



Homicide as a Source of Posttraumatic Stress?: A Meta-Analysis of the Prevalence of Posttraumatic Stress Disorder After Committing Homicide

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There is a growing body of literature on the diagnosis of posttraumatic stress disorder (PTSD) after committing homicide that has examined the prevalence of this phenomenon among individuals who have been convicted, but these studies considerably vary. The present study was the first meta-analysis to synthesize scientific evidence regarding the prevalence of offense-related PTSD among convicted killers. A total of 691 articles were identified through an initial screening process, and the final analysis included 11 studies that met the analysis criteria. We examined the prevalence of PTSD after committing homicide and explored how these rates varied by sample type, offender type, diagnosis timeframe, and diagnosis type. Among adult offenders, the pooled prevalence was 42.6%, 95% CI [38.0%, 47.4%], for current full-criteria homicide-related PTSD and 13.1%, 95% CI [9.9%, 17.2%], for current partial-criteria homicide-related PTSD. For mixed offenders (i.e., killers and violent offenders), the pooled prevalence of current full-criteria offense-related PTSD was 33.1% (95% CI [14.1, 59.8]). Thus, we found that PTSD prevalence was higher in killers than mixed offenders, although this difference was not statistically significant. Finally, among youth mixed offenders, the pooled prevalence for current full-criteria offense-related PTSD was 5.3%, 95% CI [2.9%, 9.5%]. These findings provide evidence of the high rate of this phenomenon, especially among convicted adults.

Posttraumatic stress disorder (PTSD) is a psychiatric disorder that can occur in people who have experienced or witnessed a traumatic event, such as a terrorist act, war or combat, a serious accident, a natural disaster, rape, or a violent personal assault (American Psychiatric Association [APA], 2018). Some studies have suggested lifetime and past-year PTSD prevalence rates of 8.0% and 4.8%, respectively, among military samples (Wisco et al., 2014), with estimated prevalence rates of 3.0% and 4.7% in community samples (Kilpatrick et al., 2013). In addition, women are twice as likely as men to develop PTSD (APA, 2013).

Typically, PTSD is related to being the victim of a traumatic event; however, there is evidence indicating that PTSD may also be caused by a person's own actions (e.g., Collins & Bailey,

1990). In this way, such evidence suggests that homicide perpetrators can develop PTSD following their offense (e.g., Harry & Resnick, 1986), suggesting that killing another person might precipitate PTSD in some individuals (e.g., Di et al., 2018; Pollock et al., 1999).

A PTSD diagnosis requires exposure to a traumatic event, which is followed by persistent symptoms, such as intrusive memories of the event, avoidance of reminders of the event, alterations in cognition, hyperarousal, or emotional numbing (APA, 2013). The definition of trauma requires “actual or threatened death, [or] serious injury” (APA, 1987, 1994, 2000, 2013). Historically, exposure to traumatic events meant experiencing or directly witnessing these events (APA, 1987, 1994, 2000); the most recent definition, however, also includes learning that the traumatic event occurred to a close family member or friend or experiencing repeated or extreme exposure to aversive details of traumatic events (APA, 2013). Killing another person can be traumatizing (i.e., a traumatic event) given that the person who has committed the homicide experiences, witnesses, and confronts an event involving serious injury and death (Pollock, 1999; Ternes et al., 2020). Therefore, killing another person meets *Diagnostic and Statistical Manual of Mental Disorders* (fifth ed.; *DSM-5*; APA, 2013) Criterion A for a

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PTSD diagnosis. In addition, research has found that homicide-related PTSD reactions include intrusive memories of the moment when the act of violence turned worse, flashbacks related to the killing or assault (Evans et al., 2007; Kruppa, 1991), partial amnesia related to the offense (Evans et al., 2009), and avoidance symptoms (Gray et al., 2003).

Several studies have analyzed the prevalence rate of posthomicide PTSD in different samples (i.e., adult or youth offenders), offenders (i.e., killers or mixed offenders, including killers and other violent offenders), PTSD diagnostic timeframes (i.e., current or lifetime diagnosis), and diagnoses (i.e., full or subthreshold PTSD criteria), which has yielded different prevalence rates for the diagnosis of offense-related PTSD. Consequently, research is required to systematically and rigorously approximate these estimates and take into account the different methodologies used to examine the development of PTSD after committing homicide. The present meta-analysis may be of interest not only to the community of researchers engaged in the field of psychotraumatology and forensic psychology but also to mental health professionals engaged in the assessment and treatment of homicide perpetrators, suggesting the need for specific intervention strategies.

The aim of the present study was to conduct a meta-analysis of the PTSD prevalence rates of homicide perpetrators to quantitatively integrate the scientific evidence and provide a pooled prevalence rate. We also accounted for methodological variations across studies and, to this end, examined the prevalence rates of PTSD after committing a violent crime with regard to sample type (i.e., adult or youth offenders), offender type (i.e., killers or mixed offenders, including killers and other violent offenders), diagnosis timeframe (i.e., current or lifetime diagnosis), and diagnosis type (i.e., fulfilling full or partial PTSD criteria). As such, this work contributes to current research by drawing from international studies and producing pooled estimates of the prevalence of PTSD among incarcerated homicide perpetrators after they have committed their offense.

Method

This meta-analysis was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) statement (Moher et al., 2009), the guidelines recently proposed by the APA Publications and Communications Board Task Force (Appelbaum et al., 2018, Table 9, pp. 21–23), and the Guidelines for Reporting Systematic Reviews and Meta-Analyses (see Rubio-Aparicio et al., 2018).

Study Selection Criteria

The inclusion criteria were (a) publication in a peer-reviewed journal between 1980 and January 2019—this timeframe was chosen because it represents the first contribution placed in the 1980s; (b) article was an original and quantitative investigation; (c) sample was composed, either completely or partially, of convicted homicide perpetrators; (d) study measured PTSD

in some way (i.e., used a measurement instrument that specifically assessed the symptoms of PTSD or its diagnostic criteria); (e) study analyzed offense-related PTSD; and (f) study reported on the prevalence of PTSD following an offense or reported statistical data enabling the prevalence to be computed. No limits were placed on the studies' language or participants' age. Studies were excluded if they were case series or if the sample consisted of a single clinical case or was selected from combat or terrorist populations.

Search Strategy

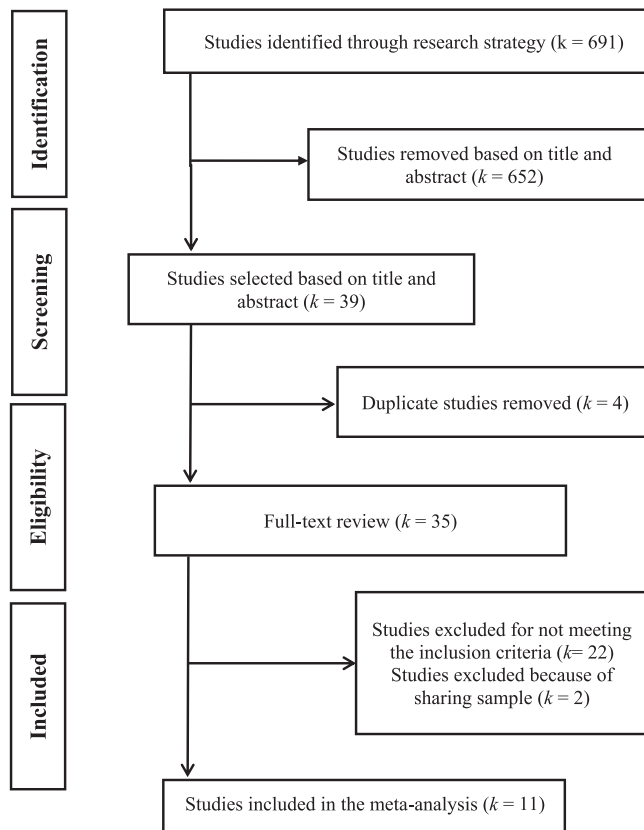
Electronic searches were carried out in February 2019 using the Web of Science, PubMed, Scopus, and Google Scholar databases, using the following combination of keywords: “ptsd” “post trauma” “post traumatic” AND “homicide” OR “following homicide” OR “post homicide” OR “homicide related ptsd.” Further manual searches of reference lists from the retrieved studies were conducted to identify additional studies that met the selection criteria. The reference lists from previous reviews and meta-analyses (Goff et al., 2007; Prins, 2014; Tarolla et al., 2002) were also screened to find studies that met the inclusion criteria for the present meta-analysis. The study eligibility process was independently conducted by two researchers. Disagreements between these researchers were resolved by consensus, and a third reviewer was consulted if required. Figure 1 presents a flowchart of the screening and selection process.

A total of 691 articles identified using the search strategy were reviewed based on their titles and abstracts. Of these, 39 articles were included, which was reduced to 35 after removing duplicates. The full texts of these articles were then reviewed, and 22 were excluded for not meeting the inclusion criteria, leaving 13 studies. Of these, two were removed because they shared a sample with another study (Di et al., 2018; Evans et al., 2009). Ultimately, 11 studies fulfilled the selection criteria, all of which were written in English and published in peer-reviewed journals between 1989 and 2017.

Study Coding

The coding process was conducted in a standardized and systematic manner, and the data were extracted by two independent reviewers: one psychology doctoral candidate and one psychology PhD. A protocol for extracting the studies' characteristics was established and applied to each study. The characteristics coded were (a) the year of the study, (b) geographical location, (c) sampling method (convenience vs. randomized sample), (d) sample size, (e) setting, (f) mean age and standard deviation, (g) participant sex distribution (percentage of males), (h) participant ethnicity, (i) mean time since the offense (months), (j) mean time in prison (months), (k) sample type (adult or youth offenders), (l) offender type (killers or mixed offenders, including killers and other violent offenders), (m) PTSD definition, (n) index trauma, (o) diagnosis timeframe (current or lifetime diagnosis), (p) diagnosis

Figure 1
Flowchart of the Study Selection Process



type (fulfilling full or partial PTSD criteria), and (q) statistics reported to calculate the prevalence of PTSD. The most comprehensive report was used when sample data appeared in multiple manuscripts; in these instances, we supplemented the missing data with data from the other report(s).

Finally, the studies' methodological quality was assessed using an ad hoc nine-item checklist. The items within this checklist were used to assess whether a study (a) used a probabilistic sampling procedure, (b) specified eligibility criteria, (c) specified exclusion criteria, (d) specified the time of data collection, (e) specified methodological details to allow replication, (f) used valid measures to assess PTSD, (g) used reliable measures to assess PTSD, (h) conducted appropriate statistical analyses, and (i) drew appropriate conclusions based on the data. Each item was scored as 1 when the study met the criterion and 0 otherwise. A total quality score (TQS) was calculated for each study by summing the corresponding quality item scores (range: 0–9, with higher scores indicating a higher degree of overall quality). The TQs across the 16 studies in our sample ranged from 3 to 7 ($M = 5.55$, $SD = 1.13$; range: 4–7).

Interrater reliability was high, with a mean intraclass correlation of .98 ($SD = .05$), with a range of .85 to 1.00 for continuous variables and kappa coefficients ranging from .84 to 1.00 for categorical variables. In addition, when there was disagreement on the coding, a reconciliation process was undertaken;

that is, the raters arrived at a consensus, and a third reviewer was consulted if required.

Computing Effect Sizes

The prevalence of PTSD following a violent crime served as the effect measure of interest. For studies in which PTSD prevalence was not directly reported, we calculated it by dividing the number of participants affected by offense-related PTSD by the total number of participants in the sample. Consistent with standard meta-analytic methods (Borenstein et al., 2009), the effect size (i.e., proportions) for each study was translated to logits and used in all analyses. Once the statistical analyses were conducted, their results, using logits, were then back-translated to proportions, along with their corresponding confidence intervals, for easier interpretation.

Statistical Analysis

Separate meta-analyses were conducted on the studies' effect sizes; these meta-analyses considered sample type (i.e., adult or youth offenders), offender type (i.e., killers or mixed offenders, including killers and other violent offenders), diagnosis timeframe (i.e., current or lifetime diagnosis), and diagnosis type (i.e., fulfilling full or partial PTSD criteria). Given that not all studies assessed all constructs, each meta-analysis included a different number of studies (range: 2–5). To accommodate this variability in prevalence, a random-effects model was assumed (Borenstein et al., 2009; Sánchez-Meca & Marín-Martínez, 2008). We calculated a pooled prevalence and its corresponding 95% confidence intervals, as confidence intervals indicate the degree of precision, as well as the significance of the mean (logit) effect size. Forest plots were also constructed to represent the individual and pooled prevalence estimates with their 95% confidence intervals and to allow visual inspection for study heterogeneity. When only two studies were available with regard to examining a given construct, the pooled prevalence was calculated to improve the score estimation and provide a confidence interval, but forest plots were not constructed.

Further, both Cochran's Q statistic and the I^2 index were calculated to assess the effect sizes' heterogeneity (Higgins et al., 2003). A Q statistic with a p value of less than .05 was indicative of heterogeneity among the effect sizes. The degree of this heterogeneity was then estimated using the I^2 index, with I^2 values of approximately 25%, 50%, and 75% denoting low, moderate, and large heterogeneity, respectively (Huedo-Medina et al., 2006). The statistical analyses were performed using Comprehensive Meta-Analysis software (Version 3.0; Borenstein et al., 2014).

Results

Descriptive Characteristics

Table 1 presents the studies' descriptive characteristics. All studies applied a cross-sectional design, and the samples were

Table 1
Description of the Study Characteristics

First author (year)	Location	Sample	Setting	Ethnicity (%)	M time since offense (months)	M time in prison (months)	PTSD measure	Index trauma	PTSD prevalence
Chung (2016a) TQS: 7	China	150 killers (M age = 36.76 years, SD = 10.51, 100% male)	3 prison units	CH: 100	126.6	69.9	PDS (DSM-IV)	Homicide	Current PTSD 44.0% full, 13.3% partial
Chung (2016b) TQS: 7	China	167 killers (M age = 36.73 years, SD = 5.47, 100% male)	3 prison units	CH: 100	73.53	68.41	PDS (DSM-IV)	Homicide	Current PTSD 44.9% full, 12.6% partial
Crisford (2008) TQS: 6	United Kingdom	45 mixed offenders (M age = 39 years, SD = 9, 100% male)	Regional and local secure units	W: 43.6; 66.4	78	NR	DAPS (DSM-IV-TR)	Violent offense (84.4%), sex offense (15.6%)	Current PTSD, 40%
Evans (2007) TQS: 5	United Kingdom	105 mixed offenders (M age = 19.8 years, 100% male)	Young offenders' institutions	W: 74.2; O: 25.7	22.6	20	PSS-I (DSM-IV) IRI	Violent offense	PSS-I: Current PTSD: 5.7% full, 56% intrusive symptoms, 20% avoidance symptoms, 11.4% hyperarousal symptoms, 45.7% reported intrusive memories of their violent offense. IRI: Current: 43.8% reported intrusions of their violent offense, 36% reported ruminations of their violent offense.

(Continued)

Table 1
(Continued)

First author (year)	Location	Sample	Setting	Ethnicity (%)	M time since offense (months)	M time in prison (months)	PTSD measure	Index trauma	PTSD prevalence
Gray (2003) TQS: 4	United Kingdom	37 mixed offenders (M age = 35 years, SD = 12.4, 86.5% male)	Medium secure hospital	NR	46.6	NR	DSM III-R criteria, IES (cutoff scores)	Homicide or violent offense	DSM-III-R: Current full PTSD, 33%; current intrusive symptoms, 56%; current avoidant symptoms, 56%; current hyperarousal symptoms, 59% IES (cutoff): Current full PTSD, 54.1%; current intrusive symptoms, 45.9%; current avoidant symptoms, 48.6% Lifetime since index offense: 16.3% Current PTSD: 11%
Kruppa (1995) TQS: 4	United States	43 mixed offenders (M age = 34.3, range: 22–64, 75% male)	Maximum security facility for mentally disordered offenders	NR	66 (females)	111	PTSD-I (DSM-III-R)	Violent offense	
Papanastassiou (2004) TQS: 6	United Kingdom	19 killers (M age = 42.6 years, SD = 11.1, 84.2% male)	Medium secure hospital	NR	18-240	NR	CAPS (DSM-IV)	Homicide	Lifetime since index offense: 57.9% full, 21.1% partial Current PTSD: 26.3% full, 15.8% partial

(Continued)

Table 1
(Continued)

First author (year)	Location	Sample	Setting	Ethnicity (%)	M time since offense (months)	M time in prison (months)	PTSD measure	Index trauma	PTSD prevalence
Payne (2008; Sample 1) ^a TQS: 5	United Kingdom	15 killers (M age = 31.4 years, 100% male)	Category B male adult prison	W: 88.5 CH: 3.8, AF: 3.8, P/I: 3.8	range: 6 to > 71	NR	PSDS (DSM-IV)	Homicide	Current full PTSD: 26.7%
Pollock (1999) TQS: 5	United Kingdom	80 killers (age not reported, 100% male)	Regional forensic psychiatric service	NR	28	NR	PTSD-I (DSM-III-R)	Homicide	Current full PTSD: 41.3%
Steiner (1997) ^b TQS: 7	United States	85 mixed offenders (M age = 16.6, SD = 1.2, 100% male)	Young offenders' institutions	W: 30.1 B: 37.6 H: 26.9 O: 5.4	24	13	PTSD-I (DSM-III-R)	Violent offense	Current full PTSD: 5%
Welfare (2015) TQS: 5	United Kingdom	8 killers (range age: 15–17, 100% male)	Young men's prison	NR	NR	> 36	IRI (cutoff score)	Homicide	Lifetime since index offense: 25% intrusion symptoms Current intrusion symptoms, 75%, current rumination, 100%

Note. $k = 11$. All studies used convenience sampling unless otherwise noted. TQS = total quality score (range: 0–9); PTSD = posttraumatic stress disorder; NR = not reported; mixed = killers and violent offenders; AF = African; B = Black; CH = Chinese; H = Hispanic; O = other; P/I = Pakistan/Indian; W = White; CAPS = Clinician-Administered PTSD Scale; DAPS = Detailed Assessment of Posttraumatic Stress; DIS PTSD = DIS/DSM-III diagnosis for PTSD; IES = Impact of Events Scale; IRI = Intrusions and Ruminations Interview; PDS = Posttraumatic Diagnostic Scale; PSDS = Posttraumatic Stress Diagnostic Scale; PSS-I = Posttraumatic Symptom Scale-Interview Version; PTSD-I = PTSD Interview; DSM-III-R = *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., rev); DSM-IV = *DSM* (4th ed.); DSM-IV-TR = *DSM* (4th ed., text rev.).

^aRandom sample. ^bBoth random and convenience sampling.

primarily male. Most of the studies were conducted in the United Kingdom ($k = 7$), although two studies were carried out in China and two were conducted in the United States. Most of the studies used nonprobabilistic sampling methods ($k = 10$), one used mixed methods (Steiner et al., 1997), and one utilized random sampling (Payne et al., 2008).

Overall, the studies' sample sizes ranged from eight (Welfare & Hollin, 2015) to 167 (Chung et al., 2016b) participants, with a mean age of 32.96 years ($SD = 8.23$; range: 16.60–42.60 years). More specifically, most of the studies ($k = 8$) were conducted with adult offender samples, and three used youth offender samples (Evans et al., 2007; Steiner et al., 1997; Welfare & Hollin, 2015). In addition, the average percentage of male participants in the sample was 95.5% ($SD = 8.59$; range: 75%–100%), and the mean percentage of White participants was 33.8% ($SD = 33.88$; range: 0%–88.5%). The average mean time since the offense was 58.06 months ($SD = 35.55$; range: 22.6–126.7 months), and the average mean time since incarceration was 57.41 months ($SD = 36.17$; range: 13–111 months).

The 11 studies used different definitions of PTSD (i.e., measurement instrument used to assess PTSD diagnosis), which were based on at least three variations of psychiatric nosology, from the third edition of the *DSM* (i.e., *DSM-III-R*) through the fourth edition (text rev.; *DSM-IV-TR*). Five studies, including three with adult samples and two with youth samples, used self-report measures to assess PTSD diagnosis, although most of these studies used item scores to apply the *DSM* algorithm. Only two studies used cutoff scores, one of which used an adult sample (Gray et al., 2003), whereas the other used a youth sample (Welfare & Hollin, 2015). The most common self-report measure was the Posttraumatic Diagnostic Scale (PDS; Foa et al., 1997; $k = 2$), which assesses PTSD based on *DSM-IV* criteria (APA, 1994). Six studies used structured interviews to assess PTSD diagnoses ($k = 4$ adult samples, $k = 2$ youth samples), such as the Clinician-Administered PTSD Scale (CAPS; Blake et al., 1995), Detailed Assessment of Posttraumatic Stress (DAPS; Briere, 2001), Posttraumatic Symptom Scale–Interview Version (PSS-I; Foa et al., 1993), Posttraumatic Stress Diagnostic Scale (PDS; Foa, 1995), and PTSD Interview (PTSD-I; Watson et al., 1991). The most common measure overall was the PTSD-I (Watson et al., 199; $k = 3$), which assesses PTSD diagnosis based on *DSM-III-R* criteria (APA, 1987).

Regarding homicide-related PTSD assessment, participants in all studies were instructed to rate the severity of their PTSD symptoms using the offense (i.e., homicide or homicide/violent offense) as the index trauma, except for the study by Welfare and Hollin (2015), which assessed PTSD related to childhood traumatic experiences or homicide. For instance, Crisford et al. (2008) amended their utilized PTSD measure so that instead of prompting patients to respond to questions regarding a “traumatic experience,” it referred to “the offense.” From there, the researchers instructed the participants to complete the PTSD measure with the chosen offense in mind. Gray et al. (2005) asked participants to describe the events surrounding their in-

dex offense, then conducted a semistructured interview focused on the given participant's PTSD symptomatology relating to the offense. Similarly, Pollock (1999) asked a specific question regarding trauma connected to the index offense itself to subjectively appraise the participant and define whether the traumatic event they experienced was offense-related.

Regarding the timeframe of PTSD diagnosis, all of the studies assessed current PTSD diagnoses, although three also assessed lifetime diagnoses since the participants' initial offense-related PTSD diagnosis, two of which used an adult sample (Kruppa et al., 1995; Papanastassiou et al., 2004), and the other a youth sample (Welfare & Hollin, 2015).

Concerning diagnosis type, all studies assessed full PTSD criteria for PTSD related to an offense as the index trauma, except Welfare and Hollin (2015), who assessed PTSD related to a childhood traumatic experience or offense. Only three studies assessed partial PTSD criteria (i.e., subclinical PTSD symptoms), two of which included adult samples (Chung et al., 2016a; Papanastassiou et al., 2004); the other, in which researchers assessed intrusions and rumination symptoms related to committing the index offense, included a youth sample (Welfare & Hollin, 2015).

Finally, most studies analyzed the prevalence of PTSD following a violent crime as reported by homicide perpetrators ($k = 6$; Chung et al., 2016a, 2016b; Papanastassiou et al., 2004; Payne et al., 2008; Pollock, 1999; Welfare & Hollin, 2015), whereas the remaining studies used mixed samples composed of killers and perpetrators of grievous bodily harm to others ($k = 5$; Crisford et al., 2008; Evans et al., 2007; Gray et al., 2003; Kruppa et al., 1995; Steiner et al., 1997).

Prevalence of Offense-Related PTSD

We conducted separate meta-analyses for the studies' effect sizes, taking into account sample type, offender type, diagnosis timeframe, and diagnosis type.

Prevalence Rates of Offense-Related PTSD Among Adult Convicted Offenders

Figure 2 displays the forest plot for the meta-analysis of the pooled prevalence of PTSD among convicted adults by offender type (i.e., killers vs. mixed offenders) according to the criteria for current and full PTSD. As shown, the prevalence of current and full-criteria homicide-related PTSD for adult killers ranged from 26.3% to 44.9% per study, with a pooled prevalence of 42.6%, 95% CI [38.0%, 47.4%] ($k = 5$). For mixed offenders (i.e., killers and other violent offenders), the prevalence of offense-related PTSD ranged from 11.6% to 54.1% per study, with a pooled prevalence of 33.1%, 95% CI [14.1%, 59.8%] ($k = 3$). Thus, PTSD prevalence was higher for killers than for mixed offenders, although this difference did not reach statistical significance given the overlapping confidence intervals for the pooled prevalence. In addition, the heterogeneity among the PTSD prevalence rates was low for killers, $Q_4 = 4.01$, $p = .405$, $I^2 = 19.5\%$, and high for mixed offenders,

Figure 2
Forest Plot of the Prevalence of Current Full-Criteria Posttraumatic Stress Disorder Following Offense, by Offender Type

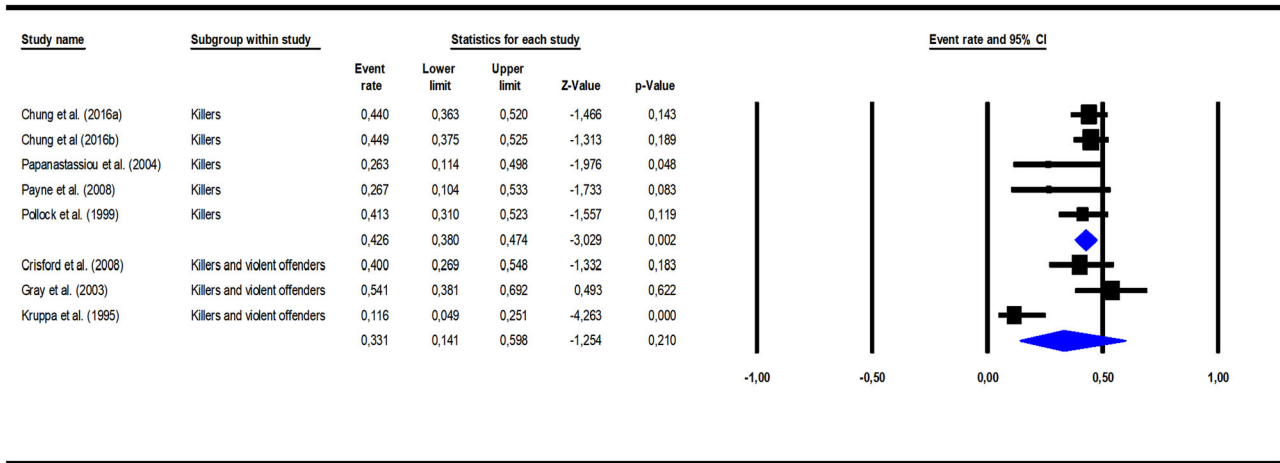
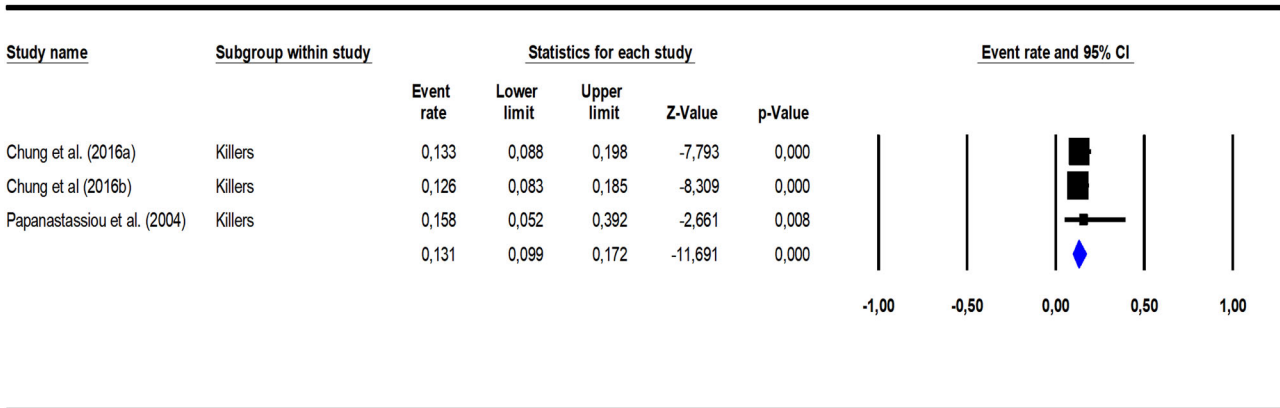


Figure 3
Forest Plot of the Prevalence of Current Partial-Criteria Posttraumatic Stress Disorder Following Homicide Among Killers



$Q_2 = 14.44, p = .001, I^2 = 86.2\%$. No data were reported on the prevalence of lifetime PTSD since the offense, except one study that used a sample of killers, nor were data reported in studies with a sample of mixed offenders; as such, these analyses could not be performed.

Figure 3 shows the forest plot for the meta-analysis of the pooled prevalence of PTSD among adult killers according to the criteria for current and partial PTSD. Per this figure, for adult killers, the prevalence rate of current and partial-criteria homicide-related PTSD ranged from 12.6% to 15.8.6%, with a pooled prevalence of 13.1%, 95% CI [9.9%, 17.2%] ($k = 3$). There was no heterogeneity among the PTSD prevalence rates, $Q_2 = 0.17, p = .920, I^2 = 0\%$, and no data for mixed offenders were reported in the analyzed studies.

Prevalence Rates of Offense-Related PTSD among Youth Convicted Offenders

Among youth mixed offenders, the prevalence of full-criteria offense-related PTSD ranged from 4.7% (Steiner et al., 1997) to 5.7% (Evans et al., 2007), with a pooled prevalence of 5.3%,

95% CI [2.9%, 9.5%] ($k = 2$). There was no heterogeneity among these PTSD prevalence rates, $Q_1 = 0.10, p = .757, I^2 = 0\%$. In addition, the prevalence of rumination symptoms ranged from 36% (Evans et al., 2007) to 100% (Welfare & Hollin, 2015), with a pooled prevalence of 69.6%, 95% CI [7.9%, 98.4%] ($k = 2$). The heterogeneity among the rumination symptoms' prevalence rates was large, $Q_1 = 5.36, p = .021, I^2 = 81.3\%$. Current intrusion symptoms ranged from 75% (Welfare & Hollin, 2015) to 43.8% (Evans et al., 2007), with a pooled prevalence of 54.8%, 95% CI [26.0%, 80.7%] ($k = 2$). There was moderate heterogeneity among these prevalence rates, $Q_1 = 2.57, p = .109, I^2 = 61.2\%$.

Discussion

The present meta-analysis examined the prevalence of PTSD following homicide and was the first study, to our knowledge, to use such a method to examine this rate. The results of the meta-analysis indicate that 42.6% of incarcerated adult killers met the criteria for a full PTSD diagnosis after committing homicide,

whereas 13.3% developed PTSD symptomatology after committing homicide (i.e., subclinical PTSD). Moreover, 33.1% of convicted adult mixed offenders met the full PTSD criteria after committing an offense. These findings suggest that an appreciable proportion of homicide perpetrators and violent offenders develop PTSD following an offense, and some also reexperience aspects of the crime with symptoms of PTSD (i.e., partially meet the PTSD criteria).

It is noteworthy that it is likely for killers and violent offenders to have high rates of exposure to multiple traumatic experiences apart from their own offenses during their lifetime (Terne et al., 2020). Indeed, research has shown that cumulative exposure to different types of traumatic events may increase the likelihood of PTSD development (Briere et al., 2016). As such, a history of exposure to traumatic events might contribute to the high prevalence of PTSD in the assessed samples. Nevertheless, as Ternes et al. (2020) pointed out, prior trauma exposure might cause a habituation response, thus decreasing the likelihood of developing PTSD symptoms, and should be taken into consideration. Extant studies have also found offenders who did not experience adverse childhood events to be more likely to develop PTSD symptomatology in reaction to their violent offenses as compared to offenders who did experience these events (Papanastassiou et al., 2004; Pollock, 1999). Therefore, future research should clarify the link between traumatic event history and emotional reactions to subsequent trauma exposure.

Another interesting result from the present study indicated that adult killers had higher offense-related (i.e., homicide) PTSD prevalence rates (42.6%) than other violent offenders (33.1%), although this difference did not reach statistical significance. As Pollock (1999) suggested, it is possible that the gravity of the offense might affect the rates of PTSD among different offenders. As such, the consequences of the crimes committed by homicide perpetrators are much more serious than the nonfatal injurious offenses committed by others, which might explain the different PTSD prevalence rates between killers and violent offenders. However, for both types of offenders, there was a considerable proportion of individuals who developed PTSD following their offense. These findings suggest that killing or committing a violent crime against another person might be experienced as a traumatic event for the perpetrator, which meets *DSM* Criterion A for a PTSD diagnosis (APA, 2013).

Regarding PTSD following an offense in young offenders, including both killers and violent offenders, the results showed a pooled prevalence of full-criteria PTSD of 5.3%. This prevalence rate was lower than the pooled prevalence rate found among adult perpetrators (38.5%), which might be due to the two groups' different exposure levels to various types of traumatic events. As mentioned earlier, cumulative exposure to different types of traumatic events may increase the likelihood an individual will develop PTSD (Briere et al., 2016). Accordingly, it is likely that adult offenders have been exposed to more traumatic events than young offenders, explaining their higher prevalence of full-criteria PTSD.

Finally, significant heterogeneity existed among the PTSD prevalence rates of studies with mixed offender samples. This variability might be explained by the samples' different compositions (i.e., killers and violent offenders) and the studies' use of different measures to assess PTSD diagnoses (i.e., different self-report measures and structured interviews), which were based on at least three variations of psychiatric nosology, from *DSM-III-R* through *DSM-IV-TR*. However, the heterogeneity of the homicide-related PTSD prevalence rates for the studies with samples of killers was low. In the same way, the PTSD prevalence rates of young violent offenders were homogenous across the studies. These findings suggest that the extent of PTSD among homicide perpetrators and young violent offenders does not vary drastically, despite cultural differences between countries (i.e., China, the United Kingdom, and the United States; cf. Di et al., 2017), different measures for assessing PTSD (i.e., self-report measures vs. structured interviews), and different modes of applying self-report measures (cutoff scores or the *DSM* algorithm).

Several of this study's limitations should be acknowledged. The first limitation relates to the small number of studies included in the meta-analysis; with the stringent selection criteria, only 11 studies were analyzed. Given this small number, the results represent only an initial step toward determining the prevalence of homicide-related PTSD, and it was not possible to use moderator analyses to study any theoretical explanations for the studies' heterogeneous results. It would have been interesting and informative to explore the interactions between the studies' characteristics (e.g., gender, ethnicity, time since offense, time since incarceration) and the prevalence rates of PTSD symptoms, but the sample size was too small to support such complex analyses.

The second limitation is that most of the studies included in this meta-analysis were carried out in the United Kingdom using convenience samples from prisons, predominantly with White male participants, which limits the findings' generalizability to other contexts. This indicates that the study of the prevalence of PTSD among offenders after committing violent crimes is in its infancy. There remains a need to conduct more research on this phenomenon in other societies, cultures, and social contexts to test possible differences caused by these factors.

Another limitation concerns the measures that the studies used to diagnose PTSD. Different measures based on at least three variations of psychiatric nosology, from *DSM-III-R* (APA, 1987) through *DSM-IV-TR* (APA, 2000), were used, which might have affected the estimated homicide-related PTSD prevalence rate. Moreover, none of the studies used a measure based on the most recent (i.e., *DSM-5*) criteria (APA, 2013), although *DSM-5* has modified the criteria for PTSD diagnosis. Such changes include the modification of Criterion A (i.e., exposure to a traumatic event) to restrict its inclusiveness and the elimination of the subjective component in the definition of trauma—that is, the subjective personal response of “intense fear, horror, or helplessness” that had been added to

Criterion A in the *DSM-IV*. Per the *DSM-5*, trauma exposure is now rather objectively defined. In particular, the definition of trauma requires “actual or threatened death, serious injury, or sexual violence” but not a personal response of fear, horror, or helplessness at the time of the event. These changes might affect PTSD prevalence, and, as mentioned earlier, the estimated prevalence rates of PTSD following homicide using *DSM-IV*, *DSM-IV-TR*, and *DSM-5* criteria might differ. For instance, Elhai et al. (2012) featured a convenience sample of college students who completed a survey based on exposure to *DSM-IV* Criterion A1 and *DSM-5* Criterion A traumatic events as well as past-month PTSD symptom intensity ratings related to their only or most distressing traumatic event. The researchers used the PSS-I to assess these results and found that past-month PTSD prevalence was higher using *DSM-5* versus *DSM-IV* criteria, although this difference was not statistically significant; similar findings were reported by Calhoun et al. (2012), who used the CAPS. In contrast, in a national sample of U.S. adults recruited from an online panel, Kilpatrick et al. (2013) used the National Stressful Events Survey (Kilpatrick et al., 2011) to assess for exposure to *DSM-IV* and *DSM-5* Criterion A events and PTSD symptoms and distress or functional impairment associated with PTSD symptoms. The authors concluded that the estimated U.S.-based population prevalence of *DSM-5* PTSD was statistically significantly lower than the prevalence of *DSM-IV* PTSD. Therefore, it is unclear how the modifications to the *DSM-5* criteria may affect PTSD prevalence following a homicide. Consequently, future studies should address this issue within samples that permit generalization to convicted homicide perpetrators.

In addition, different PTSD measures can assess the disorder by using either cutoff scores or item scores to apply the *DSM* algorithm. These different approaches can produce different PTSD prevalence rates. However, given that most of the studies in this meta-analysis assessed PTSD using item scores to apply the *DSM* algorithm and only two studies used cutoff scores—one of which used an adult sample (Gray et al., 2003) and the other a youth sample (Welfare & Hollin, 2015)—it was not possible to analyze this source of variation.

Despite these limitations, several of this study’s strengths should be observed. The study followed a meta-analytic approach to study the prevalence of PTSD following violent crimes, pooling estimates across a range of studies. It also included international studies and thus was not country-specific, which strengthens its external validity. In addition, this study represents the first meta-analysis of the prevalence of PTSD following violent crimes, providing a more accurate view of this phenomenon, the previously noted limitations notwithstanding. Specifically, the current findings provide further evidence that PTSD has a high prevalence rate among convicted prisoners as a consequence of their offense, which has implications for how these individuals are managed within the prison system. A better understanding of the extent of this problem can inform the development of effective interventions.

Given that they are aimed at correcting criminal thinking rather than treating clinical diagnose, rehabilitation programs for inmate offenders are driven by a risk assessment that measures factors associated with reoffending (Miller & Najavits, 2012). However, it is important to recognize PTSD symptoms in perpetrators following their offenses, as recognition and subsequent treatment may aid their long-term prognosis and rehabilitation (Kruppa 1991; Messina et al., 2014; Miller & Najavits, 2012; Ternes et al., 2020), which is important not only for the offenders but also for the safety of society as a whole (Gray et al., 2003). A prevalent component of PTSD is the avoidance of stimuli linked to the traumatic event, although such avoidance can hinder progress during rehabilitation in offenders (Papanastassiou et al., 2004). As Ternes et al. (2020) noted, “Offenders who wish to avoid thinking about their offense because it was a traumatic experience may not fare well in traditional correctional treatment programs” (p. 80). Consequently, the development of services for the assessment and treatment of traumatized offenders should be given serious and urgent consideration. In this sense, trauma-specific interventions may be effective in reducing PTSD symptoms in offenders and increasing prosocial coping skills (e.g., Messina et al., 2014; Miller & Najavits, 2012). Another important component of PTSD is intrusive symptomatology, which is resistant to change (Evans et al., 2007). In this case, psychological interventions are paramount (Welfare & Hollin, 2015), particularly as some research has suggested that having PTSD increases suicide risk among prisoners (Blaauw et al., 2002).

Open Practices Statement

Neither of the studies reported in this article was formally preregistered. Neither the data nor the materials have been made available on a permanent third-party archive; requests for the data or materials should be sent via email to the corresponding author.

Asterisks denote references that were included in the systematic review and meta-analysis.

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