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Prevalence of war-related posttraumatic stress disorder in adolescents: a systematic review and meta-analysis

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ABSTRACT

Background: Posttraumatic stress disorder is common in civilians who are currently experiencing, or who have experienced, war. Most previous studies have focused on adult populations and, despite the recognised detrimental effect of war trauma on adolescent mental health, there remains a paucity of evidence on the prevalence of war-related PTSD in adolescents.

Objective: This pre-registered (https://osf.io/dqg2z) systematic review and meta-analysis aims to understand the prevalence of PTSD, as well as both risk and protective factors for developing PTSD, in adolescents aged 10–24 years from across the world who are experiencing, or have experienced, war-related traumatic events, described in papers published in a 10 year period (2013–2023). We also examine how the choice of PTSD diagnostic assessment tool influences prevalence rates.

Method: Medline (PubMed), PsycINFO (EBSCOhost), and PTSDpubs (ProQuest) were searched, which resulted in 21 papers eligible for inclusion. Data was searched, extracted and synthesised using the software tool Covidence.

Results: The age range of adolescents in the included papers was 11–19 years. The average prevalence of PTSD was 29.4% (95% CI [18.7%, 43.0%]), although prevalence rates across studies were highly inconsistent ($I^2 = 99.4\%$). Prevalence rates were significantly higher in studies conducted longer after war exposure, and the PTSD diagnostic assessment tool used influenced prevalence.

Conclusions: There is high prevalence of PTSD in adolescents during and after war. The prevalence of war-related PTSD increases with time in the post-war period, highlighting the need for access to psychological services following war. This study underscores the importance of defining age ranges and using validated and culturally sensitive assessment tools when interpreting prevalence rates of PTSD in adolescents.

HIGHLIGHTS
- We examined the prevalence of PTSD, as well as both risk and protective factors for developing PTSD, in adolescents across the world who are experiencing, or have experienced, war-related traumatic events.
- The average prevalence of PTSD among adolescents who have experienced war-related traumatic events is 29.4% with higher prevalence rates in studies conducted longer after war exposure.
- The study underscores the importance of validated and culturally sensitive assessment tools when interpreting prevalence rates of PTSD, as well as developing psychological services for adolescents in the post-war period.

Prevalencia del trastorno por estrés postraumático relacionado con la guerra en adolescentes: revisión sistemática y metaanálisis

Antecedentes: El trastorno de estrés postraumático (TEPT) es común en civiles expuestos a conflictos armados. Aunque los efectos del trauma de guerra en adolescentes están bien reconocidos, la evidencia sobre la prevalencia específica del TEPT en esta población sigue siendo limitada.

Objetivo: Esta revisión sistemática y metaanálisis (pre-registrada en https://osf.io/dqg2z) tuvo como objetivo estimar la prevalencia del TEPT, así como identificar factores de riesgo y protección en adolescentes (10–24 años) expuestos a eventos traumáticos relacionados con la guerra. También se examinó el impacto de la herramienta de evaluación utilizada en las tasas de prevalencia. Se incluyeron estudios publicados entre 2013 y 2023.

Método: Se realizaron búsquedas en Medline (PubMed), PsycINFO (EBSCOhost) y PTSDpubs (ProQuest). Veintiún estudios cumplieron los criterios de inclusión. Los datos fueron extraídos y sintetizados utilizando Covidence.

Resultados: Los adolescentes en los estudios tenían entre 11 y 19 años. La prevalencia media del TEPT fue del 29,4% (IC 95%: 18,7%–43,0%), con alta heterogeneidad entre estudios ($I^2 = 99,4\%$). Las tasas fueron mayores en estudios realizados más tiempo después del conflicto. Asimismo, las herramientas diagnósticas utilizadas influyeron significativamente en la prevalencia observada.

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Conclusiones: El TEPT relacionado con la guerra es altamente prevalente en adolescentes, especialmente en contextos posbélicos. Estos hallazgos destacan la necesidad urgente de servicios de salud mental accesibles después de la guerra. Además, se subraya la importancia de definir adecuadamente los rangos de edad y utilizar instrumentos de evaluación validados y culturalmente sensibles para obtener estimaciones fiables de prevalencia.

1. Background

' … the end of the world is always a local event, it comes to your country and visits your town and knocks on the door of your house and becomes to others but some distant warning, a brief report on the news, an echo of events that has passed into folklore'.

Paul Lynch, *Prophet Song*, 2023

In the past decade, the world has experienced a surge in wars, armed conflicts and acts of terrorism. These events have resulted in significant traumas, affecting not only active-duty service members on the frontline, but also civilian populations who are exposed to multiple war-related events that can impact mental wellbeing (Lim et al., 2022). These traumatic events may lead to the development of posttraumatic stress disorder (PTSD) in those that experience or witness them. PTSD is characterised by intrusive thoughts, avoidance, negative changes in thinking and mood, and changes in reactivity (American Psychiatric Association, 2013). Along with depression and anxiety, PTSD is among the most frequently reported mental disorders experienced by civilians living in regions affected by war (Charlson et al., 2019).

War-related PTSD typically arises from prolonged and repeated exposure to traumatic events over an extended period, referred to as continuous traumatic stress (Eagle & Kaminer, 2013). Compared to non-war-related PTSD, which is usually triggered by a specific traumatic event or a series of discrete traumatic incidents, continuous traumatic stress is a constant exposure to multiple intense traumatic situations that leads to prolonged physiological arousal, physical and mental exhaustion, and increased morbidity (Goral et al., 2021; Zasiekina et al., 2024).

Recent literature focusing on war-related PTSD has begun to consider the continuous traumatic stress of ongoing war as a possible risk factor for increased difficulties in discriminating between actual and imagined threats, developing severe forms of PTSD and other associated mental health symptoms (Abu-Kaf et al., 2021; Kaminer et al., 2018; Leshem et al., 2025; Potluri & Patel, 2021). Despite the association between war-related PTSD and continuous traumatic stress, few studies describe the prevalence of PTSD in civilians during ongoing wars compared to the period after war has ended. To address this question, a recent meta-analysis performed by Lim et al. (2022) focused on mental health symptoms during and after wartime in civilian and military populations. The analysis revealed a significant difference in the prevalence of diagnosed depression and anxiety between these groups during wartime when compared to the post-war period, as well as higher rates of depression and anxiety in civilians compared to the military population. The results indicate a higher prevalence of depression and anxiety during wartime compared to the post-war period. No difference in the prevalence of PTSD was observed between military and civilian populations, nor during wartime compared to the post-war period. Additionally, the meta-regression analysis found that neither the mean age nor the proportion of female participants significantly predicted the prevalence of PTSD within each study (Lim et al., 2022).

Children and adolescents exhibit significant levels of psychological distress and mental health problems after exposure to war (Liu, 2017; Skrypnyk & Labenko, 2022; Zatzick et al., 2008). Adolescence is a critical period for physical, cognitive, emotional and social development (Andrews et al., 2020; National Academies of Sciences, Engineering, and Medicine et al., 2019). During this period, individuals undergo rapid changes, making them particularly susceptible to various stressors and mental health challenges (Holder & Blaustein, 2014). War-related trauma can disrupt critical developmental processes and experiences, including essential aspects of identity and autonomy-seeking, as well as cognitive and emotional regulation, which can lead to dramatic long-term psychological consequences – including PTSD and associated mental health symptoms (Cook et al., 2005). Recent work has shown that children and adolescents are some of the most vulnerable populations when exposed to war-related trauma, which may be due to reduced personal and coping resources, as well as limited life experiences and opportunities, when compared to adults (Khamis, 2015). There are sex/gender differences in war and war-related trauma. For example, adolescent females are at particular risk from sexual violence during wartime, whereas males are under social pressure to fight (Ferguson, 2021; Neal et al., 2016).

Evidence from a recent meta-analysis by Carpiniello (2023) suggests that various traumatic events can predict war-related PTSD faced by adolescents

during war, including multiple exposures to explosions, loss of loved ones and subsequent grief, internal and external forcible displacement, and the disruption of their pre-existing lives. Nickerson et al. (2017) point out that half of the globally displaced population who were displaced as a result of conflict and persecution are children and adolescents, a population that experiences increased poverty and limited access to education, socialisation and mental health services. Further evidence suggests a significant effect of armed conflicts on moral behaviour in adolescents, including increases in aggressive behaviour, hostility and engagement in violent acts, which are often combined with PTSD symptoms (Parra Grajales & Decety, 2023). The psychological consequences of war for adolescents are compounded by the economic deterioration of community structures and services during and after war (Neal et al., 2016).

Despite the detrimental effect of war trauma on adolescents' mental health, there remains a paucity of evidence on the prevalence of war-related PTSD in this age group when they experience war and armed conflicts. A recent meta-analysis of adolescents (up to 20 years old) affected by war in Middle Eastern, African and South Asian countries revealed an overall PTSD prevalence of 22.7% (Blackmore et al., 2020). However, this review primarily focused on refugee and asylum-seeker samples, and did not include studies of young people experiencing ongoing wars. Additionally, potential protective and risk factors for PTSD prevalence, such as age, sex/gender, time after experiencing traumatic events, and the level of country income were not considered. There is inconsistent evidence on whether sex/gender acts as a risk factor for developing war-related PTSD in adolescents and young adults (Abu-Kaf et al., 2021; Braun-Lewensohn & Al-Sayed, 2018; Haag et al., 2020; Langeland & Olff, 2024; Nooner et al., 2012; Zasiekina et al., 2023). In addition, the use of different diagnostic assessment tools based on DSM-4 versus DSM-5, which have different number of major symptom clusters, has an impact on estimations of PTSD prevalence in adolescents during and after war (Kilpatrick et al., 2013).

Other challenges with the assessment of PTSD in adolescents relate to defining the precise age limits of this life stage. Recent findings indicate that the transition period from childhood to adulthood spans a broader age range than previously thought, typically between 10 and 24 years old (Sawyer et al., 2018). This extension is attributed to shifts in social roles (e.g. marriage, parenting) to later life periods, as well as the protracted brain development during this stage of life. An expanded definition of adolescence is crucial for understanding the mechanisms of developing PTSD, as well as helping to shape assessment and treatment plans to use throughout this life stage. Furthermore, a standardised definition may help to accurately estimate the prevalence of PTSD during adolescence. More work is needed to better understand the prevalence of PTSD in adolescents who have experienced or are experiencing war-related trauma in different cultural contexts.

Thus, the aim of this meta-analysis was to understand the prevalence of PTSD, as well as both risk and protective factors for developing PTSD, in adolescents worldwide aged 10–24 years, who are experiencing, or have experienced, war-related traumatic events, in studies published during the past 10 years (2013–2023). We also examined how the choice of PTSD diagnostic tools influences prevalence estimates.

2. Method

The protocol for the systematic review and meta-analysis was pre-registered on OSF and can be found on the following link (https://osf.io/dqg2z).

2.1. Selection of studies

Medline (PubMed), PsycINFO (EBSCOhost), and PTSDpubs (ProQuest) were all searched to find papers published in empirical, English language, peer-review journals, as well as dissertations, theses and preprints, which were published between January 2013 and August 2023. Search terms for Medline (PubMed) and PsycINFO (EBSCOhost) were ADOLESCEN∗[-Mesh] OR 'YOUNG ADULT∗'[tw] OR CHILD[tw] OR TEEN∗[tw] OR YOUTH∗[tw] OR STUDENT∗[tw] OR 'EMERGING ADULT∗' [tw] AND 'STRESS DISORDER∗' [Mesh], 'POSTTRAUMATIC' [tw] OR PTSD [tw] OR 'POSTTRAUMATIC STRESS DISORDER' [tw] OR 'POSTTRAUMATIC STRESS DISORDER' [tw] OR 'POST TRAUMATIC STRESS DISORDER' [tw] AND 'ARMED CONFLICT∗' [Mesh], OR 'POLITICAL VIOLENCE' OR WAR∗[tw] in title and abstract. Search terms for PTSDpubs (ProQuest) were ADOLESCENT∗ OR 'YOUNG ADULT∗' OR TEENAGER∗ OR CHILD∗ OR CHILDREN OR YOUTH∗ AND PTSD OR 'POST-TRAUMATIC STRESS DISORDER' OR 'POSTTRAUMATIC STRESS DISORDER' OR 'POST TRAUMATIC STRESS DISORDER' AND 'ARMED CONFLICT∗' OR 'POLITICAL VIOLENCE' OR WAR∗ in title and abstract.

2.2. Inclusion and exclusion criteria

Studies were selected if they:

- Were published between 2013 and 2023;
- Included participants who had experienced or continue to experience war-related trauma;
- Included only civilian participants aged between 10 and 24 years;

- Assessed war-related PTSD using validated psychometric measures within a cross-sectional design;
- Contained records that provided all the necessary information to determine the prevalence of PTSD according to demographic characteristics (age, gender, ongoing war/past war, time after experiencing traumatic event, level of country income);
- Were written in English and published in peer-reviewed journals, doctoral or master's dissertations/theses on PTSDpubs (ProQuest), or preprints.

We validated the search process using a known set of five papers to check that they could be identified. The set of five known papers was chosen from PTSDpubs. After searching in Medline (PubMed), PsycINFO (EBSCOhost), and PTSDpubs (ProQuest), one author (IH) compared the identified list of articles with the results of another literature search in Research4Life (a platform which provides institutions in lower-income countries with online access to academic and professional peer-reviewed content as a way to improve teaching, research and policy-making in health and other life, physical and social sciences). At the beginning of 2024, the search was repeated to check whether any additional papers fit with the inclusion criteria, but no papers were found.

2.3. Screening

The study used Covidence, an online software tool for conducting systematic reviews, blind screening and data extraction. The systematic review focused on searching, collating, and summarising available evidence regarding the prevalence of war-related PTSD in adolescents. Screening and selection of studies was conducted on Covidence by two authors: AG and IH. Duplicates were removed automatically and checked by AG and IH using the Covidence duplicate identification strategy. Following this, using Covidence, these two authors independently screened titles, abstracts and keywords based on inclusion and exclusion criteria. The first author (LZ) was involved in discussing articles on the Resolve Conflict page. Following this, full text articles were screened and assessed for eligibility independently by two authors (LZ and IH). Twenty-one studies met all eligibility criteria (Preferred Reporting Items for Systematic Reviews and Meta-Analyses [PRISMA] flowchart is provided in Figure 1).

2.4. Data extraction

A data extraction form based on a Covidence template was developed, including the variables to be collected and clear definitions for them. The first author (LZ)

pilot-tested the form using ten randomly selected studies to increase the reliability of the data extraction process.

Afterwards, two authors, LZ and IH, independently extracted data from the included studies. They summarised the number of participants, their age, the general prevalence of PTSD, and the prevalence of PTSD separately in males and females, diagnostic assessment tools, country of the war, ongoing war or aftermath, and number of months after exposure to war-related trauma.

2.5. Quality of studies

The quality of each study was assessed using a risk of bias tool adapted by Woolgar et al. (2022) from the Joanna Briggs Institute (Prevalence Critical Appraisal Tool, PCAT) (Munn et al., 2015). The PCAT included six questions and assessed the description of the participants and settings; participation rate of the eligible participants; reasons for non-response; quality and representativeness of the sample, appropriateness of recruitment; exclusion and inclusion criteria. Authors LZ and AG allocated each study a risk-of-bias score (9–12 = low risk of bias, 5–8 = medium risk, 0–4 = high risk). There was high interrater agreement between the two raters (Kappa = .647, $p < .001$). Discrepancies were discussed and resolved. Individual study ratings for each risk-of-bias criterion are detailed in Table S1 in Supplement 1.

2.6. Statistical analysis

The study includes two research questions:

(RQ1): What is the overall prevalence of PTSD in adolescents aged between 10 and 24 years, and how varied are PTSD rates across the studies?
(RQ2): What study-level factors – including age, sex/gender, ongoing war/aftermath of war, duration of aftermath, diagnostic assessment tool, and economic income of the country – moderate the prevalence of PTSD in adolescents aged between 10 and 24 years?

Meta-analyses were conducted using the metafor R package (Viechtbauer, 2010). Mixed effect logistic regression models were used, which are designed to model count and prevalence data (Lin & Chu, 2020). We report estimates of heterogeneity (τ^2), inconsistency (I^2) and prediction intervals. Prediction intervals indicate how the population prevalence rates vary across studies and are highly recommended in the meta-analysis of proportions (Borenstein, 2022).

We first report a model with no explanatory (moderator) variables to estimate the overall prevalence of PTSD. To test for moderators, we added additional

Prevalence of war-related posttraumatic stress disorder in adolescents: a systematic review with meta-analysis
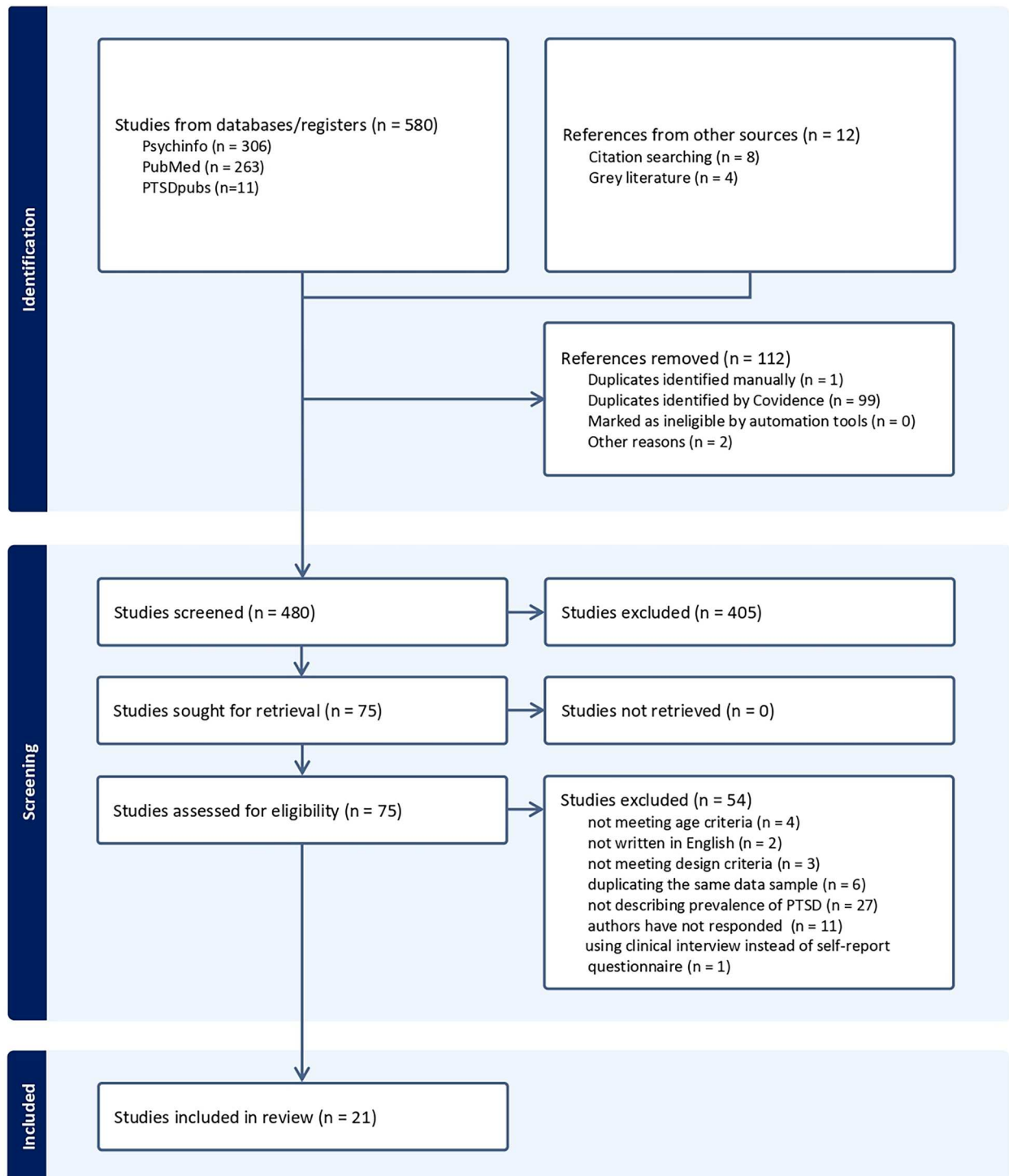
Figure 1. PRISMA diagram outlining the search and exclusion process.

study-level predictors to the model. Each moderator is tested individually. Continuous moderator variables were mean-centred. Categorical moderators with multiple levels (e.g. PTSD diagnostic assessment tool) were dummy-coded. We report an omnibus test of the significance of moderation (Q_m test), which tests the null hypothesis that prevalence rates are the same across all moderator groups or all values of the continuous moderator variable. For categorical

moderator variables, we also report the estimated prevalence of PTSD within each moderator group, estimated from the meta-analysis model.

To estimate sex/gender differences in PTSD rates, we compared PTSD rates between male and female participants from the same study using the noncentral hypergeometric-normal model (Bakbergenuly & Kulinskaya, 2018). The model estimates the log odds ratio – the odds of male participants having PTSD

divided by the odds of female participants having PTSD. Lower numbers indicate that more female participants have PTSD than male participants. Note that the included studies did not typically differentiate between gender and sex or specify which they measured. Therefore, for this analysis, gender and sex cannot be differentiated.

3. Results

3.1. Descriptive statistics

The meta-analysis included 21 studies, comprising 12,898 war trauma-exposed adolescents (PRISMA flowchart in Figure 1). Study samples ranged in size from 40 to 2314 and participants ranged in age from 11 to 24 years.

Fourteen studies applied school or university recruitment (Al-Hadethe et al., 2014; Bhat & Rangaiah, 2015; El-Khodary & Samara, 2019; Fayyad et al., 2017; Freh, 2016; Harb & Schultz, 2020; Kakaje et al., 2022; Lavi et al., 2013; Okello et al., 2014; Osokina et al., 2023; Pat-Horenczyk et al., 2014; Shoshani & Slone 2016; Thabet et al., 2014; Uysal et al., 2022). Two studies used data from national study recruitment (Charak et al., 2017; Marroquín Rivera et al., 2020). Five studies recruited participants in refugee camps and community organisations (Abu-Kaf et al., 2021; Shaheen et al., 2020; Shehadeh et al., 2016; Yilmaz & Cikili Uytun, 2020). Four studies indicated that the sampling method was random (El-Khodary & Samara, 2019; Fayyad et al., 2017; Freh, 2016; Kakaje et al., 2022), and two studies applied purposive sampling recruiting participants from specific geographic areas (Bhat & Rangaiah, 2015; Okello et al., 2014). In the paper by Bhat and Rangaiah (2015), the sample was drawn from colleges located in three districts in Kashmir, India. Okello et al. (2014) selected seven secondary schools, including both government and private institutions, with further stratification by single-sex and mixed-sex schools in Gulu district, Uganda. Six studies (Abu-Kaf et al., 2021; Al-Hadethe et al., 2014; Harb & Schultz, 2020; Pat-Horenczyk et al., 2014; Shaheen et al., 2020; Yilmaz & Cikili Uytun, 2020) did not specify the sampling methods.

The time after war-related trauma exposure range was between 1 and 10 years. The selected studies and their characteristics are illustrated in Table 1.

Twelve studies investigate the prevalence of PTSD aftermath of the war (Abu-Kaf et al., 2021; Charak et al., 2017; Fayyad et al., 2017; Freh, 2016; El-Khodary & Samara, 2019; Kakaje et al., 2022; Lavi et al., 2013; Okello et al., 2014; Pat-Horenczyk et al., 2014; Thabet et al., 2014; Uysal et al., 2022; Yilmaz & Cikili Uytun, 2020), while nine studies contain data from ongoing wars (Al-Hadethe et al., 2014; Bhat & Rangaiah, 2015; Harb & Schultz, 2020; Marroquín Rivera et al., 2020; Mels et al., 2015; Osokina et al., 2023; Shaheen

et al., 2020; Shehadeh et al., 2016; Shoshani & Slone 2016). Fifteen studies include participants up to 18 years old (Abu-Kaf et al., 2021; El-Khodary & Samara, 2019; Fayyad et al., 2017; Harb & Schultz, 2020; Kakaje et al., 2022; Lavi et al., 2013; Marroquín Rivera et al., 2020; Osokina et al., 2023; Pat-Horenczyk et al., 2014; Shaheen et al., 2020; Shehadeh et al., 2016; Shoshani & Slone, 2016; Thabet et al., 2014; Uysal et al., 2022; Yilmaz & Cikili Uytun, 2020) and six studies included participants older than 18 years old (Al-Hadethe et al., 2014; Bhat & Rangaiah, 2015; Charak et al., 2017; Freh, 2016; Mels et al., 2015; and Okello et al., 2014). In eight studies, the sample contained more males than females (Al-Hadethe et al., 2014; Bhat & Rangaiah, 2015; Charak et al., 2017; Freh, 2016; Kakaje et al., 2022; Mels et al., 2015; Okello et al., 2014; Shehadeh et al., 2016). The majority of studies (10) were scored as having a medium level risk of bias when assessed by the PCAT (Bhat & Rangaiah 2015; Fayyad et al., 2017; Freh, 2016; El-Khodary & Samara, 2019; Lavi et al., 2013; Marroquín Rivera et al., 2020; Mels et al., 2015; Okello et al., 2014; Shaheen et al., 2020; Shehadeh et al., 2016), whereas four studies were scored as having a low level of risk of bias (Charak et al., 2017; Kakaje et al., 2022; Osokina et al., 2023; Uysal et al., 2022), and seven a high level of risk (Abu-Kaf et al., 2021; Al-Hadethe et al., 2014; Harb & Schultz, 2020; Pat-Horenczyk et al., 2014; Shoshani & Slone, 2016; Thabet et al., 2014; Yilmaz & Cikili Uytun, 2020).

The authors of six papers used the term 'armed conflict' instead of 'war' (Bhat & Rangaiah, 2015; Charak et al., 2017; Marroquín Rivera et al., 2020; Shaheen et al., 2020; Shehadeh et al., 2016; Shoshani & Slone, 2016). Three studies underscored the social-ecological approach, including individual, family, and community factors in estimating the prevalence of PTSD (El-Khodary & Samara, 2019; Fayyad et al., 2017; Kakaje et al., 2022). One study applied an acculturation approach, including strategies of separation and competition, to examine community coherence and prevalence of PTSD in adolescent refugees (Abu-Kaf et al., 2021). Three studies examined forcibly displaced adolescents after exposure to war (Abu-Kaf et al., 2021; Marroquín Rivera et al., 2020; Yilmaz & Cikili Uytun, 2020), and two studies included exceptional risk factors for developing PTSD symptoms, namely parental imprisonment (Shehadeh et al., 2016) and bullying by peers (Yilmaz & Cikili Uytun, 2020).

The reviewed papers focused on wars and armed conflicts in various countries and represent Burundi (1 study), Colombia (1 study), Congo (1 study), Gaza Strip (4 studies), India (1 study), Israel (4 studies), Iraq (2 studies), Lebanon (1 study), Syria (4 studies), Uganda (1 study), and Ukraine (1 study).

Studies applied various diagnostic tools to assess PTSD prevalence, namely: The UCLA Child/

Table 1. Studies included in the meta-analysis.

	Authors	Year	Age-range	Age mean (SD)	Country of war	Sample size	Proportion of males (%)	Years after exposure	Measures	Risks of bias category (0/12)
1.	Abu-Kaf et al.	2021	13–18	15.85 (1.49)	Syria	173	37.50	10.00	CBCL	3
2.	Al-Hadethe et al.	2014	16–19	**	Iraq	403	61.50	–	SPTSS	3
3.	Bhat & Rangaiah	2015	19–24	19.90*	India	797	58.80	–	PCL-5	2
4.	Charak et al.	2017	12–21	14.19 (1.99)	Burundy	231	41.6	.08	CPSS	9
5.	El-Khodary & Samara	2019	11–17	13.71 (1.36)	Gaza Str	1029	48.20	1.00	PTSD-SS	2
6.	Fayyad et al.	2017	12–18	14.70 (1.70)	Lebanon	252	45.60	.75	CRIES	2
7.	Freh	2016	12–23	15.80	Iraq	224	53.60	10.00	PTSD-SS	1
8.	Harb & Schultz.	2020	12–16	13.50 (0.94)	Gaza Str	40	37.00	–	CRIES	1
9.	Kakaje et al.	2022	16–18	16.38 (0.79)	Syria	1353	52.80	9.00	CRIES	1
10.	Lavi et al.	2013	12–15	13.50 (0.67)	Israel	2314	48.40	.83	CPTS-RI	2
11.	Marroquín Rivera et al.	2020	12–17	14.61 (1.65)	Colombia	102	39.22	–	PCL-C	2
12.	Mels et al.	2015	13–21	15.83 (1.81)	Congo	952	54.70	–	IES-R	2
13.	Okello et al.	2014	13–21	16.72 (1.33)	Uganda	551	51.50	4.00	IES-R	2
14.	Osokina et al.	2023	11–17	**	Ukraine	1463	47.40	–	HTQ	2
15.	Pat-Horenczyk et al.	2014	12–18	16.29 (0.70)	Israel	482	46.70	.17	UCLA-PTS	2
16.	Shaheen et al.	2020	11–16	13.49 (0.97)	Israel	233	30.04	–	UCLA-PTS	2
17.	Shehadeh et al.	2016	11–18	13,37 (1.85)	Israel	314	53.80	–	UCLA-PTS	2
18.	Shoshani & Slone	2016	13–15	13.73 (0.84)	Gaza Str	1078	49.70	–	UCLA-PTSD-RI	3
19.	Thabet et al.	2014	15–18	16.70 (0.72)	Gaza Str	358	44.10	.25	UCLA PTS	3
20.	Uysal et al.	2022	12–18	15.50 (11.76)	Syria	430	43.00	4.75	CRIES	2
21.	Yilmaz & Cikili Uytun	2020	12–16	13.50 (0.94)	Syria	119	36.10	3.86	DSM-5	2

Note: * = missing standard deviation. ** = missing mean and standard deviation. Acronyms of measures are as follows: CBCL (Child Behaviour Checklist); SPTSS (Screen for Posttraumatic Stress Symptoms); PCL-5 (PTSD Checklist for DSM-5); CPSS (Child PTSD Symptom Scale-Self-Report); CRIES (The Children's Revised Impact of Event Scale); PTSD-SS (Posttraumatic Stress Disorder – Short Scale); CPTS-RI (Child Posttraumatic Stress Reaction Index); PCL-C (The PTSD Checklist – Civilian Version); IES-R (The Impact of Events Scale-Revised); HTQ (The Harvard Trauma Questionnaire); UCLA-PTS (The UCLA Child/Adolescent PTSD Reaction Index); DSM-5 (The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition).

Adolescent PTSD Reaction Index (UCLA PTSD-RI) (5 studies); The Children's Revised Impact of Event Scale (CRIES) (four studies); Child Behaviour Checklist (CBCL) (one study); CPSS (Child PTSD Symptom Scale-Self-Report) (one study); Posttraumatic Stress Disorder (PTSD)-Short Scale (PTSD-SS) (two studies); The Impact of Events Scale-Revised (IES-R) (two studies); Screen for Posttraumatic Stress Symptoms (SPTSS) for DSM-4 (one study); Child Posttraumatic Stress Reaction Index (CPTS-RI) (one study); DSM-5 (one study). The Harvard Trauma Questionnaire (HTQ) (one study); The PTSD Checklist for DSM-5 (PCL-5) (one study); The PTSD Checklist – Civilian Version (PCL-C) (one study).

3.2. Overall PTSD prevalence rates across studies

The meta-analytic estimate of the average prevalence of PTSD was 29.4% (95% CI [18.7%, 43.0%], $k = 21$). However, studies were highly heterogeneous ($\tau^2 = 1.68$) and inconsistent ($I^2 = 99.4\%$). Indeed, the 95% prediction interval was extensive (2.6%−86.9%). These results indicate that there is no universal prevalence of PTSD, but rather, the prevalence levels are contingent on the specific context of each study (see Figure 2).

3.3. Factors moderating the prevalence of PTSD in adolescents

Next, we explored several factors that could explain differences in prevalence rates between studies. The study quality did not significantly predict the prevalence of PTSD ($F(df_1 = 2, df_2 = 18) = 0.639$, $p = .54$). However, the type of PTSD diagnostic assessment tools used significantly predicted prevalence rates ($F(df_1 = 11, df_2 = 9) = 6.492$, $p = .005$).

The estimated prevalence rates for studies using different measures of PTSD are shown in Table 2. These estimates are uncertain as each diagnostic assessment tool was only used a few times. Studies with a longer time after trauma exposure were also associated with higher prevalence rates. Every additional year after trauma exposure in the sample was associated with a slight increase in the logit-transformed prevalence of PTSD ($b_{logit} = .26$, 95% CI [.06, .45], $p = .01$, K = 12, N participants = 7516) (see Figure 3). This effect remained when also controlling for mean sample age ($b_{logit} = .26$, $p = .02$). There were no significant effects associated with economic index, quality assessment, mean sample age or ongoing war (see Table 2). There was a nonsignificant trend of samples with an older average age having slightly higher prevalence rates. However, this effect was not strong enough to conclude that age is a reliable predictor of PTSD, $b = .26$; 95% CI [−.07, .59], $p = .12$.

Next, we analysed six of the included studies that reported PTSD rates in male and female participants separately. There was a nonsignificant trend towards higher prevalence rates in female participants (Odds Ratio = .89, 95% CI [.49, 1.63], $p = .64$). However, studies were again highly heterogeneous ($\tau^2 = .236$) and inconsistent ($I^2 = 81.6\%$). Prediction intervals
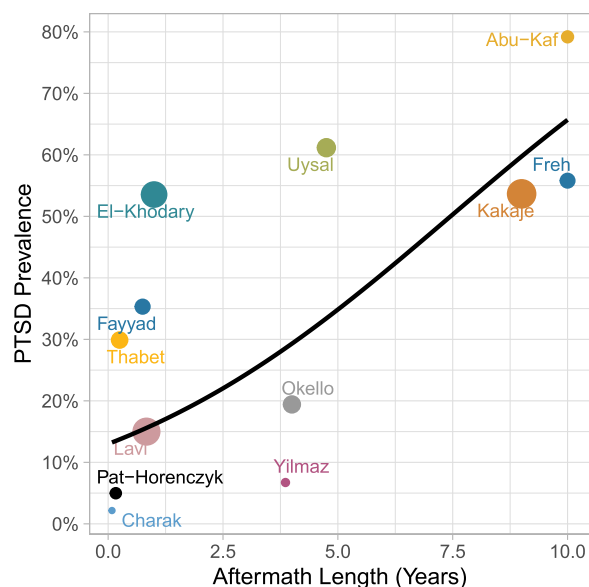
Figure 2. Forest Plot of PTSD prevalence rates for each study and meta-analysis results of mean PTSD rates and 95% prediction intervals. The sample size and number of participants with PTSD is also shown.

Note: Meta-analysis results are shown below the forest plot, including the number of studies (K), degrees of freedom (df) and inconsistency (I2). The black diamond shows the 95% confidence interval for the meta-analytic average prevalence rate, and the error bars show the 95% prediction intervals, which are much broader due to heterogeneity between studies.

Table 2. Meta-regression results testing which factors moderate the PTSD prevalence rates across studies.

Group	b/%	95% confidence interval	
		Lower bound	Upper bound
Quality Assessment, F(df_1 = 2, df_2 = 18) = 0.639, p = .54			
High Risk	29.1%	12.9%	53.2%
Medium Risk	34.8%	18.7%	55.3%
Low Risk	18.5%	5.61%	46.6%
Aftermath Length, F(df_1 = 1, df_2 = 10) = 8.81, p = .014*			
Intercept	b = −.95	b = −1.67	b = −.23
Aftermath (centred)	b = .26	b = .06	b = .45
Economic Index, F(df_1 = 3, df_2 = 17) = .17, p = .91			
1	28.00%	11.20%	54.30%
2	29.90%	9.95%	62.30%
3	40.10%	12.20%	76.40%
4	26.60%	12.20%	48.70%
PTSD Measure, F(df_1 = 11, df_2 = 9) = 6.49, p = .005**			
CBCL	79.30%	49.20%	93.80%
CPSS	2.04%	0.39%	9.99%
CPTS-RI	15%	4.51%	39.70%
CRIES	43.90%	28.20%	60.90%
DSM-5	6.47%	1.44%	24.70%
HTQ	5.30%	1.45%	17.60%
IES-R	34.10%	16.80%	56.90%
PCL-5	49.80%	21%	78.80%
PCL-C	12.50%	3.15%	38.40%
PTSDSS	54.70%	32%	75.60%
SPTSS	61.10%	29.30%	85.60%
UCLA-PTSD-RI	26.20%	16.30%	39.30%
Mean Sample Age, F(df_1 = 1, df_2 = 19) = 2.66, p = .12			
Intercept	b = −.88	b = −1.44	b = −.32
Age (centred)	b = .26	b = −.07	b = .59
Ongoing / Aftermath War, F(df_1 = 1, df_2 = 19) = .10, p = .76			
Ongoing War	31.60%	15.70%	53.40%
Aftermath	27.80%	14.90%	45.90%

Note: For categorical moderator variables, the prevalence rate is shown for each subgroup estimated using the meta-regression model. For continuous moderator variables, we present the model intercept and regression coefficient representing the change in the logit-transformed proportion for every unit change in the predictor. The number of studies included in each meta-analysis differs because studies with missing data on the moderator variables were dropped from the analysis. The number of studies is equal to 1 + df_1 + df_2.

were also wide (95% Odds Ratio Prediction Interval [.22, 3.56]) (see Figure 4).

4. Discussion

Given the detrimental effect of war on adolescents' mental health, it is important to understand the prevalence of war-related PTSD, as well as both risk and protective factors for developing PTSD, in adolescents across the world. This systematic review and meta-analysis examined the prevalence of PTSD in adolescents in war-affected areas studied over the past 10 years (2013–2023). Twenty-one studies met the inclusion criteria for this review, including 12,898 participants aged 11 and 24 years.

Our first research question investigated the overall prevalence of PTSD and its variability across the studies. The meta-analytic average prevalence of PTSD was 29.4% (95% CI [18.7%, 43.0%]). However, prevalence rates were highly inconsistent across studies, varying from 2% to 79%. This finding broadly supports previous research linking variations in PTSD prevalence with country-level predictors in different cultural contexts, including rates of exposure to trauma and country vulnerability in terms of social and educational disadvantage (Dückers et al., 2016; Ford et al., 2015).

The variability in PTSD rates across countries found here demonstrates the complex nature of this condition and the impact of different factors on the reported prevalence rates. Factors such as the type and severity of war-related trauma, direct and indirect exposure to trauma, cultural attitudes towards mental health, belonging to the most vulnerable groups of the population (e.g. refugees, displaced persons, abused or neglected individuals), and access to mental health services all contribute to the variability of PTSD in adolescents (Abu-Kaf et al., 2021; Charak et al., 2017; Lavi et al., 2013; Marroquín Rivera et al., 2020; Yilmaz & Cikili Uytun, 2020). Additionally, individual differences, including genetic predisposition, previous trauma history and childhood adversity further influence the development of PTSD or resilience to it (El-Khodary & Samara, 2019; Mels et al., 2015; Okello et al., 2014; Pat-Horenczyk et al., 2014; Uysal et al., 2022). The reviewed articles also indicate that variations in the prevalence of PTSD rates might be explained by both the personal characteristics of adolescents, such as emotional and conduct problems, and their interpersonal family and peer problems, including parental imprisonment, bullying, physical and emotional abuse, community coherence, religious beliefs, and political settings (Al-Hadethe et al., 2014; Charak et al., 2017; El-Khodary & Samara, 2019; Fayyad et al., 2017; Kakaje et al., 2022; Shehadeh et al., 2016; Shoshani & Slone, 2016; Yilmaz & Cikili Uytun, 2020).
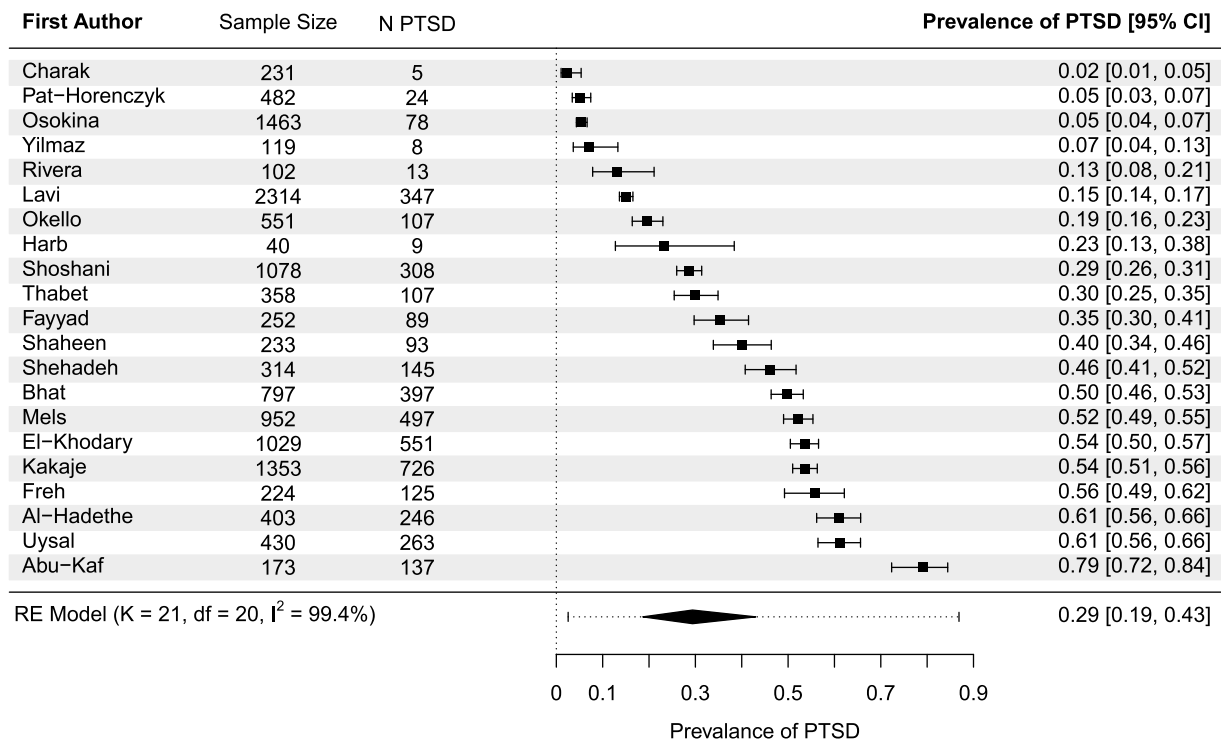
First Author	Sample Size	N PTSD		Prevalence of PTSD [95% CI]
Charak	231	5		0.02 [0.01, 0.05]
Pat−Horenczyk	482	24		0.05 [0.03, 0.07]
Osokina	1463	78		0.05 [0.04, 0.07]
Yilmaz	119	8		0.07 [0.04, 0.13]
Rivera	102	13		0.13 [0.08, 0.21]
Lavi	2314	347		0.15 [0.14, 0.17]
Okello	551	107		0.19 [0.16, 0.23]
Harb	40	9		0.23 [0.13, 0.38]
Shoshani	1078	308		0.29 [0.26, 0.31]
Thabet	358	107		0.30 [0.25, 0.35]
Fayyad	252	89		0.35 [0.30, 0.41]
Shaheen	233	93		0.40 [0.34, 0.46]
Shehadeh	314	145		0.46 [0.41, 0.52]
Bhat	797	397		0.50 [0.46, 0.53]
Mels	952	497		0.52 [0.49, 0.55]
El−Khodary	1029	551		0.54 [0.50, 0.57]
Kakaje	1353	726		0.54 [0.51, 0.56]
Freh	224	125		0.56 [0.49, 0.62]
Al−Hadethe	403	246		0.61 [0.56, 0.66]
Uysal	430	263		0.61 [0.56, 0.66]
Abu−Kaf	173	137		0.79 [0.72, 0.84]
RE Model (K = 21, df = 20, I^2 = 99.4%)				0.29 [0.19, 0.43]

Prevalance of PTSD

Figure 3. Bubble plot of study aftermath length and the PTSD prevalence rates.

Note: The size of each point is proportional to the precision (inverse variance) of each effect size, so that larger studies have larger points. The meta-regression effect of aftermath length is shown in black, and is curved because the model is non-linear.
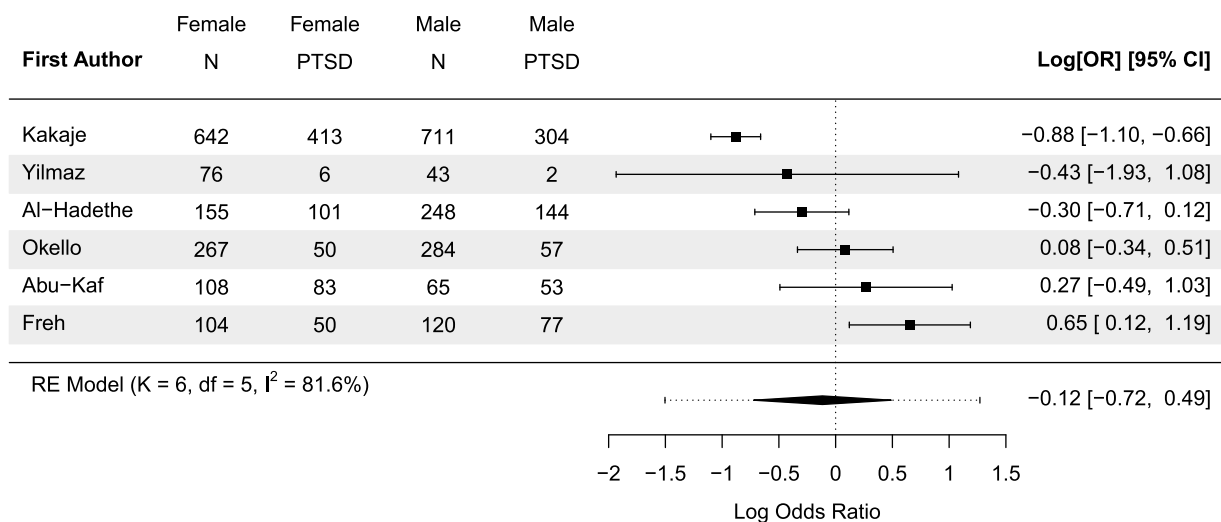
First Author	Female N	Female PTSD	Male N	Male PTSD		Log[OR] [95% CI]
Kakaje	642	413	711	304		−0.88 [−1.10, −0.66]
Yilmaz	76	6	43	2		−0.43 [−1.93, 1.08]
Al−Hadethe	155	101	248	144		−0.30 [−0.71, 0.12]
Okello	267	50	284	57		0.08 [−0.34, 0.51]
Abu−Kaf	108	83	65	53		0.27 [−0.49, 1.03]
Freh	104	50	120	77		0.65 [0.12, 1.19]
RE Model (K = 6, df = 5, I^2 = 81.6%)						−0.12 [−0.72, 0.49]

Log Odds Ratio

Figure 4. Forest plot of studies that compared PTSD rates between males and females, negative Log Odds Ratios indicate higher prevalence in women, and positive Log Odds Ratios indicate higher prevalence in men.

Addressing the variability in PTSD prevalence rates among war-affected adolescents requires a comprehensive understanding of the set of factors influencing these rates. Tailoring interventions to the specific cultural, socioeconomic, and personal contexts of affected individuals is crucial for effective treatment. Future research should explore risk factors for PTSD in different cultural contexts in order to develop more effective trauma-informed care.

Our second research question used meta-regression to investigate what study-level factors moderated the prevalence of PTSD in adolescents. PTSD prevalence was significantly moderated by the type of diagnostic assessment tool used, which supports previous findings (Ford et al., 2015; Potluri & Patel, 2021). The difference in number of major symptom clusters for PTSD in DSM-4 and DSM-5, the language and specific wording in assessment tools, cultural differences and various psychometric properties all contribute to the variability in prevalence rates of PTSD observed across different studies (Armour et al., 2016; Blackmore et al., 2020). Differences in the

sensitivity and specificity of different PTSD assessments may also explain differences across tools (Mouthaan et al., 2014). This underscores the importance of using validated and culturally sensitive diagnostic assessment tools and considering contextual factors when interpreting prevalence rates of PTSD. Ensuring that diagnostic assessment tools have been rigorously tested for reliability and validity across different cultural groups is crucial for accurate diagnosis. These tools must account for cultural and linguistic expressions of psychotrauma that may differ in various cultural contexts (Armour et al., 2016; Schnyder et al., 2016). Consistency in diagnostic criteria and the use of culturally adapted tools can improve the comparability of PTSD prevalence rates across studies and regions. Future research should focus on developing and validating assessment instruments that are sensitive to cultural settings and PTSD symptoms as experienced by diverse populations.

Another important meta-analytic finding is that PTSD prevalence rates increase over time after exposure to war trauma. This aligns with Santiago et al.'s (2013) systematic review, which observed a consistent rise in PTSD rates at one, three, six- and 12-months post-trauma. These results suggest that the psychological impact of war trauma may intensify or become more apparent as time passes, highlighting the need for long-term mental health support and monitoring for individuals affected by war-related traumatic events. Lavi et al. (2013) point out that further research is needed to explore adolescents' psychological adjustment to the post-war period. Understanding these dynamics has practical implications and might contribute to developing targeted interventions and support systems for adolescents in their adjustment process. Additionally, longitudinal studies could provide valuable insights into the long-term effects of war exposure on adolescents and their needs during the transition into adulthood. By addressing these research gaps, the integration of adolescents into post-war society might be better supported.

Our findings show that there was a nonsignificant trend of slightly higher prevalence rates of PTSD in female participants compared with male participants, as well as in samples with older average ages compared with those with younger average ages. However, the effects of both age and sex/gender were not significant enough to determine that either can be considered a reliable predictor of PTSD in the studies reviewed.

Regarding age as a possible predictor of PTSD prevalence, it is important to consider the variability in the definition of adolescence across different countries. Schulenberg and Schoon (2012) emphasise the importance of considering both cultural and structural contexts when examining the transition from adolescence to adulthood. They argue that there are cross-cultural differences in how the childhood/

adolescence phase and the beginning of adulthood are understood, as the timing and experience of key milestones such as education and parenthood vary.

While using a consistent age definition across studies, as we did in this review, makes comparisons more straightforward, we recognise that socio-cultural expectations differ across countries, which might influence how individuals respond to various life events, including armed conflicts. Understanding the cultural settings and societal expectations that shape normative behaviours during this period will be an important direction for future research.

Sex/gender differences in PTSD rates varied significantly across studies. One study (Freh, 2016) found significantly higher prevalence in male participants, another study (Kakaje et al., 2022) found significantly higher prevalence in female participants, while four studies did not find significant sex/gender differences. These differences might be associated with the varying types and levels of exposure to war-related trauma between sex/genders across studies (Wilker et al., 2021). Male participants are more likely to experience direct combat exposure, forced recruitment, captivity and life-threatening situations, while female participants are at higher risk for sexual violence and displacement (Charak et al., 2017; Ferguson, 2021). Differences in exposure to these different traumatic events across studies might explain the varying PTSD rates between sex/genders.

The cultural settings and types of war in each study might also play a role. Therefore, future studies should focus on the influence of sex/gender in relation to different types of war-related trauma. Our findings emphasise the importance of considering sex/gender-specific traumas when assessing PTSD symptoms and developing interventions, as prevention and treatment strategies may need to address the unique experiences and needs of each sex/gender.

5. Limitations

Like all observational research, our meta-regression results are not immune from the risk of confounding bias. For example, although we found that studies conducted after a later post-war period had higher PTSD rates, other factors may be driving this effect. In addition to increased war-related trauma exposure, the participants included in data from the post-war period had grown older and might have experienced other significant traumatic events unrelated to war in the period between the war and the time of testing. The potential mechanisms underlying PTSD in adolescents might be related to their cognitive emotional and social development. Initially, they may show a tendency to rely on avoidance or denial, and symptoms may be delayed or suppressed. As adolescents grow and their cognitive abilities become more

sophisticated, greater reflection on past experiences, coupled with heightened emotional awareness, might lead to the emergence or intensification of PTSD symptoms (Cisler & Herringa, 2021).

One limitation of this study is the lack of standardised data on the number of non-war-related traumatic experiences among participants across the included studies. Although we recognise the potential impact of such experiences as a moderator in PTSD, the absence of this information prevented us from assessing its potential effect. Future research should aim to include data on both war-related and non-war-related trauma exposure to better understand how different types of trauma may affect PTSD prevalence.

Meta-analyses are limited to using moderator variables measured at the study level rather than the individual level. As such, we cannot control for individual age or the number of non-war-related traumas each participant experienced. Given these considerations, future research should further explore the role of non-war-related traumatic experiences and individual age as moderators to better understand their impact on PTSD prevalence.

Six papers did not report the sampling method in their study. Unreported sampling methods makes it difficult to determine whether differences in PTSD prevalence are due to true variations or artifacts of how the study samples were selected. To assess study quality and risk of bias, we used the PCAT tool which includes the question 'Were participants recruited in an appropriate way?' as well as five other criteria (see Table S1). We found that overall study quality assessment scores did not significantly predict PTSD prevalence rates, even though the PCAT captures risk of bias in terms of sample representativeness as well as other factors like reporting. However, this non-significant effect does not mean that study quality is unimportant: our analysis could be underpowered, specific aspects of quality (e.g. sampling representativeness) may influence prevalence, and low study quality may increase between-study heterogeneity (which we did not test).

Additionally, all the included studies examined the prevalence of PTSD using only self-report questionnaires. Future research should include studies that use professional reports and clinical interviews alongside self-report measures. Only six studies reported prevalence separately for male participants and female participants, reducing the statistical power to detect a difference between these groups.

Due to our strict definition of adolescence being between the ages of 10–24, we excluded numerous studies for including participants outside of that age range. For example, studies may include younger adolescents in studies on children and older adolescents in studies on adults. This potentially obscures our understanding of PTSD prevalence across the lifespan. Future studies with an expanded definition of adolescence should be carried out to understand war-induced PTSD across the lifespan and help to develop more efficient assessment and treatment.

6. Conclusion

In this systematic review and meta-analysis, we synthesised studies of war-related PTSD in adolescents, published during the past decade, conducted under the circumstances of ongoing war or its aftermath. We found that the prevalence of war-related PTSD increases with time during the post-war period, which underscores the importance of access to psychological services after war. These findings are in line with previous reviews and represent a contribution to the debate regarding the effect of different diagnostic tools assessing PTSD on prevalence estimates in adolescents, as well as the impact of time after an exposure to war-trauma. The findings have implications for future practice concerning planning psychological support for adolescents in the long aftermath of war.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

Analysis code is available at https://github.com/giac01/6_ptsd_metaanalysis.

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