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Prevalence and associated factors of post-traumatic stress disorder in pediatric populations in Africa: a systematic review and meta-analysis

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Abstract

Introduction Post-traumatic stress disorder (PTSD) is a prevalent challenge faced by individuals following traumatic events. Given the substantial impact of PTSD on the well-being of young people, comprehensive assessment of the available evidence can inform more effective prevention and intervention strategies to support the mental health and resilience of children in the African context. Despite its high incidence, there has been no up-to-date systematic synthesis of evidence to measure the magnitude of PTSD in pediatric populations in Africa. This systematic review and meta-analysis aim to quantify the prevalence of PTSD and identify associated factors in this vulnerable population.

Methods A systematic search was conducted across multiple databases, including PubMed, Embase, Scopus, Science Direct, and the search engines Google Scholar and Google, covering the period from 2014 up to May 15, 2024. The primary objective of this search was to identify relevant studies. Subsequently, a meta-analysis was performed using random-effects models to estimate the pooled effect size for each outcome of interest. Additionally, subgroup analysis was conducted to explore potential sources of heterogeneity, with study characteristics considered as covariates.

Results The pooled prevalence estimate for post-traumatic stress disorder (PTSD) among pediatric individuals was 36% (95% CI: 28–44%). Notably, significant heterogeneity existed among the studies ($I^2 = 98.41\%$, p value < 0.001), prompting us to employ a random effect model analysis. Furthermore, our meta-analysis revealed that children above 14 years of age and those who experienced family deaths due to traumatic events were significantly associated with PTSD.

Conclusion This systematic review and meta-analysis revealed that the prevalence of PTSD among pediatric individuals aged 0–18 years in Africa was high. Notably, older children and those who experienced family deaths due to traumatic events were at a significantly higher risk of developing PTSD. These findings underscore the need for

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early intervention, age-specific support, and trauma-informed care to address the mental health challenges faced by pediatric populations.

Keywords Prevalence, Factors, Post-traumatic stress, Pediatric, Africa

Introduction

Post-traumatic stress disorder (PTSD) is a mental health condition triggered by a terrifying event, either experienced directly or witnessed [1, 2]. To be diagnosed with PTSD, individuals must exhibit a cluster of symptoms including re-experiencing the trauma, avoidance of trauma-related stimuli, negative changes in cognitions and mood, and alterations in arousal and reactivity [3]. Individuals affected by PTSD may have encountered the trauma themselves, witnessed it happening to others (especially primary caregivers), or learned about it happening to a parent or caregiving figure Various factors, such as age, gender, place of residence, educational status, trauma cause, personal or family history of mental illness, and social support, have been associated with PTSD in research studies [4, 5].

Children often react differently to stressful events, and due to this, their PTSD symptomatology could vary from adult PTSD symptomatology depending on their developmental stage and degree of cognitive and emotional maturity [6]. The burden of PTSD on children is significant, with exposure to potentially traumatic events (PTEs) directly linked to its onset [7]. Common PTEs reported among the pediatric population include physical injuries, domestic violence, and natural disasters. Research indicates that around 60% of children and adolescents have experienced a PTE [8]. Among this exposed population, approximately 30% develop PTSD symptomatology. While most individuals may only experience transient symptoms, a small but unfortunate group will endure chronic, long-lasting effects. Estimates suggest that 10% of children under 18 years old receive a diagnosis of PTSD, with girls being four times more likely than boys to develop the disorder [7, 9].

Despite significant advances in understanding mental health issues in war-affected populations, the prevalence of PTSD among children and adolescents in Africa remains an area of concern, necessitating a focused examination [10]. In this respect, the number of African countries affected by conflict has varied over the years. According to the Peace Research Institute Oslo (PRIO), last year saw the highest number of state-based conflicts since 1946, and the past three years were the most violent in the last three decades [11]. In 2023, the number of countries that experienced conflict dropped from 39 to 34, with Africa remaining the region with the most state-based conflicts per year [28], followed by Asia [17], the Middle East [10], Europe [3], and the Americas [1, 11]. The underpinnings of conflict in Africa are deeply rooted and multifaceted, often stemming from a confluence of ethnic and religious discord, resource scarcity, political instability, economic deprivation, colonial legacies, and external interventions [11]. Ethnic and religious disparities, exacerbated by historical grievances, frequently ignite tensions, while competition for limited resources such as land, water, and minerals can lead to violent confrontations [11]. Political instability, characterized by weak governance, corruption, and undemocratic practices, often results in power struggles and civil unrest [12]. Economic factors, including poverty and unemployment, contribute to societal discontent, providing fertile ground for militant group recruitment [11, 12]. The arbitrary borders and governance systems imposed during colonial rule continue to challenge the social and ethnic coherence of nations [12]. Moreover, foreign influence, through intervention or support for certain factions, can intensify existing conflicts [13]. Each African conflict is unique, with specific triggers and dynamics, necessitating a nuanced understanding of the individual and collective causes that drive these complex disputes [13].

While individual primary studies have provided valuable insights [14–16], we are still at the early stages of research on PTSD in the pediatric population [17], and there are specific considerations in the African context that warrant further investigation. First, there is a critical scarcity of population-level representative data specific to pediatric populations in Africa, which limits our understanding of the true burden of PTSD in this vulnerable group [18]. By conducting a systematic review and meta-analysis, we can synthesize and analyse existing studies to provide a comprehensive overview of PTSD prevalence and identify its predictors. Second, the impact of PTSD on children's overall well-being, educational attainment, and social functioning is of particular significance in the African context [10, 19]. Limited access to mental health services and the presence of other adversities, such as poverty and armed conflicts, may exacerbate the consequences of PTSD. Therefore, it is crucial to explore the multifaceted impact of PTSD on African children, considering the unique challenges they face. Third, African countries encompass a diverse range of cultural and contextual factors that may influence the prevalence and symptomatology of PTSD among children. Factors such as traditional healing practices, cultural beliefs, and social support systems may interact with PTSD experiences. Therefore, a comprehensive review of these factors is essential to develop culturally sensitive interventions

and inform mental health policies tailored to the African context.

This systematic review and meta-analysis aimed to synthesize the available evidence on the prevalence of PTSD in the pediatric population, defined as individuals under the age of 18 years. The findings will provide valuable insights for policymakers, healthcare professionals, and researchers, enabling them to make informed decisions and develop targeted interventions to mitigate the impact of PTSD on children's lives in Africa.

Methods

We conducted a thorough systematic review and meta-analysis, adhering to the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) 2020 [20] (Supplementary File 1). The study was registered in the international prospective register of systematic reviews in health and social care (PROSPERO) database (registration number: CRD42024532631). The registration ensures transparency and minimizes bias by documenting the review's protocol before data collection and analysis.

Search strategy

Our study involved a thorough and extensive search for publications focusing on post-traumatic stress disorder (PTSD), with a particular emphasis on the pediatric population. We conducted this search across multiple prominent databases, including PubMed, Embase, Scopus, Science Direct, and the search engines, Google Scholar and Google. The search encompassed articles published from 2014 until May 15, 2024.

To refine our search and improve its precision, we employed relevant MeSH headings and carefully selected keywords that were specifically related to PTSD in pediatrics. The literature search was conducted across multiple prominent databases, including PubMed, Embase, Scopus, Science Direct, as well as the search engines Google Scholar and Google. A comprehensive set of MeSH terms and keywords were used to capture all relevant studies. This included terms related to post-traumatic stress disorder, such as "Acute Post-Traumatic Stress Disorder", "Chronic Post-Traumatic Stress Disorder", "Delayed Onset Post-Traumatic Stress Disorder", "Moral Injury", "Neuroses, Post-Traumatic", "Neuroses, Posttraumatic", "PTSD", "Post Traumatic Stress Disorder", "Post-Traumatic Stress Disorders", "Posttraumatic Stress Disorders", "Stress Disorder, Post Traumatic", and "Stress Disorders, Posttraumatic".

To capture information on prevalence and associated factors, additional terms were included, such as "Prevalence", "Epidemiology", "Risk Factors", "Incidence", and "Associated Factors".

These PTSD-related and prevalence/associated factor terms were combined with terms for the population of interest, including "Pediatric", "Pediatrics", "Paediatric", "Children", "Adolescents", "Child", and "Kids".

Finally, a comprehensive set of geographic terms was used to capture studies from across the African continent, including countries such as Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cape Verde, Cameroon, Central African Republic, Chad, Comoros, Congo Democratic Republic, Congo, Cote d'Ivoire, Djibouti, Egypt, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia, and Zimbabwe.

By utilizing this approach, we aimed to optimize the retrieval of articles that were most relevant to our study objectives. Through this comprehensive and targeted search strategy, we intended to gather a robust collection of publications that would provide valuable insights into the understanding and management of PTSD in the pediatric population. In addition to electronic searches, we examined the reference lists of all included primary studies. This step was crucial to ensure that no relevant studies were inadvertently missed. In cases where we encountered articles that were inaccessible, we proactively reached out to the authors via email to request the full texts. When we encountered inaccessible articles, we contacted the authors directly to request the full texts. For two articles that met our inclusion criteria, we successfully obtained the full texts from the corresponding authors.

Eligibility criteria

Inclusion criteria for this systematic review and meta-analysis were: (1) studies of individuals under the age of 18 years, (2) studies that reported the prevalence of PTSD as defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM) criteria, and (3) studies published between 2014 and May 15, 2024. To ensure the relevance and currency of our findings, we restricted our literature search to the past 10 years. This decision was based on several factors: the types and severity of traumatic events experienced by children, such as natural disasters, armed conflicts, and abuse, have varied over the past decade, impacting PTSD prevalence. Additionally, significant advancements in the understanding, screening, diagnosis, and treatment of PTSD in children and adolescents have occurred, potentially influencing reported prevalence rates. Furthermore, societal attitudes towards mental health and the availability of

mental health resources for children and adolescents in Africa have evolved, affecting the identification and reporting of PTSD cases. By focusing on the most recent 10-year period, we aim to provide the most relevant and reliable estimates of PTSD prevalence and associated factors in pediatric populations.

We excluded studies conducted in languages other than English. Additionally, we omitted case reports, correspondence, reviews, editorials, and duplicate studies.

Outcomes of the study

The primary outcome of interest for this study was the prevalence of post-traumatic stress disorders (PTSD) in pediatrics. Additionally, we investigated the factors associated with PTSD as secondary outcomes.

Screening of articles

Duplicates were first removed from all citations identified through our search strategy. Two authors (TTT and BY) independently screened the titles, abstracts, and full texts to identify eligible studies. Any discrepancies were discussed and resolved by consensus. The Rayyan programme [21] was used for screening of articles.

Quality assessments

The methodological quality and risk of bias of the included studies were evaluated using the Newcastle-Ottawa Scale, a tool specifically designed for assessing the quality of cross-sectional studies [22]. This scale provides a comprehensive assessment of study selection, comparability of groups, and the ascertainment of the outcome of interest. The Newcastle-Ottawa Scale assigns scores ranging from 0 to 10 points, with the following categories: Very Good Studies (9–10 points), Good Studies (7–8 points), Satisfactory Studies (5–6 points), and Unsatisfactory Studies (0–4 points) (Supplementary File 2).

Data extraction

Data were extracted from included articles using a piloted form. We collected information about the characteristics of studies (author, country, design, year of publication, sample size, prevalence of PTSD and predictors). The data were extracted independently by two reviewers (TTT and BY).

Statistical analysis

The meta-analysis was conducted using Comprehensive Meta-Analysis software, version 3. A random-effects model was used to estimate the pooled proportion of PTSD and predictors in pediatric population in Africa. The summary effect estimates and 95% confidence intervals (CI) for the outcomes were represented with a forest plot. Heterogeneity between studies was examined using Cochran's Q test and quantitatively measured by the index of heterogeneity squared (I^2) statistics and corresponding 95% confidence intervals (CI) [23]. Heterogeneity was considered low, moderate or high when I^2 values were below 25%, between 25% and 75%, and above 75%, respectively [23]. To evaluate the stability and reliability of our results, we performed a comprehensive sensitivity analysis and the detailed findings from this analysis, including any significant changes or consistencies in the results, are thoroughly documented. The sources of heterogeneity were explored through subgroup analysis using study characteristics as covariates. Potential publication bias was assessed using funnel plots and asymmetry was evaluated with Egger's method.

Meta-Regression Analysis Considerations: According to the Cochrane Handbook for Systematic Reviews and Meta-Analyses, meta-regression is appropriate when there is substantial heterogeneity between studies and a sufficient number of studies to reliably estimate the effects of potential moderator variables [24]. However, for the current review, we determined that meta-regression would not provide robust or reliable insights. This decision was based on the relatively small number of studies available for the variables of interest, which was below the Cochrane-recommended minimum of 10 studies per covariate [24]. Attempting meta-regression with such a limited dataset would likely result in unstable and unreliable estimates. Therefore, we instead focused our analysis on a comprehensive subgroup and sensitivity analysis, as reported in the results section. As the evidence base expands in the future, meta-regression may become a more viable approach to explore the influence of key moderating factors on PTSD prevalence in African pediatric populations.

Results

Study selection

In this systematic review and meta-analysis, we conducted a meticulous search across various databases to ensure the inclusion of relevant studies. Our search strategy encompassed the following databases: PubMed, from which we retrieved 101 articles; Embase, which yielded 20 articles; Scopus, where we found 41 articles; and Science Direct, where we discovered 33 articles. Additionally, we performed a search on Google Scholar, which identified 647 articles, and Google, which yielded 650 articles, identifying a total of 1492 articles. To ensure the integrity of the review, we took several steps to refine the article selection process. Initially, we eliminated 1082 duplicate records, ensuring that each study was included only once. This left us with 410 records, which underwent a thorough screening process. Subsequently, we excluded 312 articles by title, 38 by abstract, and 43 by full-text. Finally, we conducted an eligibility assessment on the remaining

17 reports, evaluating their suitability for inclusion in our review. Ultimately, our thorough evaluation resulted in the inclusion of 17 high-quality studies that met our predetermined criteria after two articles written in a language other than English were excluded (Fig. 1).

Quality assessments

We evaluated the quality of the included studies using the Newcastle-Ottawa Scale, specifically adapted for cross-sectional studies [22]. Among the reviewed articles, four studies met the criteria for 'very good' quality, while thirteen were rated as 'good.' The quality scores ranged from seven to nine. For detailed quality assessment scores, please refer to Supplementary Information (Supplementary File 3).

Characteristics of included studies

In this review, we included a total of 17 studies published between 2014 and 2024, involving 8,930 pediatric study subjects. Among these studies, one was conducted in Zambia and published in 2014, another in Egypt (published in 2015), two in Nigeria (published in 2016 and 2017), two in Kenya (published in 2018 and 2019), three in Morocco (conducted from 2020 to 2022), four in

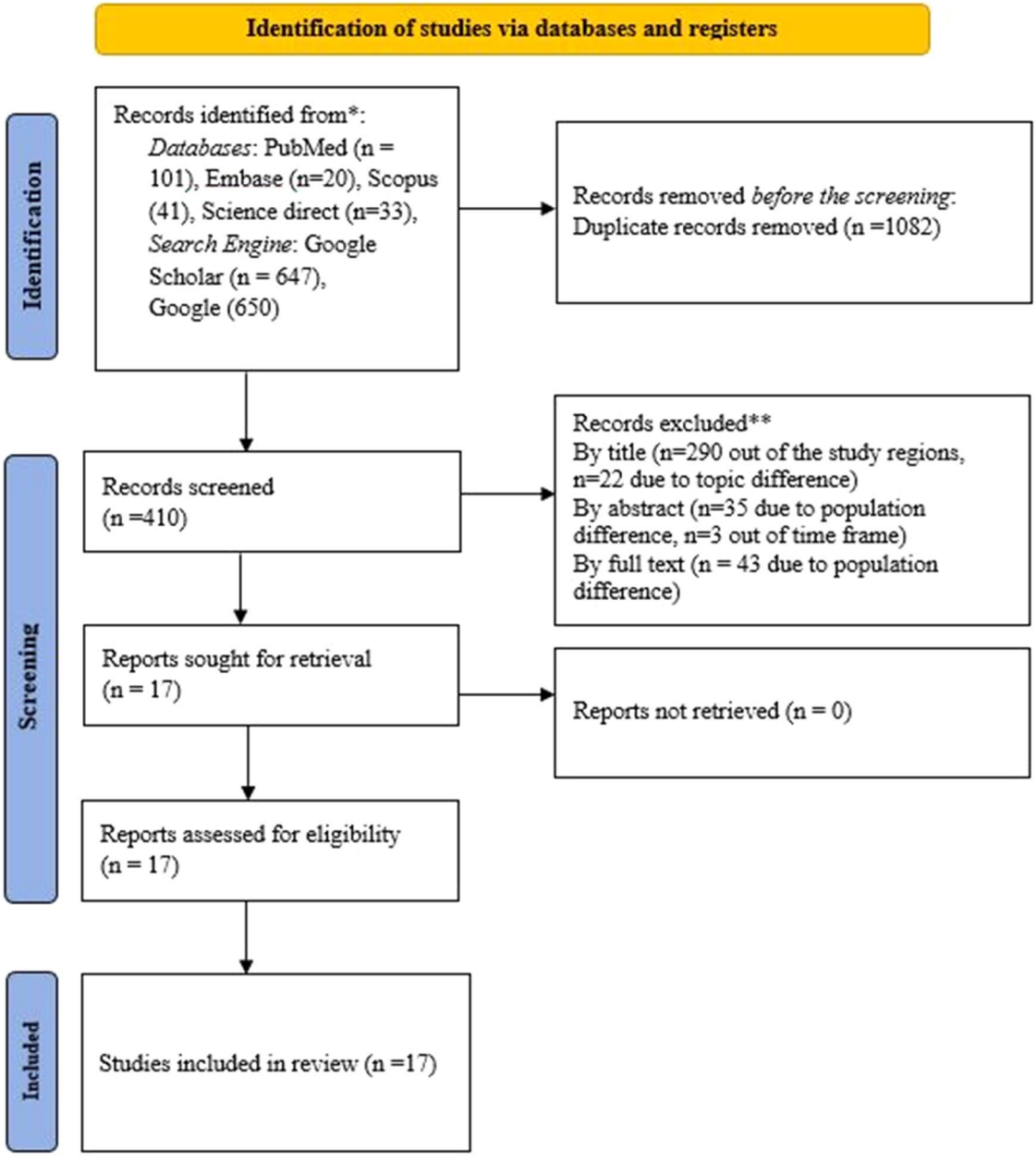

Fig. 1 PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers

Ethiopia (published from 2019 to 2023), one in Uganda (published in 2022), one in Tunisia (published in 2023), one in the Democratic Republic of Congo (published in 2023), and one study conducted in Sudan with a preprint released in 2024 (not yet published) (Table 1).

Meta-analysis

Prevalence of posttraumatic stress disorder (PTSD) in Pediatric Population in Africa

In this systematic review and meta-analysis, we investigated the prevalence of PTSD among pediatric individuals aged 0–18 years in Africa. The pooled prevalence estimate for PTSD was 34%, with a 95% confidence interval (CI) ranging from 26 to 42%. Notably, there was significant heterogeneity among the studies, prompting the use of a random effect model analysis. The I^2 statistic indicated 98.5% variability due to heterogeneity (p value < 0.001). Figure 2 below provides additional visual details related to these findings.

Subgroup analysis

The observed apparent heterogeneity prompted us to conduct subgroup analyses to identify its source. We performed these subgroup analyses based on the DSM tools used, the quality score of the articles, and the year of publication. The prevalence of PTSD was 36% (95% CI: 25–51, I^2 = 97.86%, $p < 0.001$) for articles studying children exposed to trauma associated with conflict,

Table 1 The characteristics of the included studies ($n = 8,930$)

Study (Author, Year)	Country	Study design	Specific Tool	DSM of Tools	Nature of trauma	Sample	Prevalence	QS
Familiar I, 2014 [25]	Zambia	Cross-sectional	UCLA PTSD RI	DSM IV	Non conflict	343	58.90%	7
Rabie MA, 2015 [26]	Egypt	Cross-sectional	MINI-KID	DSM IV	Conflict	423	16.31%	8
Sheikh TL, 2016 [27]	Nigeria	Cross-sectional	RATS	DSM IV	Conflict	73	4.10%	7
Shekwolo DM, 2017 [28]	Nigeria	Cross-sectional	PCL-C	DSM IV	Conflict	41	41.50%	7
Nyagwencha SK, 2018 [29]	Kenya	Cross-sectional	HTQ	DSM V	Non conflict	232	21.60%	7
Haji EM, 2019 [30]	Ethiopia	Cross-sectional	UCLA PTSD RI	DSM IV	Conflict	184	16.30%	7
Mbwayo AW, 2019 [31]	Kenya	Cross-sectional	UCLA PTSD RI	DSM IV	Conflict	2482	26.80%	9
Arega NT, 2020 [32]	Ethiopia	Cross-sectional	RATS	DSM IV	Conflict	384	38.00%	8
Astitene K, 2020 [33]	Morocco	Cross-sectional	CPTS-RI	DSM IV	Non conflict	523	70.40%	8
Astitene K 2021 [34]	Morocco	Cross-sectional	CPTS-RI	DSM IV	Non conflict	871	19.30%	9
Tamir TT, 2022 [35]	Ethiopia	Cross-sectional	CPSS-V-SR	DSM V	Non conflict	417	22.03%	9
Astitene K, 2022 [36]	Morocco	Cross-sectional	CPTS-RI	DSM IV	Non conflict	348	25.80%	8
Ainamani HE, 2022 [38]	Uganda	Cross-sectional	CPSS-V-SR	DSM V	Conflict	232	60.00%	7
Biset G, 2023 [38]	Ethiopia	Cross-sectional	CPSS-V-SR	DSM V	Conflict	557	36.45%	8
Boudabous J, 2023 [39]	Tunisia	Cross-sectional	CPSS	DSM IV	Conflict	326	37.40%	9
Cénat JM 2023 [40]	CDR	Cross-sectional	CPSS-V-SR	DSM V	Conflict	416	44.42%	8
Awad MH, 2024 [41]	Sudan	Cross-sectional	CPSS-V-SR	DSM V	Conflict	1078	44.60%	7
Study (Author, Year)	**Setting**			**Mean/median Age**		**Males**	**Females**	
Familiar I, 2014 [25]	HIV orphans			11.9 ± 3.22		161	182	
Rabie MA, 2015 [26]	Schools			NR		211	212	
Sheikh TL, 2016 [27]	IDP camp			13 (12–16)		37	36	
Shekwolo DM, 2017 [28]	Community-based			NR		13	28	
Nyagwencha SK, 2018 [29]	Charity children's institutions			NR		117	115	
Haji EM, 2019 [30]	Orphan's bording school			NR		146	38	
Mbwayo AW, 2019 [31]	Schools			NR		1209	1230	
Arega NT, 2020 [32]	Unaccompanied refugee minors			NR		221	163	
Astitene K, 2020 [33]	School			14.22 ± 1.36		251	272	
Astitene K 2021 [34]	Schools			14.98 ± 1.49		391	480	
Tamir TT, 2022 [35]	Physical trauma patients			15 (12–15)		281	132	
Astitene K, 2022 [36]	Schools			16.13 ± 0.81		140	208	
Ainamani HE, 2022 [37]	Schools			14.03 ± 3.25		120	112	
Biset G, 2023 [38]	Community-based			8.45 ± 5		NR	NR	
Boudabous J, 2023 [39]	Schools during Covid 19			16.65 ± 1 h		92	234	
Cénat JM 2023 [40]	Orphans of Ebola Virus Disease			13.37 ± 2.79		203	213	
Awad MH, 2024 [41]	Community-based			15.18 ± 2.98		387	691	

Note CPTS-RI: Children's Post Traumatic Stress Reaction Index, CPSS: Child PTSD symptoms scale self-report, CPSS-V-SR: Child PTSD Symptom Scale for DSM-V, CDR: Congo Democratic Republic, DSM: Diagnostic and Statistical Manual of Mental Disorders, HTQ: Harvard Trauma Questionnaire, HH: Household, IDP: Internally Displaced Person, MINI-KID: Mini International Neuropsychiatric Interview, NR: Not Reported, PCL-C: PTSD Checklist – Civilian Version, QS: Quality score, RATS: Reactions of adolescents to traumatic stress, UCLA PTSD RI: University of California at Los Angeles Post-traumatic Stress Disorder Reaction Index

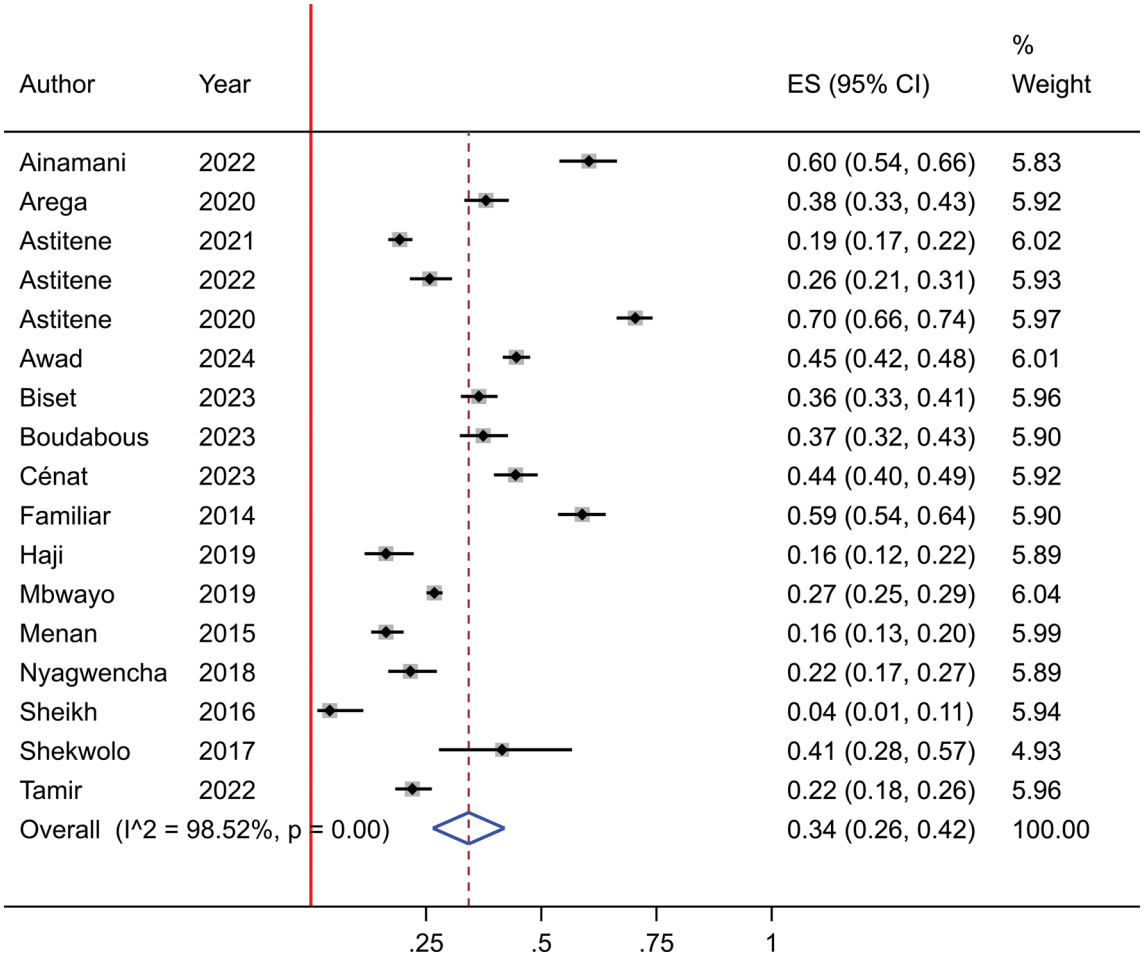

Fig. 2 Pooled prevalence of Posttraumatic Stress Disorder in Pediatric Population in Africa

and 32% (95% CI: 18–41, $I^2 = 97.86\%$, $p<0.001$) for children exposed to trauma not associated with conflict. Among articles that assessed PTSD using DSM-IV tools, the prevalence was 32% (95% CI: 22–43, $I^2 = 97.79\%$, $p<0.001$). Conversely, articles that used DSM-V tools reported a higher prevalence of 38% (95% CI: 28–48, $I^2 = 97.12\%$, $p<0.001$). When considering article quality, 'good' quality articles had a PTSD prevalence of 37% (95% CI: 26–48, $I^2 = 98.642\%$, $p<0.001$), while 'very good' quality articles had a lower prevalence of 26% (95% CI: 20–32, $I^2 = 93.46\%$, $p<0.001$). Notably, articles published within the past five years (2020–2024) exhibited a higher PTSD prevalence of 40% (95% CI: 29–50, $I^2 = 98.55\%$, $p<0.001$), compared to 26% (95% CI: 15–37, $I^2 = 97.91\%$, $p<0.001$) for articles published before 2020. These subgroup analyses demonstrate the existence of significant heterogeneity, necessitating further outlier-adjusted analysis (see Table 2).

Outlier-adjusted meta-analysis

The outlier-adjusted meta-analysis aimed to assess variability among the included studies by systematically identifying and excluding outlier studies. This approach allowed us to understand the impact of each study on the overall prevalence of PTSD in our review. We identified one study as an outlier and excluded it from the pooled estimate [27]. This adjustment slightly altered the original prevalence, resulting in an adjusted prevalence of 36% (95% CI: 28–44%, $I^2 = 98.41\%$, $p<0.001$). Consequently, we reported this adjusted prevalence as the overall prevalence of PTSD (see Fig. 3).

Test of publication bias

Small-study effects refer to the tendency for estimates of intervention effects to be more beneficial in smaller studies. The estimated bias coefficient (intercept) is 4.92, with a standard error of 5.010879. This standard error reflects the uncertainty associated with our estimate of the bias coefficient. A larger standard error suggests greater uncertainty, while a smaller one indicates more precise estimates. The p-value associated with the bias coefficient is 0.342. A p-value helps us assess the statistical significance of the bias coefficient. In this case, a p-value greater than 0.05 indicates that the bias coefficient is not

Table 2 Subgroup analysis of PTSD in pediatric population in Africa

Subgroup Analysis by nature of trauma		Effect size (95% CI)	Percent Weight
War or armed conflict associated trauma	Ainamani	0.60 (0.54, 0. 66)	5.83
	Arega	0.38 (0.33, 0.43)	5.92
	Awad	0.45 (0.42, 0.48)	6.01
	Biset	0.36 (0.33, 0.41)	5.96
	Boudabous	0.37 (0.32, 0.43)	5.9
	Cénat	0.44 (0.40, 49)	5.92
	Haji	0.16 (0.12, 0.22)	5.89
	Mbwayo	0.27 (0.25, 0.29)	6.04
	Menan	0.16 (0.12, 0.20)	5.99
	Sheikh	0.04 (0.01, 0.11)	5.94
	Shekwolo	0.41 (0.28, 0.57)	4.93
	Subtotal (I^2 = 97.86%, p < 0.001)	**0.36 (0.25, 0.51)**	**64.32**
Non conflict associated trauma	Astitene	0.19 (0.17, 0.22)	6.02
	Astitene	0.26 (0.21, 0.31)	5.93
	Astitene	0.7 (0.66, 0.74)	5.97
	Familiar	0.59 (0.54, 0.64)	5.9
	Nyagwencha	0.22 (0.17, 0.27)	5.89
	Tamir	0.22 (0.18, 0.26)	5.96
	Subtotal (I^2 = 99.18%, p < 0.001)	**0.32 (0.18, 0.41)**	**35.68**
Subgroup analysis by DSM of tools			
DSM V	Ainamani	0.60 (0.54, 0.66)	5.83
	Awad	0.45 (0.42, 0.48)	6.01
	Biset	0.36 (0.33, 0.41)	5.96
	Cénat	0.44 (0.40, 0.49)	5.92
	Nyagwencha	0.22 (0.17, 0.27)	5.89
	Tamir	0.22 (0.18, 0.26)	5.96
	Subtotal (I^2 = 97.12%, p < 0.001)	**0.38 (0.28, 48)**	**35.58**
DSM IV	Arega	0.38 (0.33, 43)	5.92
	Astitene	0.19 (0.17, 0.22)	6.02
	Astitene	0.26 (0.21, 31)	5.93
	Astitene	0.70 (0.66, 0.74)	5.97
	Boudabous	0.37 (0.32, 0.43)	5.90
	Familiar	0.59 (0.54, 0.64)	5.90
	Haji	0.16 (0.12, 0.22)	5.89
	Mbwayo	0.27 (0.25, 0.29)	6.04
	Menan	0.16 (0.13, 0.20)	5.99
	Sheikh	0.04 (0.01, 0.11)	5.94
	Shekwolo	0.41 (0.28, 0.57)	4.93
	Subtotal (I^2 = 98.79%, p < 0.001)	**0.32 (0.22, 0.43)**	**64.42**
Sub-group analysis by year of publication			
2020–2024	Ainamani	0.60 (0.54, 0.66)	5.83
	Arega	0.38 (0.33, 0.43)	5.92
	Astitene	0.19 (0.17, 0.22)	6.02
	Astitene	0.26 (0.21, 0.31)	5.93
	Astitene	0.70 (0.66, 0.74)	5.97
	Awad	0.45 (0.42, 0.48)	6.01
	Biset	0.36 (0.33, 0.41)	5.96
	Boudabous	0.37 (0.32, 0.43)	5.90
	Cénat	0.44 (0.40, 0.49)	5.92
	Tamir	0.22 (0.18, 0.26)	5.96
	Subtotal (I^2 = 98.55%, 0.001)	**0.40 (0.29, 0.50)**	**59.42**

Table 2 (continued)

Subgroup Analysis by nature of trauma		Effect size (95% CI)	Percent Weight
2014–2019	Familiar	0.59 (0.54, 0.64)	5.9
	Haji	0.16 (0.12, 0.22)	5.89
	Mbwayo	0.27 (0.25, 29)	6.04
	Menan	0.16 (0.13, 0.20)	5.99
	Nyagwencha	0.22 (0.17, 0.27)	5.89
	Sheikh	0.04 (0.01, 0.11)	5.94
	Shekwolo	0.41 (0.28, 0.57)	4.93
	Subtotal ($I^2 = 97.91\%$ $p < 0.001$)	0.26 (0.15, 0.37)	40.58
Subgroup analysis by grade of quality score			
Good	Ainamani	0.60 (0.54, 0.66)	5.83
	Arega	0.38 (0.33, 0.43)	5.92
	Astitene	0.26 (0.21, 0.31)	5.93
	Astitene	0.70 (0.66, 0.74)	5.97
	Awad	0.45 (0.42, 0.48)	6.01
	Biset	0.36 (0.33, 0.41)	5.96
	Cénat	0.40(0.41, 0.49)	5.92
	Familiar	0.59 (0.54, 0.64)	5.9
	Haji	0.16 (0.12, 0.22)	5.89
	Menan	0.16 (0.13, 0.20)	5.99
	Nyagwencha	0.22 (0.17, 0.27)	5.89
	Sheikh	0.04 (0.01, 0.11)	5.94
	Shekwolo	0.41 (0.28, 0.57)	4.93
	Subtotal ($I^2 = 86.64\%$, $p < 0.001$)	**0.37 (0.26, 0.48)**	**76.08**
Very good	Astitene	0.19 (0.17, 0.22)	6.02
	Boudabous	0.37 (0.32, 0.43)	5.9
	Mbwayo	0.27 (0.25, 0.29)	6.04
	Tamir	0.22 (0.18, 0.26)	5.96
	Subtotal ($I^2 = 93.46\%$, $p < 0.001$)	**0.26 (0.20, 0.32)**	**23.92**
Overall ($I^2 = 98.52\%$, $p < 0.001$)		**0.34 (0.26, 0.42)**	**100.00**

statistically significant. Based on the test results, there is no compelling evidence to suggest the presence of small-study effects (Fig. 4). Essentially, we're saying that the bias introduced by selectively publishing positive findings is not strongly evident in this case.

Associated factors of post-traumatic stress disorder in Pediatric Population in Africa

This review identified a total of six predictors of post-traumatic stress disorder (PTSD) that were eligible for meta-analysis, drawing evidence from two or more studies. These predictors include female gender, age above 14 years, primary school education level, single-parent living arrangements, low household income, and experiencing the death of family members or loved ones. However, primary studies reported additional predictors of PTSD, such as poor social support, duration of trauma, severity of pain from trauma, comorbid mental illness, family history of mental illness and comorbid chronic medical illness [28, 31–35, 37, 39, 41]. Despite this, these additional predictors were not incorporated into our meta-analysis.

Female gender consistently identified as a predictor in seven primary studies [28, 31–35, 37, 39, 41] (Fig. 5), while age above 14 years was reported in five studies [31, 32, 34, 35] (Fig. 6). The majority of studies identified focused the age classification on children up to 14 years old and above 14. To provide a comprehensive synthesis of the available evidence on PTSD prevalence in pediatric populations in Africa, we chose to use 14 as the cut-off to align with the age ranges most commonly represented in the primary literature.

Primary school education level emerged as a common predictor in five studies [30, 31, 34, 35, 37] (Fig. 7), single-parent living arrangements in two studies [31, 39] (Fig. 8), low household income in two studies [34, 39] (Fig. 9), and the death of family members or loved ones in three studies [31, 39, 41] (Fig. 10).

Our meta-analysis revealed that age above 14 years and the occurrence of family deaths resulting from traumatic events were significantly associated with PTSD. Children aged above 14 years old exhibited 1.59 times higher odds of developing PTSD following a potential traumatic event (adjusted odds ratio [AOR] = 1.59, 95% CI: 1.11–2.26) compared to children aged 14 years or younger (Fig. 6). Additionally, within the pediatric population, the odds of PTSD were 1.86 times higher among children who

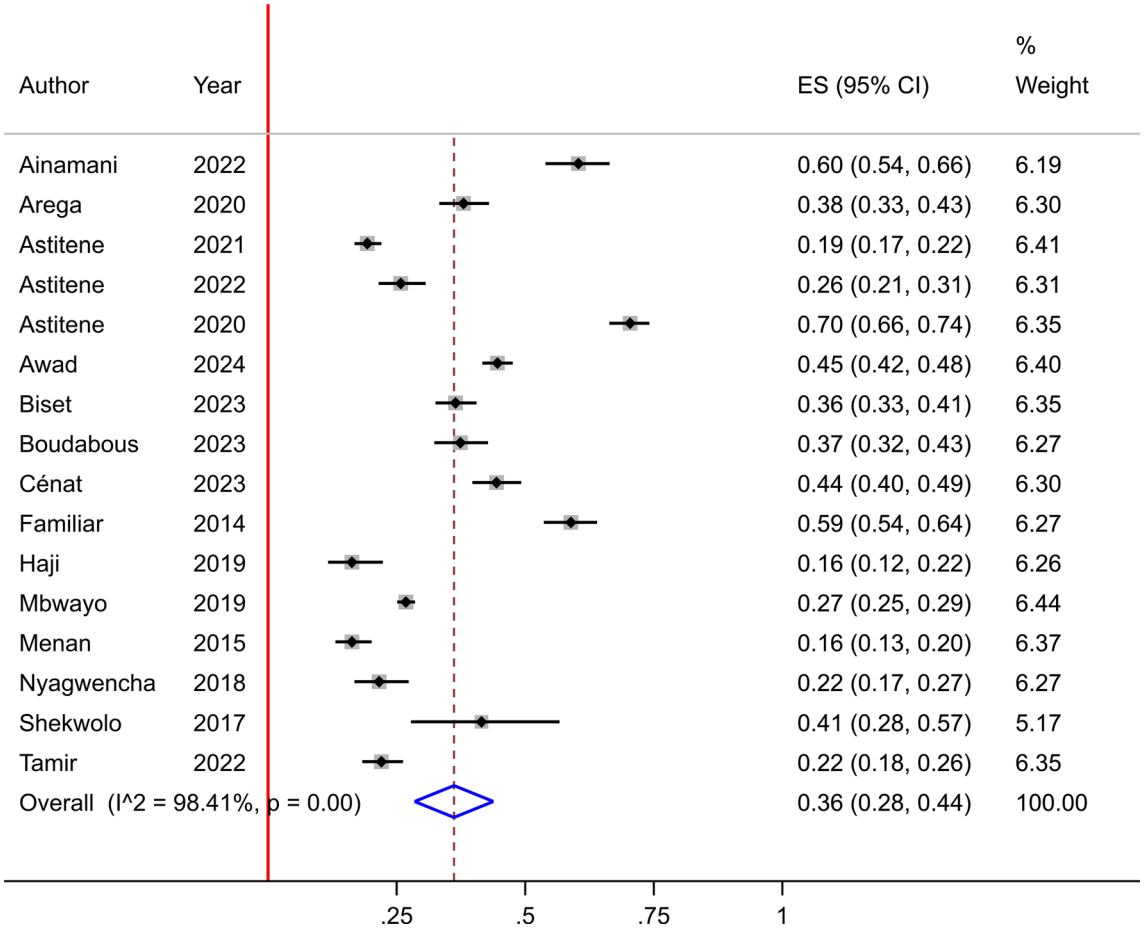

Fig. 3 Outlier-adjusted meta-analysis of prevalence of Posttraumatic Stress Disorder in Pediatric Population in Africa

experienced the loss of family members due to traumatic events compared to those who did not encounter such losses (AOR = 1.86, 95% CI: 1.80–1.91) (Fig. 10).

Discussion

This systematic review and meta-analysis on post-traumatic stress disorder (PTSD) in African pediatric populations provides insights for future research and clinical practice. We explored key interpretations, acknowledge limitations, and offer evidence-based recommendations.

The current systematic review and meta-analysis reveals the prevalence and associated factors of post-traumatic stress disorder (PTSD) in pediatric individuals aged 0–18 years in Africa. The pooled prevalence estimate for PTSD was 36%, with a 95% confidence interval (CI) ranging from 28 to 44%. This finding aligns with the prevalence reported in a previous meta-analysis conducted in China (28.15%) [42]. It is important to note that the previous meta-analysis conducted in China [42] focused specifically on the prevalence of PTSD among youth during the COVID-19 pandemic, which may have represented an additional significant stressor contributing to elevated PTSD rates compared to non-pandemic periods.

However, prevalence in our study surpasses the pooled estimates from systematic reviews in the United Kingdom (21.5%) [43] and a collaborative meta-analysis by researchers from China and Canada (19.95%) [44]. The discrepancy between our findings and those of previous reviews may be attributed to several factors. First, the economic, socio-political variations, nature of traumatic events might have a role in the discrepancies among the African countries included in our study versus the countries represented in the previous reviews likely contribute to the differences in PTSD prevalence. Additionally, our review incorporated primary studies on PTSD in children following a wide range of traumatic events, whereas other reviews focused on specific contexts, such as road traffic accidents [44] or preschool children [43]. The breadth of trauma exposure experienced by the pediatric populations in the included studies may have contributed to the higher pooled prevalence estimate observed in our review. Studies have consistently demonstrated that the type of traumatic event can significantly impact the risk

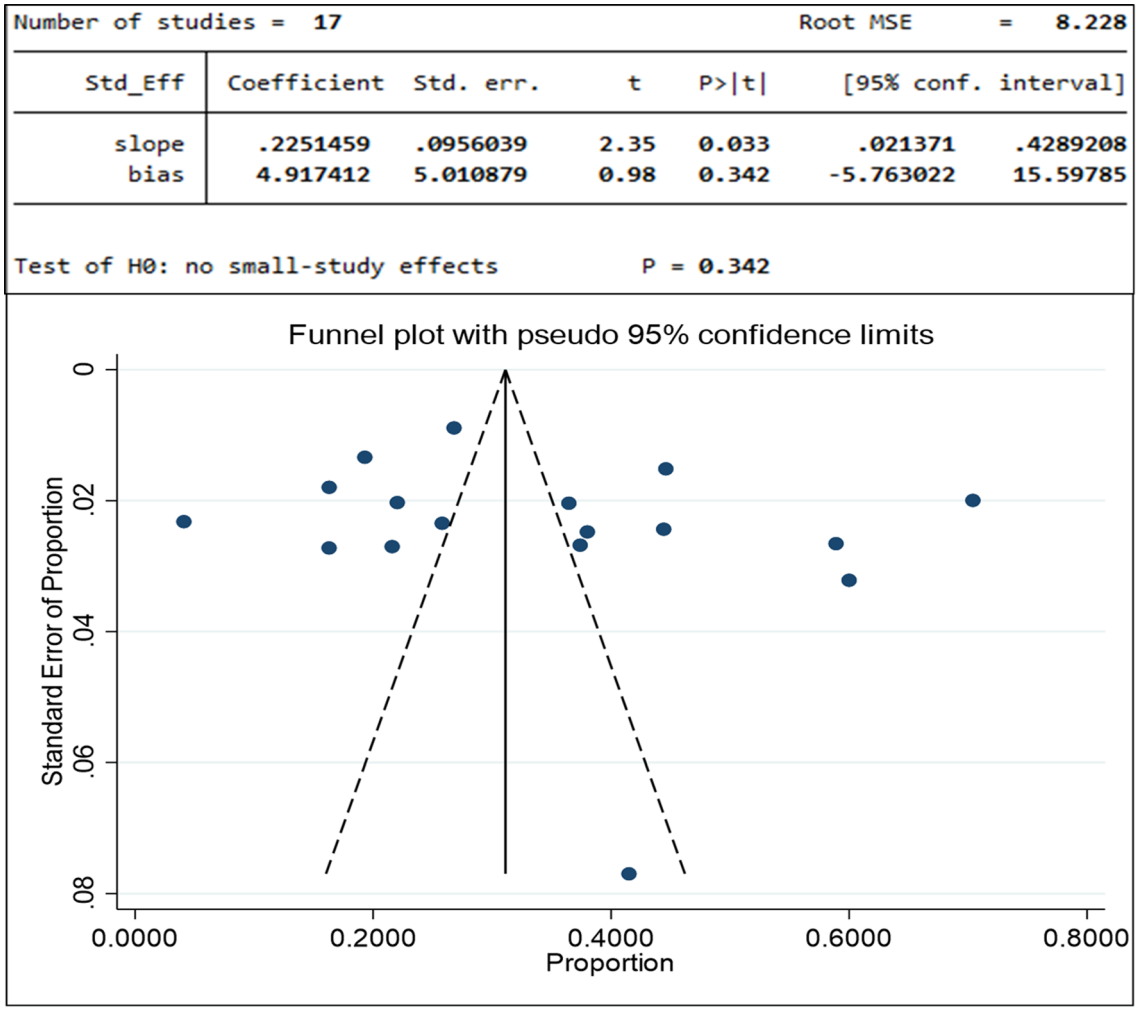

Fig. 4 Egger's test of small study bias of prevalence of PTSD in pediatric population in Africa

and severity of PTSD symptoms in children and adolescents [45, 46].

The subgroup analyses conducted in this study provide valuable insights into the potential sources of heterogeneity observed in the overall PTSD prevalence estimate. When comparing the PTSD prevalence estimates between the two subgroups, several key differences emerge. The PTSD prevalence for children exposed to conflict-related trauma was 36% (95% CI: 25–51), while the prevalence for children exposed to non-conflict-related trauma was 32% (95% CI: 18–41). Although the prevalence appears higher for conflict-related trauma, the overlapping confidence intervals indicate that this difference is not statistically significant.

The finding that studies utilizing the specific screening tools of DSM-V diagnostic criteria reported a higher prevalence of PTSD (38%) compared to those using the tools of DSM-IV criteria (32%) suggests that the updated diagnostic guidelines in the DSM-V may have identified a larger proportion of individuals with PTSD. This could be due to refinements in the diagnostic criteria or increased sensitivity in the assessment of PTSD symptoms [47]. The DSM-V, published in 2013, included several updates to the diagnostic criteria for PTSD that may have contributed to identifying a larger proportion of children and adolescents as meeting the requirements. First, the stressor criterion (Criterion A) was expanded to include indirect exposure, such as learning that a traumatic event occurred to a close family member or friend [48]. Additionally, a new symptom cluster focused on negative alterations in cognitions and mood associated with the traumatic event was added. The DSM-V also allowed for greater flexibility in how PTSD symptoms are expressed based on developmental level, with more emphasis on play-based re-enactment in young children [48]. Finally, the inclusion of a dissociative PTSD subtype to capture experiences of depersonalization and derealisation provided a framework for recognizing PTSD presentations that may be more common in youth [48]. These changes to the diagnostic framework likely enabled the

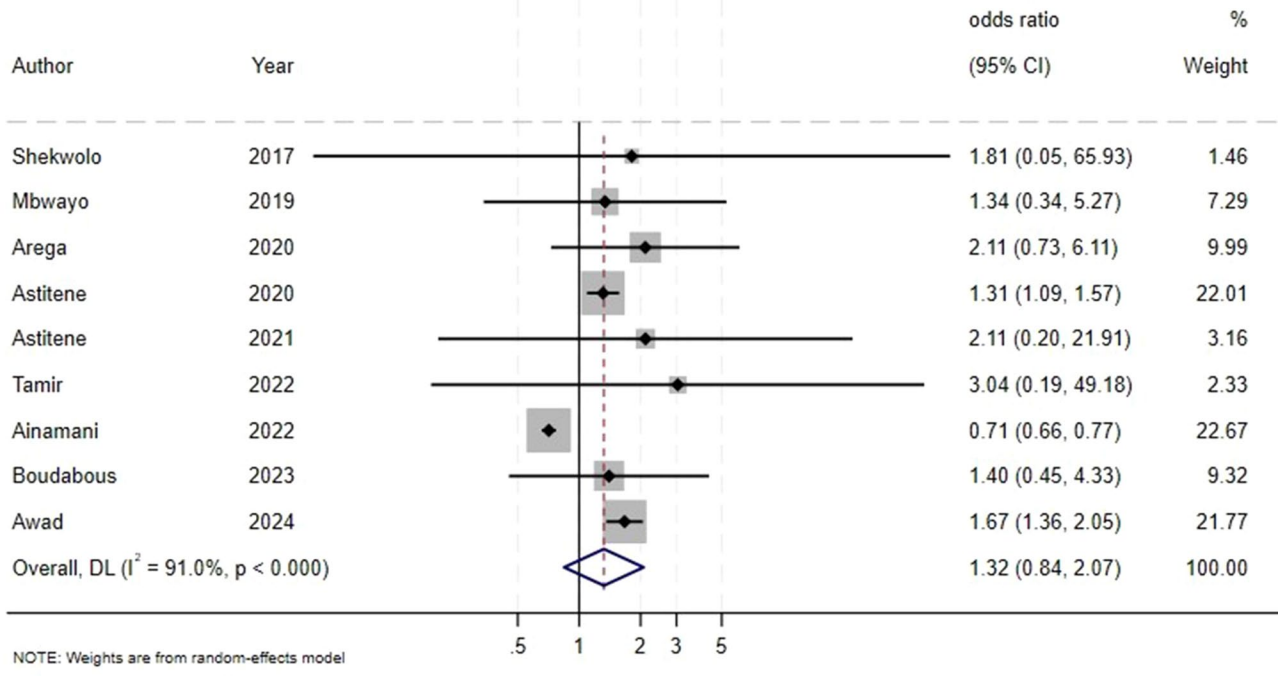

Fig. 5 Gender as a predictor of PTSD in Pediatric population in Africa

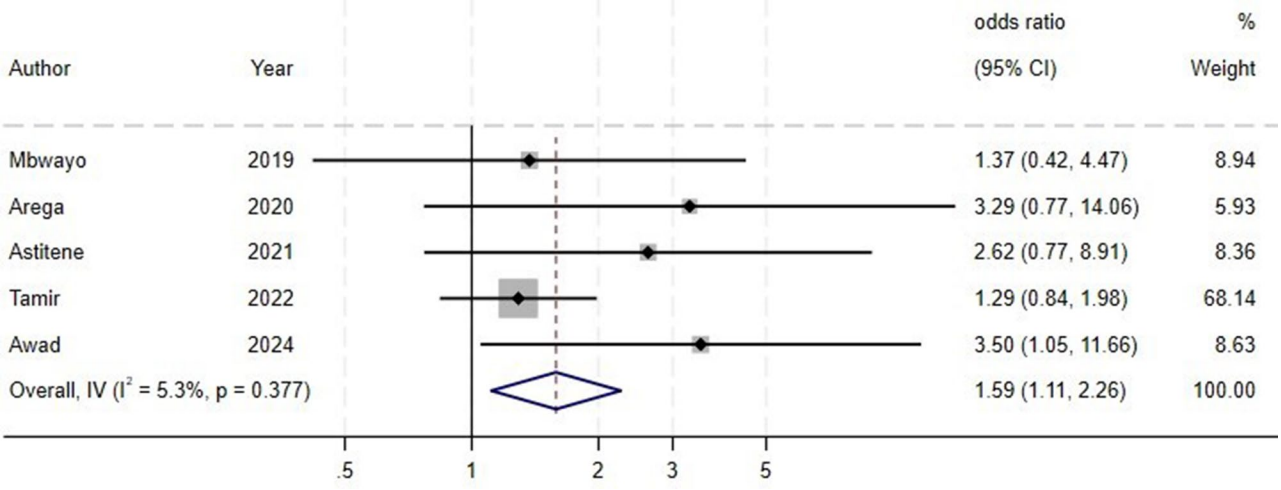

Fig. 6 Age as a factor of PTSD in pediatric population in Africa

identification of a greater number of children and adolescents meeting the criteria for PTSD compared to previous editions of the DSM. It highlights the importance of considering the impact of evolving diagnostic frameworks when interpreting and comparing PTSD prevalence estimates across different studies.

The differences observed based on study quality are also noteworthy. Studies rated as 'good' quality had a higher PTSD prevalence (37%) compared to those rated as 'very good' quality (26%). This inverse relationship between study quality and PTSD prevalence may indicate that higher-quality studies, with more rigorous methodological approaches, were more stringent in their assessment and diagnosis of PTSD, leading to a lower overall prevalence estimate. This underscores the need to carefully consider the potential impact of study quality on the interpretation of meta-analytic findings. Furthermore, the subgroup analyses revealed a temporal trend, with more recent studies published within the last 5 years (2020–2024) reporting a higher PTSD prevalence (40%) compared to studies published before that period (26%). This could suggest an increasing burden of PTSD over time, potentially driven by factors such as changes in

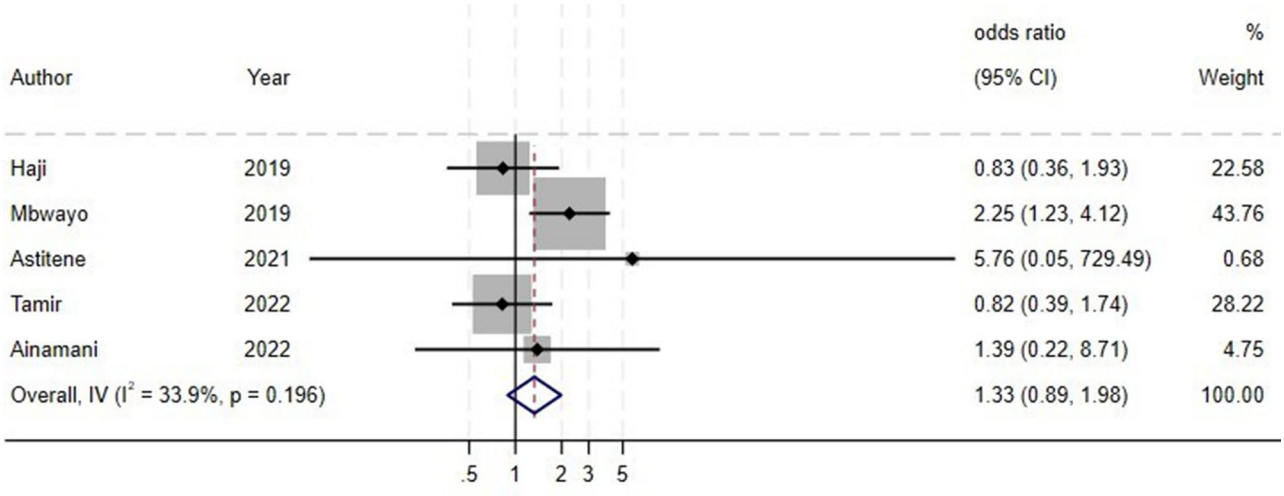

Fig. 7 Educational level as a factor of PTSD in pediatric population in Africa

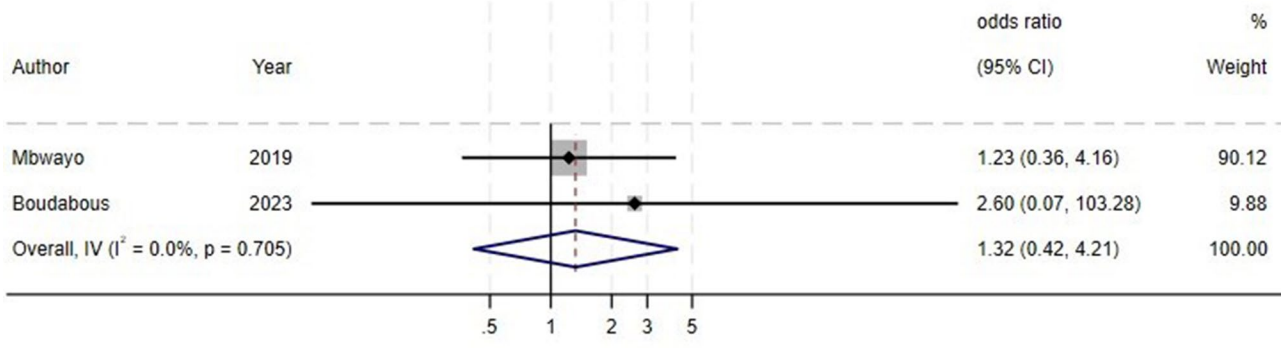

Fig. 8 Living arrangement as a factor of PTSD in pediatric population in Africa

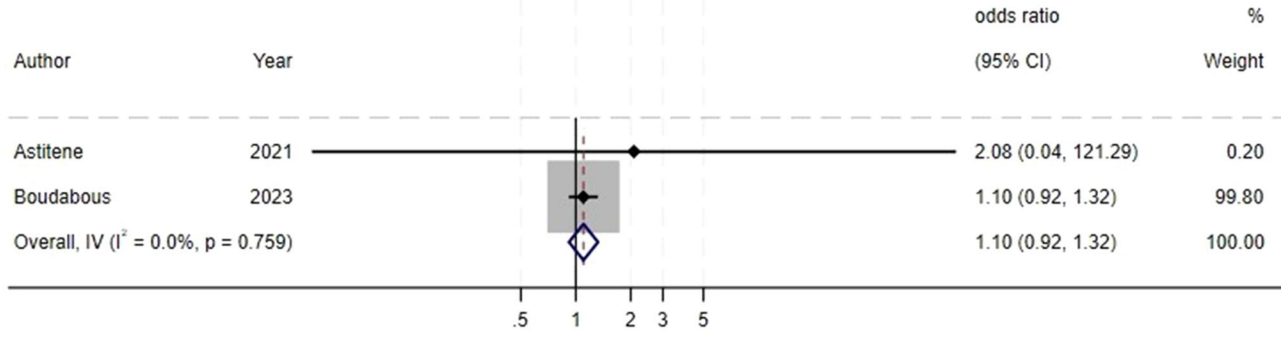

Fig. 9 Household income as a factor of PTSD in pediatric population in Africa

societal conditions, improved awareness and detection of PTSD, or a true rise in the incidence of the disorder.

Regarding the factors of PTSD, age of above fourteen years and death of family were significantly associated with PTSD in pediatric individuals in this systematic review and meta-analysis.

In this respect, the odds of PTSD were higher among older children (over 14 years) as compared to children aged 14 years or lower. This finding aligns with existing evidences [49–51]. Several studies have investigated the relationship between age and PTSD in children and adolescents. The increased risk of PTSD in older children (above fourteen years) can be attributed to several factors. Firstly, their advanced cognitive abilities allow them to better understand and process traumatic events, potentially intensifying their emotional response [51,

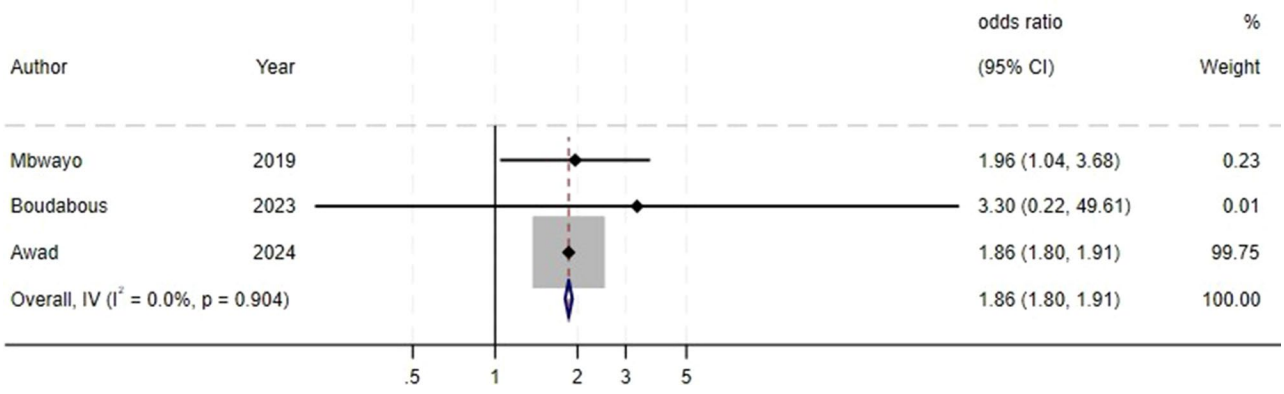

Fig. 10 Death of family as a factor of PTSD in pediatric population in Africa

52]. Secondly, older children often experience complex trauma, such as prolonged abuse or multiple traumatic events, which can have cumulative effects [53]. Thirdly, social support plays a crucial role, and older children may face changing relationships and social isolation [51, 52]. Lastly, hormonal changes during adolescence and the developing brain's response to trauma contribute to the observed differences [51, 53].

Furthermore, the included studies spanned a wide age range (0–18 years), and research has shown that PTSD symptoms and risk factors can vary significantly across different developmental stages [54, 55]. Future studies should stratify the analysis by specific age groups or developmental stages to provide a more nuanced understanding of the age-related patterns in PTSD prevalence among African pediatric populations.

In addition, the likelihood of PTSD was high among children who experienced the loss of family members due to traumatic events compared to those who did not. This finding is supported by previous evidences [56–59]. The loss of family members due to traumatic events can profoundly impact an individual's mental health [59]. When a loved one dies suddenly and violently—such as in accidents, acts of violence, or natural disasters—the emotional toll can be immense [58]. Evidence suggests that survivors of such traumatic losses are at a higher risk of developing PTSD [56, 57]. These survivors may experience symptoms such as intrusive thoughts, nightmares, hypervigilance, and emotional numbing [59]. The grief associated with traumatic loss is complex and may persist for years, affecting daily functioning and overall well-being. Early intervention, counselling, and support are essential for those navigating the aftermath of traumatic loss [58].

While our meta-analysis revealed age of above fourteen years and death of family as significant predictors of PTSD in pediatric populations across Africa, it is essential to recognize that non-significant factors should not be dismissed outright. These factors, although not statistically significant in our study, may still hold clinical relevance and merit further investigation. Among these non-significant predictors were female gender, low education level, living arrangements, and low household income. Although their individual impact did not reach statistical significance, their potential influence on PTSD outcomes cannot be overlooked. As researchers and practitioners, we should remain open to exploring these variables in more depth and consider their contextual significance when designing interventions and preventive strategies.

Although our current systematic review and meta-analysis yielded invaluable findings, it is essential to acknowledge its limitations. Firstly, we deliberately included only studies published in English, potentially introducing language bias and excluding relevant research conducted in other languages. This decision was pragmatic, driven by the availability of English-language literature. Secondly, our focus on cross-sectional studies—while necessary due to the availability—constrained our ability to explore temporal relationships or establish causality. Incorporating a mix of study designs, including longitudinal or experimental approaches, would enhance our understanding of post-traumatic stress disorder (PTSD) in pediatric populations. Thirdly, we recognize that the subgroup analysis based on the year of publication may be biased due to the inclusion of studies from different countries and settings in the different time categories. This variation in study settings could influence the observed differences in prevalence rates over time. Future research should consider these contextual differences when interpreting trends in PTSD prevalence. Lastly, the heterogeneity in assessment tools used across studies presents challenges in synthesizing and comparing results. The variation in PTSD screening instruments makes it difficult to draw concise conclusions. Researchers should prioritize consistency in measurement tools to facilitate meaningful comparisons in future meta-analyses.

Implications

Prevalence and awareness

- The prevalence of PTSD among pediatric individuals is substantial, affecting approximately 34% of the studied population.
- Healthcare providers, educators, and parents should be aware of this high prevalence to recognize and address symptoms early.

Heterogeneity, and Individual and contextual differences

- The significant heterogeneity among the studies ($I^2 = 98.5\%$) suggests that PTSD risk factors and manifestations can vary widely.
- Researchers and clinicians should consider individual and contextual differences when assessing and treating pediatric PTSD.

Age considerations

- Children above 14 years of age appear to be more vulnerable to PTSD.
- Age-specific interventions and support may be necessary to address their unique needs.

Family deaths and traumatic events

- Children who experienced family deaths due to traumatic events are at increased risk of developing PTSD.
- Bereavement support and trauma-informed care are crucial for these children.

Conclusion

This systematic review and meta-analysis revealed that the prevalence of PTSD among pediatric individuals aged 0–18 years in Africa was high. Notably, older children and those who experienced family deaths due to traumatic events were at a significantly higher risk of developing PTSD. These findings underscores the need for early intervention, age-specific support, and trauma-informed care to address the mental health challenges faced by pediatric populations.

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

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Author contributions
TTT: Involved in designing the study, protocol development, data extraction, analysis, interpretation, reporting, and manuscript writing; BY: Involved in designing the study, protocol development, interpretation, reporting, and manuscript writing; SAG: Involved in designing the study, interpretation, reporting, and manuscript writing; FAM: Involved in review, editing, conceptualization, supervision, validation, and visualization; DFT: Involved in review and editing, conceptualization, supervision, validation, and visualization; DA: Involved in review, editing, conceptualization, supervision, validation, and visualization.

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Data availability
Data is provided within the manuscript or supplementary information files.

Declarations

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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