unfamiliar person, on the streets, with friends, in transitional housing and/or other non-domicile settings are considered homeless youth (Tyler et al., 2020). For “exposures”, associated determinants of RHY on NSSI and/or suicide behaviors were evaluated. The “comparison” group was RHY not reporting lifetime NSSI and suicide behaviors. Lifetime NSSI and/or suicide behaviors, including suicidal ideation and suicide attempts among RHY were considered as “outcomes”. Regarding “study design”, cross-sectional, cohort, or case-control studies were considered to be included in the meta-analysis. Qualitative papers, secondary analyses that did not possess primary data, systematic reviews, and meta-analyses were not considered for inclusion. Variables that were only reported in only one study were not included in the meta-analysis. Variables that were reported in two or more studies were included, as it is generally accepted that a minimum of two studies are required to conduct a meta-analysis (Ryan, 2016).

Screening and data extraction

Data management was carried out using *EndNote X7 software (Thomson Reuters)*. Initially, duplicated titles and abstracts were eliminated, with an agreement rate of 89%. The titles and

abstracts of the papers identified in the literature search were independently reviewed by two authors (BA and RM), taking into account the PECOS criteria. The quality assessment procedure formulated by BA and RM was assessed using unweighted kappa (a measure of agreement beyond chance). The level of agreement was classified as poor, slight, fair, moderate, substantial, or almost perfect, based on the values of 0, 0.01-0.02, 0.021-0.04, 0.041-0.06, 0.061-0.08, or 0.081-1.00 respectively (Landis et al., 1977). If there were any disagreements about the included papers, a third co-author (MDG) was involved to resolve them and provide input as needed. Next, the full texts of the obtained papers were reviewed by two authors (BA and RM) using the PECOS framework and the inclusion and exclusion criteria of the study. The absence of critical data or inability to access full texts were also regarded as exclusion criteria. The data from studies that were identified as meeting the inclusion criteria, were extracted and managed using *Microsoft Excel* software.

Risk of bias assessment

Study quality appraisal was evaluated using the Newcastle-Ottawa Scale (NOS) (Peterson et al., 2011) (**Supplementary File 2**). Within the NOS, there are three aspects that include: (i) selection, with three items for cross-sectional investigations, and four items for cohort explorations. This refers to the representativeness of the exposed group, the selection of the non-exposed group, and the ascertainment of exposure; (ii) comparability, with one item for both cross-sectional and cohort studies. This refers to the comparability of study groups in terms of their design or analytical approach; and (iii) exposure/outcome, with one item for cross-sectional research, and three items for cohort studies. This refers to evaluating the outcome. A point was awarded to a study that satisfied each item. The study quality scores were calculated by summing up the items, with a maximum score of 5 for cross-sectional studies and 8 for cohort studies. In the

case of cross-sectional studies, the total scores were categorized as “unsatisfactory” (0-2), “satisfactory” (3), “good” (4), or “very good” (5); and for cohort studies, the total scores were categorized as “unsatisfactory” (0-3), “satisfactory” (4), “good” (5-6), or “very good” (7-8). Fifteen studies were rated as being of high quality, 32 studies were rated as being of good quality, and 20 studies were rated as being of satisfactory quality.

Study selection process

Initially, 8,465 papers were found through the four database searches (**Figure 1**). After paper duplicates were excluded ($n=4,786$), the title and abstracts of 3,679 papers were screened. Of these, 395 were found to be related to the study’s aim. After a full text review, 883 studies were excluded. The main reasons for exclusion were as follows: 19 studies did not meet the quality appraisal score (2%), and a further 864 studies were excluded from the final analysis including: (i) those employing qualitative research methods, (ii) those failing to report the prevalence of suicidal behaviors and/or NSSI, (iii) those not providing odds ratios for the determinants of study outcomes, (iv) studies already published that involved the same study population, (v) studies that lacked participants with RHY, and (vi) studies that reported determinants considered inadequate for inclusion in the final analysis (e.g., those related to experiences like the death of a family member or exposure to trauma) (98%). Following these exclusions, 69 studies remained for meta-analysis (Adlaf et al., 1999; Adlaf et al., 1996; Baer et al., 2003; Barker et al., 2019; Barnes et al., 2018; Barr et al., 2017; Booth et al., 1999; Brands et al., 2005; Cameron et al., 2004; DiGuseppi et al., 2020; Edinburgh et al., 2013; Feitel et al., 1992; Frederick et al., 2012; Fulginiti et al., 2022; Gauvin et al., 2019; Gewirtz O’Brien et al., 2020; Greene et al., 1996; Hadland et al., 2012; Hadland et al., 2015; Harris et al., 2017; Keeshin et al., 2011; Kennedy, 1991; Khurana et al., 2004; Kidd, 2006; Kidd et al., 2017; Kirst et al., 2011; Labelle et al., 2020; Leslie et al., 2002; Liu

et al., 2022; MacLean et al., 1999; Molnar et al., 1998; Moore et al., 2018; Moskowitz et al., 2013; Narendorf et al., 2018; Neiva-Silva et al., 2023; Noell et al., 2001; Petering, 2016; Petering et al., 2017; Poremski et al., 2020; Rew, 2001; Rhoades et al., 2018; Rohde et al., 2001; Ryan et al., 2000; Saewyc et al., 2010; Salomonsen-Sautel et al., 2008; Sibthorpe et al., 1995; Slegers et al., 1998; Slesnick et al., 2008; Slesnick et al., 2005, 2009; Slesnick et al., 2002; Slesnick et al., 2021; Stiffman, 1989; Unger et al., 1997; Votta et al., 2004; Walls et al., 2007; Walls et al., 2009; Whitbeck et al., 2004; Wu et al., 2022a; Yoder, 1999; Yoder et al., 2008, 2010; Yoshioka-Maxwell et al., 2020).

Figure 1 here

Data synthesis and statistical analysis

To identify the characteristics associated with suicide behaviors among RHY, a meta-analysis was conducted, which involved generating pooled odds ratios (ORs) and 95% confidence intervals (CIs). A 2×2 table was utilized to compute the OR. An OR <1 indicates a negative correlation between independent variables and NSSI and suicide behaviors, whereas an OR >1 indicates a positive correlation between the variables. Multivariate logistic regression was considered to indicate the OR of each variable. To assess the lack of correlation among studies, the Cochran's Q test at $p < 0.05$ and I-squared (I^2) statistics (with a cutoff value of $\geq 50\%$) were deemed the most appropriate options. The 95% CI were used for I^2 . To obtain the pooled estimation, the random-effects model was employed, taking into account the various sampling methods employed in the studies. Furthermore, the sources of heterogeneity between studies were assessed using the Cochran's Q and I^2 tests. Subgroup analyses were conducted to identify the sources of heterogeneity, taking into account the sample size, study design, quality assessment of studies, and geographic regions. Each subgroup analysis was required to have at least two studies

reporting data on the variable of interest. A sensitivity analysis was conducted using Baujat plots to determine the effect of the most significant study on overall heterogeneity and exclude it when evaluating the effect of each specific study on the overall estimate. Finally, to examine the main source of heterogeneity, a multivariate meta-regression analysis was conducted. A p -value <0.05 was deemed statistically significant, and the meta-analysis was conducted using R 3.5.1 with the “meta” package.

Results

Study characteristics

Selected studies were from four WHO regions (66 from the America region [$n=109,579$ participants], two from the European region [$n=205$ participants], and one from South-East Asia region [$n=150$ participants] (**Table 1**). The USA had the highest number of included studies, with 50 studies ($n=104,191$). Considering the country income level based on the World Bank (2021) criteria, 68 studies were conducted in high-income countries ($n=109,784$), and one study was conducted in a lower-middle-income country ($n=150$). Of the included studies, the mean sample size was 1,591 participants, with 49 being the smallest sample size (Brands et al., 2005) and 68,785 being the largest sample size (Gewirtz O’Brien et al., 2020). Response rates between studies varied from 74% to 100%. Participants had a mean age of 17.2 years and were more likely to be male (mean 57%), varying from 0% to 100%. In relation to the participant cohort, 54% comprised adolescent minors (12-17 years) and 46% comprised young adults (18-24 years). Almost all studies were cross-sectional (93%). A total of 33 studies were published between 2010 and 2023. Moreover, 33 studies assessed both suicidal ideation and suicide attempts as the outcomes, taken from either administrative databases or self-report surveys. Four studies assessed suicidal ideation only, 32 studies assessed suicide attempts only, and seven studies assessed NSSI only as the

outcome measure. Most studies ($n=52$) used a simple question for assessing suicide and self-harm behaviors among RHY (e.g., “*Have you ever thought about suicide?*” and/or “*Have you ever attempted suicide?*” and/or “*Have you ever purposefully made a cut, a burn, or some other injury to your body?*”). In relation to associated factors, out of the 69 studies examined in the meta-analysis, sexual abuse was reported in four studies, physical abuse in three studies, and depressive symptoms in three studies. Other associated factors could not be met-analyzed due to a lack of data.

Table 1 here

Prevalence of NSSI and suicide behaviors among RHY

Among RHY, the analysis indicated a significant life-time pooled prevalence rate of 42% for NSSI (95% CI, 33%-51%), 38% for suicidal ideation (95% CI, 33%-43%), and 27% for suicide attempts (95% CI, 24%-31%) (**Figures 2-4**).

Figures 2-4 here

Subgroup analyses of life-time pooled prevalence of NSSI and suicide behaviors by age of participants among RHY

In another subgroup analysis, participants were classified into two groups based on age: (i) 12-17 years (adolescent minors) and (ii) 18-24 years (young adults) (**Supplementary Files 3-5**). The results showed that the lifetime pooled prevalence of NSSI (45%, 95% CI = 32%-57%; based on four studies), suicidal ideation (42%, 95% CI = 37%-47%; based on 22 studies), and suicide attempts (29%, 95% CI = 24%-33%; based on 35 studies), were higher among adolescent minors (12-17 years old) compared to the lifetime pooled prevalence of NSSI (39%, 95% CI = 24%-54%; based on three studies), suicidal ideation (33%, 95% CI = 24%-42%; based on 15 studies), and

suicide attempts (26%, 95% CI = 20%-32%; based on 30 studies) among young adults (18-24 years old) within the RHY population.

Risky determinants associated with NSSI and suicide behaviors among RHY

Significant associations were found between history of sexual and/or physical abuse and suicide behaviors among RHY (**Figure 5**). RHY who had history of physical and sexual abuse were 1.99 and 3.15 times more likely than those who did not to report lifetime suicide behaviors respectively (OR=1.99, 95%CI=1.36-2.90) (OR=3.15, 95%CI=2.16-4.60).

Figure 5 here

Subgroup analysis

Subgroup analysis confirmed that with increasing age, there was a decrease in the lifetime pooled prevalence of NSSI, suicidal ideation, and suicide attempts (**Supplementary Files 3-17**). Additionally, a decline over time was observed in the lifetime pooled prevalence of NSSI, suicidal ideation, and suicide attempts. Moreover, several subgroup analyses were conducted. However, these analyses were unable to identify the main sources of heterogeneity between studies. Unassessed variables, such as participants' gender and other factors, could potentially have contributed to the heterogeneity.

Sensitivity Analysis

Following the sensitivity analysis, studies that made the most significant contributions to heterogeneity were excluded (**Supplementary Files 18-35**). This confirmed that the sensitivity analysis did not effectively reduce heterogeneity between studies for almost all variables.

Meta-regression analysis

To explore the main source of heterogeneity, a meta-regression analysis was performed (**Supplementary File 36**). Life-time pooled prevalence of NSSI and suicide behaviors were considered as dependent variables and age, sample size, publication year, quality assessment of studies and geographic location were included as explanatory covariates. The findings of the meta-regression indicated that these covariates were unable to explain the source of heterogeneity.

Discussion

The present meta-analysis estimated the pooled prevalence rates and associated risk factors of NSSI and suicide behaviors among RHY. Generally, NSSI and suicide behaviors were associated with having a childhood history of physical and sexual abuse. The prevalence of suicidal ideation (38%) and suicide attempts (27%) among RHY was significantly greater compared to the prevalence estimates of suicidal ideation and attempts in the general population of Africa [lifetime: 18.7% and 5.5% (Kaggwa et al., 2023) respectively], Asia [lifetime: 17% and 9% (Mazumder et al., 2022) respectively], as well as Europe [lifetime: 9.08% and 2.88% (Castillejos et al., 2021) respectively].

It was also found that the pooled prevalence of NSSI (42%) among RHY was higher than that among university students (38.9%) or adults (4%-23%) (Cipriano et al., 2017), as well as higher than the prevalence among adolescents (22.1%) (Lim et al., 2019). The potential cause for the observed rates in the intensity of suicide behaviors could be attributed to the higher likelihood of homeless individuals encountering traumatic events, such as physical and sexual abuse (Liu et al., 2021; Sundin et al., 2015). These experiences may put them at greater risk of developing suicidal tendencies in comparison to the broader population. Furthermore, the substantial disparity in the prevalence of mental health disorders and/or substance use disorders among homeless individuals (Armoon et al., 2023c; Gutwinski et al., 2021), when compared to the general

population, may also contribute to self-harm and suicide behaviors. Moreover, the pooled prevalence of suicide behaviors in the present study were lower than lifetime pooled prevalence of suicidal ideation (41%) and suicide attempts (28%-31.83%) (Ayano et al., 2019; Xiang et al., 2021) reported among homeless individuals across the lifespan (Ayano et al., 2019; Xiang et al., 2021). The possible reason for this may be that the general homeless population often has higher rates of mental health disorders such as mood and psychotic disorders (Armoon et al., 2023c), which significantly increase the risk of suicide behaviors. RHY also face mental health challenges, but the prevalence and severity of these conditions are generally lower compared to the general homeless population (Gutwinski et al., 2021). Another possible reason may be that the general homeless population faces greater social isolation, rejection, and stigma (Reilly et al., 2022) compared to RHY. This lack of support and negative attitudes by others are likely to intensify feelings of hopelessness, ultimately increasing the risk of suicide behaviors.

Another one of the novel findings of the present study was that the lifetime prevalence rates of NSSI and suicide behaviors were higher among adolescent minors (aged 12-17 years) compared to young adults (aged 18-24 years). This finding appears to be counter-intuitive as it would be expected that the lifetime prevalence of NSSI and suicide behaviors would increase over time but the results may simply be due to heterogeneity between studies because, although subgroup and meta-regression analyses were conducted, they were unable to identify the source of heterogeneity. Moreover, adolescent minors who experience high levels of mental health problems (e.g., suicidal behavior) may be more likely to connect with services earlier, leading them to participate in research. Conversely, young adults are more prone (than who?) to fail in accessing services due to stigma, embarrassment, difficulties in recognizing problems, and a desire to deal with difficulties themselves (Gulliver et al., 2010).

Previously, there have been no reports on the pooled prevalence of NSSI and suicide behaviors among RHY. According to research, multiple factors contribute to adolescents showing a greater inclination towards engaging in suicide behaviors compared to adults (Ho et al., 2022; Sood et al., 2017). A contributing factor stems from the distinct challenges linked to adolescence, encompassing identity formation, peer pressure, academic stress, and hormonal changes, which may lead them to exhibit suicide behaviors (Eisenlohr-Moul et al., 2018; Ho et al., 2022). The period of transitioning from childhood to adulthood can be characterized as turbulent, marked by emotional volatility and an increased susceptibility to various challenges such as suicide behaviors (Sood et al., 2017).

In addition, adolescents encounter specific risk factors that heighten their vulnerability to engaging in suicide behaviors. These risk factors encompass a greater prevalence of mental health disorders such as depression, anxiety (Okado et al., 2021; Ruiz-Robledillo et al., 2019), and substance use (Armoon et al., 2023a; Armoon et al., 2023b), along with challenges in accessing suitable mental health services. Due to stigma, confidentiality concerns, or limited awareness of available resources, adolescents might display a lower likelihood of seeking help or showing their emotional distress (Aguirre Velasco et al., 2020; Radez et al., 2021). Furthermore, the limited life experience and coping skills inherent among adolescents can result in a diminished capacity to effectively handle and navigate challenging situations (Modecki et al., 2017). Additionally, social factors such as peer influence and exposure to social media can contribute to feelings of isolation, cyberbullying, and unhealthy comparisons, thereby intensifying the risk of engaging in suicide behaviors (Balt et al., 2023; Massing-Schaffer et al., 2020; Memon et al., 2018).

The elevated risks of suicide behaviors in the present study were significantly associated with past experiences of sexual and physical abuse. This finding is consistent with previous studies

(Armoon et al., 2023c; Fernández-Montalvo et al., 2019). Previous research has demonstrated that childhood stress and trauma histories are significantly and inversely linked to brain development, potentially exposing affected individuals to dysfunctional psychopathology (Leeb et al., 2011; Twardosz et al., 2010). The etiological mechanisms linking childhood traumatic experiences and an increased risk of suicidality have been elucidated through genetic, clinical, and epidemiological evidence (Marshall et al., 2013). Consistent with the present study's findings, other review studies have reported a significant association between childhood sexual abuse and increased risk of suicidality (Chen et al., 2010; Devries et al., 2014). Such a relationship is supported by different theories.

According to the interpersonal psychological theory of suicide, a wish to die is generated among individuals due to them perceiving they have become burdensome to others and lack of a sense of belonging (Joiner, 2005). The consequences of childhood sexual abuse (e.g., betrayal and stigmatization) are the traumagenic dynamics outlined by Finkelhor and Browne (1985). In other words, an individual's sense of belongingness and value might be undermined following the experience of adverse emotions, such as extreme disconnection from others, guilt, and shame derived from childhood sexual abuse-induced betrayal and stigmatization (Finkelhor et al., 1985).

The childhood sexual abuse-induced elevated desire to die can be explained by the interpersonal psychological theory (Finkelhor et al., 1985). This theory suggests that suicide-related death dominates the potential to attempt fatal violence towards the self. Encountering provocative circumstances and frequent distressing experiences (resulting in decreased fear of death and sensitivity to pain) may lead to developing this condition. The interpersonal–psychological theory states that individuals experiencing frequent sexual violence and abuse might

have an elevated threshold for fear and pain, leading to an exacerbated risk of suicidality (Rabinovitch et al., 2015).

Limitations

The present meta-analysis study raises specific methodological concerns regarding the included studies. First, the included studies exhibited varying operational definitions for the primary variables, and some of them lacked a precise and explicit definition. The distinction between an actual suicide attempt and other forms of self-injury was not always adequately made among the participants examined, specifically in terms of the specifier “attempted suicide” (Kamieniecki, 2001). Second, the term “abuse” was defined differently across the included studies, with multiple interchangeable operational definitions being presented. In general, terms such as victimization, neglect, sexual and physical abuse, histories of domestic violence during homelessness or housing, as well as threats of harm or death, were encompassed within the included terms related to this matter (Hadland et al., 2012; Neiva-Silva et al., 2023; Petering et al., 2017).

Furthermore, the definition of homelessness, as a situational criterion, varied across studies. More specifically, the characteristics taken into account for this criterion included being expelled from the household by family, accessing temporary accommodation or shelters, the extent of access to social support services, the duration of homelessness, and the level of interactions with family. Additionally, the majority of studies relied solely on single-item questions to evaluate suicide behaviors. Moreover, specific variables, such as being female, presence of death in the family, lack of social support, and experiencing trauma, were not assessed due to the limited availability of studies focusing on these variables. Finally, there was a high heterogeneity among studies. In the present study, several potential sources of heterogeneity were identified, including

age, sample size, publication year, quality assessment of studies, and geographic location. This seems to contradict the next sentence. While no specific sources of heterogeneity were identified, it is important to note that variables not assessed, such as participants' gender, could potentially be sources of heterogeneity. This is because the studies did not report the prevalence rates of NSSI and/or suicide behaviors separately by gender, only providing overall prevalence rates. Despite conducting various subgroup analyses and sensitivity analyses to mitigate heterogeneity, they were unable to pinpoint the primary source of heterogeneity among the studies.

Implications for research, policy, and practice

The findings of the present study emphasize the necessity for further research to investigate key areas, such as estimating NSSI and suicide behaviors among adolescent minors and young adults. It is crucial to identify prevalent NSSI and suicide behaviors with respect to age and to explore whether specific gender differences exist. The present study was unable to discern the role of gender in NSSI and suicide behaviors, emphasizing the need for comprehensive investigations into potential gender-specific patterns. As few variables were associated with NSSI and suicide behaviors among RHY, an essential research priority should be to investigate a range of potentially contributing sociodemographic, clinical, and service use variables. This is particularly important given that this vulnerable population may face constraints in accessing care services.

Another area for future research involves the operationalization of suicidal ideation and suicide attempts, necessitating the specification of criteria and behaviors that can be objectively identified and assessed. Utilizing standardized questionnaires or interviews, including essential tools such as the Columbia-Suicide Severity Rating Scale (C-SSRS) or the Suicide Ideation Questionnaire (SIQ), play a critical role in effectively operationalizing suicide behaviors. Moreover, when devising treatment plans for such individuals, it is imperative to address the

adverse repercussions stemming from prior incidents of sexual and physical abuse. Documentation of histories involving such abuses should be incorporated into the medical records of RHY to ensure that these detrimental experiences are taken into account during the process of treatment planning. Different service providers, including shelters, drop-in centers, permanent supportive housing, and outreach teams, have the capacity to systematically and reliably oversee suicide-related risks among homeless populations.

Conclusion

The present study represents the first meta-analysis conducted to determine the pooled prevalence of NSSI, suicide behaviors, and risk-taking among RHY. Notably, various novel findings emerged, including the pooled prevalence of each specific NSSI and suicide behavior categorized by the age groups of participants, encompassing both adolescent minors and young adults. Furthermore, to the authors' knowledge, the present study is the first to utilize meta-regression analysis in order to assess heterogeneity across the included studies. Based on the study findings, it is advisable for policymakers and program planners to formulate a comprehensive approach that addresses the prevention, detection, and management of suicide behavior within this vulnerable and often overlooked population. Additionally, it is crucial to develop and implement an impactful community-based suicide prevention campaign (Lebenbaum et al., 2020; Robinson et al., 2016; Thorn et al., 2020; Torok et al., 2017; van der Burgt et al., 2021) or school-based suicide prevention programs (Brann et al., 2021; Wasserman et al., 2015) specifically tailored for RHY.

To further address the mental health needs of RHY, a priority should be placed on enhancing access to mental health care, especially for those who exhibit suicide behavior. Given the potential progression from long-term NSSI to suicide behavior, it is crucial to swiftly

implement intervention strategies that effectively reduce the risk of suicide for youth engaging in self-injury. Educational institutions such as schools and colleges should adopt preventive interventions that prioritize the skillful management of negative emotions. In addition, the establishment of peer groups and mentorship programs (Bowersox et al., 2021; Lapidos et al., 2019; Schlichthorst et al., 2020; Zachariah et al., 2018) can provide invaluable support for young individuals, as supportive friendships have been shown to act as protective factors against NSSI (Fernandez et al., 2022). Finally, it is important to incorporate into their treatment plans a comprehensive approach that acknowledges and tackles the adverse effects stemming from their prior encounters with sexual and physical abuse.

Abbreviations

CI: Confidence intervals

MeSH: Medical Subject Headings

NSSI: Non-suicidal self-injury

NOS: Newcastle-Ottawa Scale

ORs: Odds ratios

PECOS: Population, exposures, comparison, outcome, and study design

RHY: Runaway and homeless youth

WHO: World Health Organization

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Table 1 Characteristics of studies for non-suicide self-injury and suicide behaviors among runaway and homeless youth

Authors (Year)	Year (y) of data collection (length)	Country	Sample at baseline	Final sample size and response rate	Study design	Data collection source	Quality assessment	Mean age	Youth type	Male %	Female %	Suicidal behaviors measurement	Lifetime suicide ideation %	Lifetime suicide attempts %	Lifetime self-injurious behavior %
Neiva-Silva et al. (2023)	2022 (1 y)	Brazil	307	307 (100)	Cross-section	Survey	Very good	18.5	Young adults	81	19	A question about suicidal behaviors	30.9	16.3	NR
Slesnick et al. (2022)	2022 (1 y)	USA	150	150 (100)	Cross-section	Survey	Good	20.9	Young adults	59	41	Interpersonal Needs Questionnaire	NR	80.7	NR
Wu et al., (2022a, 2022b)	2022 (1 y)	USA	150	150 (100)	Cross-section	Survey	Good	20.9	Young adults	49	51	Scale for Suicidal Ideation – Worst Point	74.7	NR	NR
Fulginiti et al. (2022)	2011–13 (3 y)	USA	1047	1047 (100)	Cross-section	Survey	Very good	21	Young adults	72	28	A question about suicidal behaviors	NR	12	NR
Liu et al. (2022)	2019 (1 y)	USA	4523	4523 (100)	Cross-section	Survey	Satisfactory	15	Adolescent minors	62	38	A question about suicidal behaviors	44.4	28	NR
Yoshioka-Maxwell and Rice (2020)	2015–16 (2 y)	USA	184	184 (100)	Cross-section	Survey	Very Good	21.9	Young adults	68	32	A question about suicidal behaviors	NR	2.89	NR
Gewirtz O'Brien et al. (2020)	2016 (1 y)	USA	68,785	68,785 (100)	Cross-section	Survey	Very good	16.0	Adolescent minors	49	51	A question about suicidal behaviors	41.2	19.9	50.1
Labelle et al. (2020)	2014 (1 y)	Canada	76	76 (100)	Cross-section	Survey	Good	15.5	Adolescent minors	44	56	A question about suicidal behaviors	19	19	NR
DiGiuseppe et al. (2020)	2011–13 (3 y)	USA	1032	1032 (100)	Cross-section	Survey	Very Good	21.3	Young adults	71	29	A question about suicidal behaviors	NR	11.5	NR

Table 1 (continued)

Authors (Year)	Year (y) of data collection (length)	Country	Sample at baseline	Final sample size and response rate	Study design	Data collection source	Quality assessment	Mean age	Youth type	Male %	Female %	Suicidal behaviors measurement	Lifetime suicide ideation %	Lifetime suicide attempts %	Lifetime self-injurious behavior %
Adlaf et al. (1996)	1996 (1 y)	Canada	217	217 (100)	Cross-section	Survey	Satisfactory	19.5	Young adults	74	26	A question about suicidal behaviors	NR	43	NR
Greene et al. (1996)	1992 (1 y)	USA	1240	1240 (100)	Cross-section	Survey	Satisfactory	16.0	Adolescent minors	50	50	A question about suicidal behaviors	NR	25	NR
Kennedy (1991)	1988-89 (2 y)	USA	100	100 (100)	Cross-section	Survey	Satisfactory	16.3	Adolescent minors	27	63	NR	58	45	NR
Sibthorpe et al. (1995)	1992 (1 y)	England	155	155 (100)	Cross-section	Survey	Satisfactory	16.0	Adolescent minors	54	46	NR	NR	45	NR
Rotheram-Borus (1993)	1991-2 (2 y)	USA	526	526 (100)	Cross-section	Survey	Satisfactory	16.3	Adolescent minors	49	51	NR	NR	37	NR
Feitel et al. (1992)	1990-91 (2 y)	USA	169	150 (89)	Cross-section	Survey	Good	18.5	Young adults	65	35	NR	38	27.3	NR
Stuffman et al. (1989)	1985-87 (3 y)	USA	291	291 (100)	Cross-section	Survey	Satisfactory	17.0	Adolescent minors	29	71	A question about suicidal behaviors	NR	30	NR
Authors (Year)			Being male	Being female	Do not live with family	Dropped out from school	Lack of social support	Presence of death in family	Presence of romantic break-up	Sexual abuse	Physical abuse	Having trauma	Depressive symptoms		
Neiva-Silva et al. (2023)					*	*					*				
Slesnick et al. (2022)															
Wu et al., (2022a, 2022b)														*	*
Fulginiti et al. (2022)															
Liu et al. (2022)															
Yoshioka-Maxwell and Rice (2020)															
Gewirtz O'Brien et al. (2020)							*	*	*						
Labelle et al. (2020)															
DiGiuseppe et al. (2020)															

Table 1 (continued)

Authors (Year)	Year of data collection (length)	Country	Sample at baseline	Final sample size and response rate	Study design	Data collection source	Quality assessment	Mean age	Youth type	Male %	Female %	Suicidal behaviors measurement	Lifetime suicide ideation %	Lifetime suicide attempts %	Lifetime self-injurious behavior %
Rohde et al. (2001)	2001 (1 y)	USA	523	523 (100)	Cross-section	Survey	Good	17.8	Adolescent minors	59	41	A question about suicidal behaviors	NR	38	NR
Ryan et al. (2000)	2000 (1 y)	USA	422	329 (78)	Cross-section	Survey	Good	16.4	Adolescent minors	58	42	NR	NR	36.7	NR
MacLean et al. (1999)	1999 (1 y)	USA	395	354 (90)	Cross-section	Survey	Satisfactory	16.4	Adolescent minors	58	42	NR	NR	43	NR
Adlaf and Zdanowicz (1999)	1992 (1 y)	Canada	217	217 (100)	Cross-section	Survey	Satisfactory	19.9	Young adults	74	26	NR	NR	44	NR
Booth et al. (1999)	1992-93 (2 y)	USA	244	244 (NR)	Cross-section	Survey	Good	17.4	Adolescent minors	51	49	NR	NR	47	NR
Yoder (1999)	1999 (1 y)	USA	602	527 (87)	Cross-section	Survey	Satisfactory	16.0	Adolescent minors	40	60	A question about suicidal behaviors	30	24	NR
Molnar et al. (1998)	1992-93 (2 y)	USA	755	755 (100)	Cross-section	Survey	Satisfactory	17.5	Adolescent minors	65	35	A question about suicidal behaviors	58	34	NR
Yoder et al. (1998)	1998 (1 y)	USA	347	297 (85)	Cross-section	Survey	Satisfactory	16.1	Adolescent minors	42	58	A question about suicidal behaviors	53.9	26.3	NR
Slegers et al. (1998)	1994 (1 y)	Netherlands	53	50 (94)	Cross-section	Survey	Satisfactory	18.0	Young adults	88	12	A question about suicidal behaviors	NR	27	NR
Unger et al. (1997)	1997 (1 y)	USA	584	432 (74)	Cross-section	Survey	Good	17.5	Adolescent minors	65	35	A question about suicidal behaviors	61.9	38.9	49.3

Table 1 (continued)

Authors (Year)	Year (y) of data collection (length)	Country	Sample at baseline	Final sample size and response rate	Study design	Data collection source	Quality assessment	Mean age	Youth type	Male %	Female %	Suicidal behaviors measurement	Lifetime suicide ideation %	Lifetime suicide attempts %	Lifetime self-injurious behavior %
Votta and Manion (2004)	2000–1(2 y)	Canada	194	170 (88)	Cross-section	Survey	Satisfactory	17.4	Adolescent minors	100	0	A question about suicidal behaviors	46	14	NR
Votta and Manion (2004)	2000–1(2 y)	Canada	194	170 (88)	Cross-section	Survey	Satisfactory	17.4	Adolescent minors	100	0	A question about suicidal behaviors	45	16	NR
Khurana et al. (2004)	2001 (1 y)	India	150	150 (100)	cross-section	Survey	Satisfactory	14	Adolescent minor	NR	NR	A question about suicidal behaviors	25	8.3	NR
Cameron et al. (2004)	2002 (1 y)	Canada	69	69 (100)	Cross-section	Survey	Satisfactory	18.1	Young adults	62	38	A question about suicidal behaviors	24.6	20.3	NR
Whitbeck et al. (2004)	2004 (1 y)	USA	455	428 (94.3)	Cross-section	Survey	Satisfactory	17.4	Adolescent minors	44	56	A question about suicidal behaviors	57	37	NR
Baer et al. (2003)	2003 (1 y)	USA	198	198 (100)	Cross-section	Survey	Good	17.2	Adolescent minors	55	45	A question about suicidal behaviors	NR	3.3	NR
Slesnick et al. (2002)	2002 (1 y)	USA	150	145 (95)	Cross-section	Survey	Good	15.1	Adolescent minors	43	57	NR	NR	37.9	NR
Rew et al. (2001)	2001 (1 y)	USA	96	96 (100)	Cross-section	Survey	Satisfactory	17.9	Adolescent minors	59	41	A question about suicidal behaviors	35.1	12.3	NR
Noel Ochs et al. (2001)	2001 (1 y)	USA	532	532 (100)	Cross-section	Survey	Good	17.7	Adolescent minors	59	41	A question about suicidal behaviors	57.8	41.35	NR

Table 1 (continued)

Authors (Year)	Year (y) of data collection (length)	Country	Sample at baseline	Final sample size and response rate	Study design	Data collection source	Quality assessment	Mean age	Youth type	Male %	Female %	Suicidal behaviors measurement	Lifetime suicide ideation %	Lifetime suicide attempts %	Lifetime self-injurious behavior %
Slesnick et al. (2009)	2001–5 (5 y)	USA	133	133 (100)	Cross-section	Survey	Good	18.5	Young adults	60	40	NR	NR	43.6	NR
Slesnick and Prestopnik (2009)	2009 (1 y)	USA	119	119 (100)	Cross-section	Survey	Satisfactory	15.1	Adolescent minors	45	55	A question about suicidal behaviors	NR	48	NR
Slesnick et al. (2008)	2008 (1 y)	USA	133	133 (100)	Cross-section	Survey	Satisfactory	18.3	Young adults	60	40	NR	NR	43.6	NR
Salomon-Salomon-Saunetel et al. (2008)	2004 (1 y)	USA	684	684 (100)	Cross-section	Survey	Good	19.0	Young adults	51	49	A question about suicidal behaviors	NR	36	NR
Yoder et al. (2008)	2008 (1 y)	USA	444	444 (100)	Cross-section	Survey	Very good	17.3	Adolescent minors	44	56	A question about suicidal behaviors	31.3	16	NR
Eugene Walls et al. (2007)	2004–5 (2 y)	USA	187	187 (100)	Cross-section	Survey	Satisfactory	17.3	Adolescent minors	52	48	A question about suicidal behaviors	48.92	37.3	42
Kidd (2006)	2006 (1 y)	USA and Canada	208	208 (100)	Cross-section	Survey	Good	20.2	Young adults	60	40	A question about suicidal behaviors	NR	46	NR
Brands et al. (2005)	2000–2 (3 y)	Canada	49	49 (100)	Cross-section	Survey	Good	17.8	Adolescent minors	51	49	A question about suicidal behaviors	NR	17	NR
Slesnick and Prestopnik (2005)	2005 (1 y)	USA	124	122 (98)	Cross-section	Survey	Good	14.8	Adolescent minors	41	59	A question about suicidal behaviors	NR	63	NR

Table 1 (continued)

Authors (Year)	Year (y) of data collection (length)	Country	Sample at baseline	Final sample size and response rate	Study design	Data collection source	Quality assessment	Mean age	Youth type	Male %	Female %	Suicidal behaviors measurement	Lifetime suicide ideation %	Lifetime suicide attempts %	Lifetime self-injurious behavior %
Moskowitz et al. (2013)	2011–12 (2 y)	USA	474	474 (100)	Cross-section	Survey	Good	19.4	Young adults	59	41	A question about suicidal behaviors	NR	26	25
Frederick et al. (2012)	2005–6 (2 y)	Canada	150	150 (100)	Cross-section	Survey	Good	19.2	Young adults	50	50	A question about suicidal behaviors	27	15	43
Hadland et al. (2012)	2005–7 (3 y)	Canada	495	495 (100)	Cohort	Administrative database	Very good	21.8	Young adults	69	31	A question about suicidal behaviors	36.8	9.3	NR
Kirst et al. (2011)	2005–6 (2 y)	Canada	150	150 (100)	Cross-section	Survey	Good	18.5	Young adults	50	50	A question about suicidal behaviors	46	NR	NR
Keeshin and Campbell (2011)	2011 (1 y)	USA	64	64 (NR)	Cross-section	Survey	Good	20.5	Young adults	67	33	NR	NR	50	NR
Yoder et al. (2010)	1999–2000 (2 y)	USA	405	405 (100)	Cross-section	Survey	Good	17.5	Adolescent minors	38	62	A question about suicidal behaviors	48.9	26.7	NR
Leslie et al. (2010)	2010 (1 y)	USA	348	348 (100)	Cross-section	Survey	Good	16.0	Adolescent minors	57	43	A question about suicidal behaviors	28.73	18.96	NR
Saewyc et al. (2010)	2006–7 (2 y)	USA	68	68 (100)	Cross-section	Survey	Good	13.8	Adolescent minors	0	100	A question about suicidal behaviors	52	20	NR
Walls et al. (2009)	2004 (1 y)	USA	751	628 (84)	Cross-section	Survey	Good	20.0	Young adults	59	41	A question about suicidal behaviors	NR	34.71	NR

Table 1 (continued)

Authors (Year)	Year (y) of data collection (length)	Country	Sample at baseline	Final sample size and response rate	Study design	Data collection source	Quality assessment	Mean age	Youth type	Male %	Female %	Suicidal behaviors measurement	Lifetime suicide ideation %	Lifetime suicide attempts %	Lifetime self-injurious behavior %
Petering et al. (2017)	2012–13 (2 y)	USA	495	495 (100)	Cross-section	Survey	Very Good	21.3	Young adults	70	30	A question about suicidal behaviors	13.11	13.09	NR
Barr et al. (2017)	2011–13 (3 y)	USA	398	398 (100)	Cross-section	Survey	Good	21.4	Young adults	71	29	A question about suicidal behaviors	17.02	6.98	NR
Kidd et al. (2017)	2015 (1 y)	Canada	1161	1103 (95)	Cohort	Administrative database	Very good	19.0	Young adults	56	44	A question about suicidal behaviors	NR	42	NR
Moore et al. (2017)	2012–13 (2 y)	USA	1169	1169 (100)	Cross-section	Survey	Good	15.6	Adolescent minors	74	26	A question about suicidal behaviors	47.9	NR	NR
Petering (2016)	2012–13 (2 y)	USA	505	505 (NR)	Cross-section	Survey	Very Good	21.4	Young adults	72	23	A question about suicidal behaviors	19.68	11.2	NR
Edinburgh et al. (2016)	2008–10 (3 y)	Canada	269	269 (100)	Cross-section	Survey	Good	14.2	Adolescent minors	0	100	A question about suicidal behaviors	51.2	24.7	58.2
Petering et al. (2016)	2012–13 (2 y)	USA	505	505 (100)	Cross-section	Survey	Very Good	21.4	Young adults	72	28	A question about suicidal behaviors	19.68	11.2	NR
Hadland et al. (2015)	2005–13 (9 y)	Canada	660	660 (100)	Cohort	Administrative database	Very Good	21.5	Young adults	67	33	A question about suicidal behaviors	39.2	5.6	NR
Mackelprang et al. (2014)	2006–9 (4 y)	USA	7232	7232 (100)	Cohort	Administrative database	Good	21.8	Young adults	37	63	NR	33.5	8	NR

Table 1 (continued)

Authors (Year)	Year (y) of data collection (length)	Country	Sample at baseline	Final sample size and response rate	Study design	Data collection source	Quality assessment	Mean age	Youth type	Male %	Female %	Suicidal behaviors measurement	Lifetime suicide ideation %	Lifetime suicide attempts %	Lifetime self-injurious behavior %
Gauvin et al. (2019)	2019(1 y)	Canada	76	76 (100)	Cross-section	Survey	Good	15.3	Adolescent minors	44	56	A question about suicidal behaviors	25	25	NR
Barker et al. (2019)	2005–15 (11 y)	Canada	1210	1210 (100)	Cohort	Administrative database	Good	21.7	Young adults	69	31	A question about suicidal behaviors	NR	14.3	NR
Narendorf et al. (2018)	2014(1 y)	USA	374	374 (NR)	Cross-section	Survey	Very Good	20.7	Young adults	54	46	A question about suicidal behaviors	NR	24.3	NR
Rhodes et al. (2018)	2015–17 (3 y)	USA	657	524 (67.3)	Cross-section	Survey	Very good	17.6	Adolescent minors	66	34	Columbia-Suicide Severity Rating Scale (C-SSRS) and Suicide Behaviors Questionnaire-Revised (SBQ-R)	NR	34.2	NR
Harris et al. (2018)	2011–13 (3 y)	USA	1046	966 (92)	Cross-section	Survey	Good	21.1	Young adults	71	29	A question about suicidal behaviors	16.05	NR	NR
Narendorf et al. (2018)	2014 (1 y)	USA	374	374 (100)	Cross-section	Survey	Very Good	20.7	Young adults	59	41	A question about suicidal behaviors	NR	24.3	NR
Barnes et al. (2018)	2013 (1 y)	USA	4594	4594 (100)	Cross-section	Survey	Good	14.9	Adolescent minors	55	45	NR	21.04	9.22	29.1

Table 1 (continued)

Authors (Year)	Being male	Being female	Do not live with family	Dropped out from school	Lack of social support	Presence of death in family	Presence of romantic break-up	Sexual abuse	Physical abuse	Having trauma	Depressive symptoms
Gauvin et al. (2019)											
Barker et al. (2019)											
Narendorf et al. (2018)											
Rhoades et al. (2018)											
Harris et al. (2018)											
Narendorf et al. (2018)								*			
Barnes et al. (2018)											
Petering et al. (2017)											
Barr et al. (2017)											
Kidd et al. (2017)											
Moore et al. (2017)											
Petering (2016)											
Edinburgh et al. (2016)											
Petering et al. (2016)											
Hadland et al. (2015)									*		
Mackelprang et al. (2014)											
Moskowitz et al. (2013)											
Frederick et al. (2012)											
Hadland et al. (2012)									*		*
Kirst et al. (2011)											
Keshin and Campbell (2011)											
Yoder et al. (2010)											
Leslie et al. (2010)											
Saewyc et al. (2010)											
Walls et al. (2009)											
Slesnick et al. (2009)											
Slesnick and Prestopnik (2009)											
Slesnick et al. (2008)											
Salomonsen-Sautel et al. (2008)											
Yoder et al. (2008)											
Eugene Walls et al. (2007)											
Kidd (2006)											
Brands et al. (2005)											

Table 1 (continued)

Authors (Year)	Being male	Being female	Do not live with family	Dropped out from school	Lack of social support	Presence of death in family	Presence of romantic break-up	Sexual abuse	Physical abuse	Having trauma	Depressive symptoms
Slesnick and Prestopnik (2005)											
Votta and Manion (2004)											
Votta and Manion (2004)											
Khurana et al. (2004)											
Cameron et al. (2004)											
Whitbeck et al. (2004)											
Baer et al. (2003)											
Slesnick et al. (2002)											
Rew et al. (2001)											
Noel Ochs et al. (2001)											
Rohde et al. (2001)											
Ryan et al. (2000)											
MacLean et al. (1999)											
Adlaf and Zdanowicz (1999)											
Booth et al. (1999)											
Yoder (1999)											
Molnar et al. (1998)								*			
Yoder et al. (1998)											
Sleegers et al. (1998)								*			
Unger et al. (1997)											
Adlaf et al. (1996)											
Greene et al. (1996)											
Kennedy (1991)											
Sibthorpe et al. (1995)		*									
Rotheram-Borus (1993)											
Feitel et al. (1992)											
Stiffman et al. (1989)											

*Key variables that were investigated by studies

NR not reported

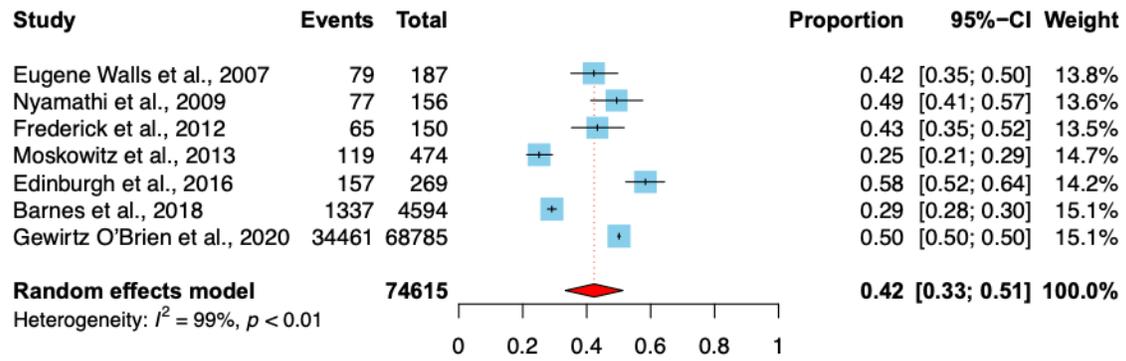


Fig. 2 Life-time pooled prevalence of non-suicidal self-injury among runaway and homeless youth (RHY)

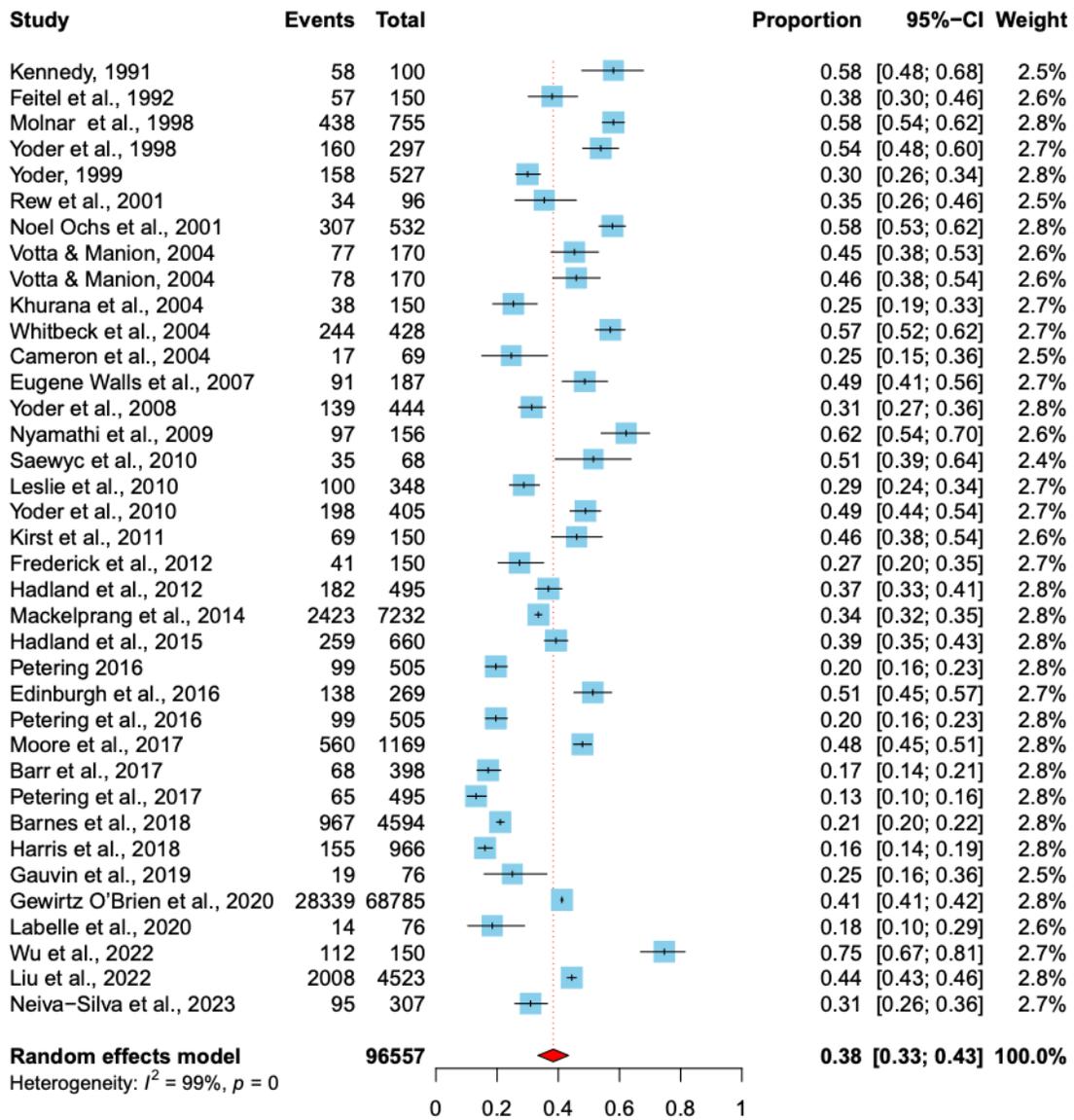


Fig. 3 Life-time pooled prevalence of suicide ideations among runaway and homeless youth (RHY)

Fig. 5 Pooled odds ratio of risky determinants associated with non-suicidal self-injury and suicide behaviors among runaway and homeless youth (RHY)

