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Are trauma-related beliefs associated with psychosis symptoms? A systematic review and meta-analysis

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Review Article

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Abstract

Trauma-related beliefs are theorized to contribute to the development and maintenance of psychosis symptoms. However, the evidence for this proposal has yet to be systematically reviewed. This article is the first to synthesize and meta-analyze studies examining associations between trauma-related beliefs and psychosis symptoms, including hallucinations, delusions, paranoia, and negative symptoms. A systematic database search of Medline, PsychINFO, Embase, Web of Science, CINHAL, and Cochrane identified a total of 15 articles that met the inclusion criteria for systematic review and 11 articles which met the inclusion criteria for meta-analysis. Separate random-effects meta-analyses were conducted for each psychosis symptom. Meta-analytic findings demonstrated a small to moderate association between trauma-related beliefs and hallucination severity ($k = 7$, $r = 0.25$, 95% CI 0.10–0.39), a moderate to large association with delusion severity ($k = 8$, $r = 0.43$, 95% CI 0.31–0.54), and large association with paranoia severity ($k = 4$, $r = 0.58$, 95% CI 0.49–0.66). Narrative synthesis findings indicate that evidence for an association between negative symptoms and trauma-related beliefs was inconclusive. The meta-analytic findings provide support for an association between trauma-related beliefs and positive psychosis symptoms. This provides evidence suggesting trauma therapies for psychosis that target these beliefs may improve distressing psychosis. However, further research adopting longitudinal designs and controlling for confounders is required to better establish causality, including mediation analysis of therapy trials.

Introduction

Research indicates that traumatic life events play a causal role across the psychosis continuum, including the general population, ultra-high risk, and psychosis diagnoses (Arseneault et al., 2011; Kelleher et al., 2013; Kraan, Velthorst, Smit, de Haan, & van der Gaag, 2015; McGrath et al., 2017; Varese et al., 2012). Higher rates of post-traumatic stress disorder (PTSD) and subclinical PTSD symptoms are also found in people with psychosis diagnoses compared to the general population, and voices and paranoia are associated with PTSD severity and diagnosis (Alameda et al., 2020; Bloomfield et al., 2021; Brewin & Patel, 2010; de Bont et al., 2015; Freeman et al., 2013). A history of trauma is associated with poorer treatment outcomes and symptom persistence among those with a psychosis diagnosis (Hassan & De Luca, 2015; Thomas, Höfler, Schäfer, & Trautmann, 2019; Trotta, Murray, & Fisher, 2015). Further research is required to understand the trauma-related psychological mechanisms which may contribute to the development and maintenance of psychosis (Schäfer & Fisher, 2011). An increased understanding of the trauma-related mechanisms implicated in this relationship may support improved assessment, treatment, and clinical outcomes for individuals across the psychosis continuum (Hardy, van de Giessen, & van den Berg, 2020; Heriot-Maitland, Wykes, & Peters, 2021). This review will specifically focus on the role of negative trauma-related beliefs (also known as appraisals or cognitions) which reflect the meaning(s) an individual ascribes to trauamatic event(s), and can contribute to the development of trauma-related mental health problems (Ehlers & Clark, 2000).

Seminal cognitive behavioral models of psychosis propose that the etiology of psychosis is multifactorial, involving an interaction between biological, psychological, and social factors (Freeman, Garety, Kuipers, Fowler, & Bebbington, 2002; Garety, Kuipers, Fowler, Freeman, & Bebbington, 2001; Morrison, 2001). The triggering of a biopsychosocial vulnerability is theorized to give rise to sensory-perceptual intrusions, with the meaning ascribed to intrusions resulting in delusions and hallucinations, leading to coping responses which may paradoxically maintain intrusions and their appraisals (Freeman et al., 2002; Garety et al., 2001; Morrison, 2001). PTSD symptoms (e.g. negative beliefs [also referred to as appraisals of cognitions] about the self and others, avoidance, hyperarousal and re-experiencing) are hypothesized to play a

role in the development and maintenance of psychosis (Berry & Bucci, 2016; Hardy, 2017; Longden, Madill, & Waterman, 2012; Morrison, Frame, & Larkin, 2003). Trauma-related beliefs about the self, others, and the world (e.g. 'I'm bad and others will harm me') are proposed to play a role in psychosis by influencing the content (e.g. hearing a voice saying 'you're nothing and I'm going to get you') and appraisals (e.g. 'I'm being persecuted') of unusual or anomalous experiences (Garety et al., 2001; Morrison, 2001). Trauma-related beliefs are also likely to interact with emotional regulation and memory processes to further influence the occurrence and maintenance of psychosis symptoms (Hardy, 2017). For example, a belief that 'the world is dangerous' may lead to increased hypervigilance, which exacerbates the likelihood of interpreting ambiguous stimuli as threatening, or alterntively, a belief that 'it was my fault' may reinforce shame-laden trauma memories, which could intrude as derrogatory voices.

Systematic reviews and meta-analyses provide evidence to support the hypothesized role of negative beliefs (about the self, others, and the world) in psychosis, alongside emotion regulation difficulties, dissociation, attachment, and other PTSD symptoms (Alameda et al., 2020; Bloomfield et al., 2021; Humphrey, Bucci, Varese, Degnan, & Berry, 2021; Sideli et al., 2020; Williams, Bucci, Berry, & Varese, 2018). However, the reviews conducted to date are limited as they evaluate studies that measure negative schemas in general and do not focus specifically on the role of trauma-related beliefs. This limits the causal inferences that can be drawn, as it is not possible to establish if the beliefs reported are specifically linked to the meaning attributed to traumatic experiences. To the best of the researcher's knowledge, research investigating the relationship between trauma-related beliefs and psychosis symptoms has not been systematically reviewed nor the strength of the association evaluated. In contrast, evidence concerning trauma-related beliefs has been examined in relation to PTSD (Ehlers & Clark, 2000; Foa, Ehlers, Clark, Tolin, & Orsillo, 1999). Meta-analyses have found a significant, large association between trauma-related beliefs and PTSD in both adult and child samples (de La Cuesta, Schweizer, Diehle, Young, & Meiser-Stedman, 2019; Mitchell, Brennan, Curran, Hanna, & Dyer, 2017). Moreover, meta-analyses indicate that changes in trauma-related beliefs appear to be a mechanism of change in trauma-focused therapies for PTSD (Cooper, Zoellner, Roy-Byrne, Mavissakalian, & Feeny, 2017; Scher, Suvak, & Resick, 2017).

It is proposed that a review of research investigating trauma-related beliefs and psychosis symptoms is required to evaluate theoretical models and improve therapeutic interventions. The aim of the present review is to systematically examine the literature regarding the relationship between trauma-related beliefs and psychosis symptoms, including delusions, hallucinations, paranoia, and negative symptoms. The review will employ meta-analytic techniques to quantify the magnitude of the association between trauma-related beliefs and specific psychosis symptoms respectively.

Method

Literature search

PROSPERO was examined to identify reviews with an overlapping research question, none were identified. The review was registered on the PROSPERO database (registration no. CRD42022306118). Relevant studies were identified through a systematic search of the databases Medline, PsychINFO, Embase, Web of Science, CINAHL, and Cochrane. Search terms were developed based on an initial scoping review of the research literature, then reviewed by two subject librarians. To ensure a comprehensive search strategy, a range of search terms pertaining to psychosis and trauma-related beliefs were used as heading or key word searches (for search terms see supplementary materials). No date restrictions or search limits were used. The database search results were collated in an Endnote library and duplicates were removed. The results were then exported to the systematic review web application Rayyan for title and abstract and full-text screening conducted by the first author (R. F.). The initial search was conducted in March 2022 and updated in August 2023. To assess reliability of the selection process, 10% of abstracts and 10% of full-text articles were screened by a second rater (O. C.).

Inclusion criteria

The review followed the flow of information as suggested by the PRISMA statement (Page et al., 2021). Studies were included if they; (i) used a quantitative or mixed methodology design; (ii) used a validated quantitative measure for psychosis symptoms; (iii) used a validated quantitative measure for trauma-related cognitions; (iv) were published in a peer-review journal; and (v) were written in English. Adult and adolescent samples (≥13 years) were included as well as clinical and non-clinical samples to capture individuals with subclinical psychosis as well as individuals along the psychosis continuum. Studies were included regardless of whether the primary focus of the paper was examining the association between psychosis symptoms and trauma-related beliefs.

Exclusion criteria

Studies were excluded if they; (i) were book chapters, conference abstracts, dissertations, qualitative studies, case studies, commentaries, editorials, or reviews; (ii) studies with participants < 13 years; and (iii) insufficient statistical information or authors did not respond to request for data.

Quality assessment

Studies were assessed using an adapted version of the Quality Assessment Tool for Quantitative studies (Thomas, Ciliska, Dobbins, & Micucci, 2004; for adapted rating scale and scoring dictionary see supplementary material). The measure was adapted to be consistent with the aim of the present review; therefore, sections C, D, and G were removed as these are only relevant for reviews of randomized control trials. The tool included six components (rated weak, moderate, strong); (1) selection bias; (2) study design; (3) data collection tool psychosis symptoms; (4) data collection tool trauma-related beliefs; (5) withdrawals and drop-outs; and (6) analysis. Global ratings were calculated for each study; weak (two or more weak ratings), moderate (one weak rating), or strong (no weak rating). All studies were rated by R. F. and a proportion of the studies (20%) were rated by a second-rater (O. C.).

Data extraction

Data extracted from each study included; study details (author, year, country, study design, sample); demographics (age, sex,

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ethnicity); trauma-related cognitions measure; psychosis symptom measure; key findings regarding the association between trauma-related cognitions and psychosis symptoms (see Table 1).

Data analysis

Separate meta-analyses were conducted to examine the relationship between trauma-related cognitions and severity of each psychosis symptom. A meta-analysis was conducted if four or more studies reported the unadjusted association between trauma-related beliefs and the specific psychosis symptom – this threshold was set by the authors during pre-registration. For the meta-analyses, Pearson's r was chosen as this was a commonly reported effect size measure across studies. If Pearson's r was not reported, authors were contacted for further information. Seven authors provided additional data and one author could not be reached (see supplementary material). Reporting multiple effect sizes for the same study would violate the assumption of independence required to conduct a meta-analysis (Borenstein, Hedges, Higgins, & Rothstein, 2010). If studies used the same dataset, only one study was included in the meta-analysis. If effect sizes were provided for more than one time point, the first time point (i.e. baseline data) was included. If multiple correlations were reported for different subscales of the same measure rather than a composite score, and authors did not provide the data requested, these associations were combined for use in the meta-analysis (for scores reflecting aggregated mean please see Table 1). In studies where multiple measures were utilized for the same psychosis symptom (e.g. hallucinations), the measure used for the analysis is indicated in Table 1. The measure selected was based on the most frequently measured psychosis symptom or domain (e.g. auditory as opposed to visual hallucinations) across other studies included in the review.

The meta-analyses were conducted in Rstudio using the metafor package in R (Viechtbauer, 2010). There was expected to be considerable methodological and clinical heterogeneity across studies, so random-effects models were used (Borenstein et al., 2010). The effect sizes were converted to Fisher's z scores to minimize the risk of bias associated with Pearson's r, then converted back to Pearson's r to provide a summary correlation (Borenstein et al., 2010). Cohen's guidelines (Cohen, 1988) for effect sizes were applied; small ($r = 0.10$), moderate ($r = 0.30$), and large ($r = 0.50$). Heterogeneity across studies was assessed via Q and I^2 statistics; heterogeneity is indicated by a statistically significant Q test or by a higher I^2 statistic. I^2 higher than 25, 50, 75% may be interpreted as representing low, moderate, or high level of heterogeneity, respectively (Higgins, Thompson, Deeks, & Altman, 2003). Funnel plots were inspected for possible asymmetry which may indicate risk of publication bias as indicated by a significant Egger's test statistic (Egger, Davey Smith, Schneider, & Minder, 1997). 'One study removed analyses' were completed to consider if any of the studies had a substantial influence on the results.

Results

Search results

The literature search and the study selection process are illustrated in Fig. 1. Fifteen studies met the systematic review inclusion criteria. Eleven studies were included in the meta-analyses (see Table 1). Two studies drew participants from the Treating Trauma in Psychosis (T.TIP) trial (van den Berg et al., 2015; van der Vleugel et al., 2020). In addition, Geddes, Ehlers, and Freeman (2016) drew participants from the same local population as Freeman et al. (2013). One study included a sexual assault sample and a control sample (Kilcommons, Morrison, Knight, & Lobban, 2008), but findings regarding the association between trauma-related beliefs and psychosis symptoms were only measured and reported in relation to the sexual assault sample, therefore, the control group has not been included in this summary of study characteristics or in the review. Inter-rater reliability showed perfect levels of agreement for title and abstract screening (100% inter-rater reliability) and almost perfect levels for full-text eligibility (kappa = 0.82, $p < 0.001$; McHugh, 2012).

Study characteristics

A summary of each study can be found in Table 1. The identified studies included 1309 unique participants; 53.1% were female, age ranged from 14 to 89 years, with a mean of 36.69 years. Studies were conducted across five different countries, most commonly in the United Kingdom. Nine studies reported ethnicity, two of which drew from the same sample; 54.9% Caucasian, 28.9% Black, 1.5% Asian, 9.2% mixed/other ethnicity, 5.5% not specified or recorded as missing. Ten studies were conducted using clinical samples and five with non-clinical samples. Nine studies included participants with severe mental illness (psychotic disorder, major affective disorder, and/or personality disorder). Three study samples were characterized by a shared traumatic experience (sexual assault, physical assault, or combat) and two characterized by student populations.

Study quality

The global quality appraisal scores can be found in Table 1 (for domain-specific quality ratings please see supplementary material). Most studies received a 'weak' or 'moderate' quality rating. Only one study received a 'strong' quality rating. Studies generally scored lower on selection bias as a participation rate of less than 60% was reported or participants self-referred to the study. Most studies also scored lower due to being cross-sectional in nature. Inter-rater reliability for global quality appraisal score was 100%.

Meta-analysis

Hallucinations

Nine studies investigated the relationship between hallucinations and trauma-related beliefs: including seven Pearson's r correlations for meta-analysis ($n = 740$). The meta-analysis showed a small to moderate significant positive association between hallucination severity and trauma-related beliefs ($r = 0.25$, 95% CI 0.10–0.39, $z = 3.27$, $p < 0.001$; see Fig. 2). Heterogeneity was in the moderate range ($Q = 17.63$, df = 6, $p = 0.007$, $I^2 = 66.8$). Visual inspection of the funnel plot showed publication bias to be unlikely. This was confirmed by Egger's test which found no evidence of publication bias ($p = 0.93$). One study removed analysis revealed that no study had substantial influence on the results.

Delusions

Nine studies investigated the relationship between delusions and trauma-related beliefs: including eight Pearson's r correlations for meta-analysis ($n = 484$). The meta-analysis showed a moderate

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Table 1. Summary of studies

Author (year); country	Design	Sample characteristics	Trauma-related beliefs measure	Psychosis measure(s)	Main findings	Quality rating
Brand et al. (2021); Australia[a]	Cross-sectional	15 treatment-seeking individuals with auditory hallucinations, 60% female (M = 43.79 years, s.d. = 8.64)	PTCI	PSYRATS – AHS PSYRATS – DS	PSYRATS-AHS: r = 0.25, p = 0.64 PSYRATS-DS: r = –0.13, p = 0.68	Weak
Calvert and Larkin (2008); UK[a]	Cross-sectional	34 forensic inpatients with a diagnosis of schizophrenia, 11.76% female (M = 35 years, s.d. = 11.06)	PTCI	PDI PS	PDI: r = 0.50, p < 0.01 PS: r = 0.54, p < 0.01	Weak
Campbell and Morrison (2007a); UK[a]	Cross-sectional	373 school students, 56.3% female (M = 14.8 years, s.d. = 0.7)	PTCI[b]	PS rLHS – auditory subscale	PS: self (r = 0.62, p < 0.01), world (r = 0.64, p < 0.01), blame (r = 0.46, p < 0.01) rLHS; self (r = 0.36, p < 0.01), world (r = 0.33, p < 0.01), blame (r = 0.25, p < 0.01)	Weak
Campbell and Morrison (2007b); UK[a]	Cross-sectional	41 British veterans, 2.4% female (M = 66.3 years, s.d. = 17.3)	PTCI[b]	PDI – no. of beliefs	PTCI self (r = 0.73, p < 0.01), world (r = 0.66, p < 0.01), blame (r = 0.59, p < 0.01)	Moderate
Freeman et al. (2013); UK[a]	Longitudinal	106 individuals attending A&E following a physical assault, 25.47% female (M = 34.4 years, s.d. = 11.6)	PTCI	GPTS PSYRATS – DS	GPTS: r = 0.69, p < 0.001 PSYRATS – DS: r = 0.43, p = 0.08	Moderate
Geddes et al. (2016); UK[c]	Longitudinal	106 individuals attending A&E following a physical assault, 25.47% female (M = 34.4 years, s.d. = 11.6)	PTCI	PANSS – hallucinatory behavior item CAPS	PTCI a significant predictor of CAPS and PANSS hallucination item at baseline	Moderate
Kilcommons and Morrison (2005); UK[a]	Cross-sectional	32 service users with a schizophrenia spectrum disorder diagnosis, 21.88% female (M = 34.5 years, s.d. = 9.96)	PTCI[b]	PANSS – hallucination and delusion items	Hallucinations: self (r = 0.52, p < 0.01), world (r = 0.39, p < 0.05), blame (r = 0.25, p > 0.05) Delusions: Self (r = 0.22, p > 0.05), world (r = 0.25, p > 0.05), blame (r = 0.25, p > 0.05)	Moderate
Kilcommons et al. (2008); UK[a]	Cross-sectional	40 sexual assault survivors, 87.5% female, (M = 28.72 years, s.d. = 10.53)	PTCI[b]	PDI rLHS – visual and auditory subscales PSYRATS –- AHS[d] PSYRATS – adapted for visual hallucinations	PDI; self (r = 0.41, p < 0.01), world (r = 0.40, p < 0.01), blame (r = 0.38, p < 0.05). rLHS auditory; self (r = 0.27, p > 0.05), world (r = 0.54, p < 0.01), blame (r = 0.15, p > 0.05) rLHS visual; self (r = 0.13, p > 0.05), world (r = 0.07, p > 0.05), blame (r = 0.12, p > 0.05). PSYRATS-AHS: self (r = 0.27, p > 0.05), world (r = 0.54, p < 0.05), blame	Moderate

(*Continued*)

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Table 1. (*Continued.*)

Author (year); country	Design	Sample characteristics	Trauma-related beliefs measure	Psychosis measure(s)	Main findings	Quality rating
					($r = 0.15$, $p > 0.05$). PSYRATS-VS: self ($r = 0.13$, $p > 0.05$), world ($r = 0.07$, $p > 0.05$), ($r = 0.12$, $p > 0.05$)	
Mazor et al. (2020); Israel	Cross-sectional	121 service users with severe mental illness, 53.7% female ($M = 43.8$ years, S.D. = 11.8)	CBI	PANSS – negative symptoms	$r = -0.51$, $p < 0.001$	Moderate
Morrison and Petersen (2003); UK[a]	Cross-sectional	64 undergraduate students, 87.5% female ($M = 21.1$ years, S.D. = 6.9)	PTCI	rLHS – auditory subscale[d] rLHS – visual subscale	rLHS auditory: ($r = 0.14$, $p > 0.05$) rLHS visual: ($r = 0.24$. $p < 0.05$)	Weak
Mueser et al. (2015); USA	Cross-sectional	201 individuals with severe mental illness and PTSD, 72.25% female; control group ($M = 44.52$ years, S.D. = 11.60), CBT group ($M = 42.96$ years, S.D. = 10.46)	PTCI	PANSS – negative symptom subscale	$r = 0.247$, $p < 0.001$	Moderate
Peach et al. (2019); Australia	Cross-sectional	66 individuals with first episode psychosis, 54.5% female, ($M = 20.18$ years, S.D. = 2.69)	PTCI	PANSS – hallucination and delusion severity items PANSS – negative symptom subscale	Delusion severity: (Spearman's rho = 0.48, $p < 0.01$) Hallucination severity: (Spearman's rho = 0.36, $p < 0.01$) Negative symptoms: (Spearman's rho = 0.18, $p = 0.138$)	Moderate
Steel et al. (2017); UK[a]	Cross-sectional	61 individuals with a schizophrenia diagnosis and PTSD, 37.7% female ($M = 42.3$ years, S.D. = 10.2)	PTCI	PSYRATS – AHS PSYRATS – DS PANSS – negative symptom scale	PSYRATS-AHS: $r = 0.53$, $p < 0.01$ PSYRATS-DS: $r = 0.58$, $p < 0.01$ PANSS negative: $r = 0.30$, $p = 0.05$	Moderate
van den Berg et al. (2015); Netherlands[a]	Cross-sectional	155 individuals with a lifetime psychotic disorder and PTSD, 54.2% female, ($M = 41.2$ years, S.D. = 10.5)	PTCI	PSYRATS – AHS PSYRATS – DS	PSYRATS-AHS: $r = 0.02$, $p = 0.798$ PSYRATS-DS: $r = 0.29$, $p < 0.01$	Moderate
van der Vleugel et al. (2020); Netherlands[a,c]	Longitudinal	155 individuals with a lifetime psychotic disorder and PTSD, 54.2% female, ($M = 41.2$ years, S.D. = 10.5)	PTCI	GPTS	GPTS: $r = 0.50$, $p < 0.01$	Strong

PTCI, Posttraumatic Cognitions Inventory; CBI, Core Beliefs Inventory; PSYRATS-AHS, Psychotic Symptoms Rating Scale – auditory hallucinations scale; PSYRATS-DS, Psychotic Symptoms Rating Scale – delusions scale; PDI, Peterson Delusion Inventory; PS, Paranoia Scale; rLHS, Launay-Slade Hallucination Scale-revised; GPTS, Green Paranoia Thought Scale; CAPS, Cardiff Anomalous Perceptions Scale; PANSS, Positive and Negative Syndrome Scale.
[a]Study included in meta-analysis.
[b]No composite PTCI score available – mean of subscale associations extracted for meta-analysis.
[c]Uses secondary data (please see method section).
[d]Indicates measure selected for meta-analysis when more than one measure was used to assess the same psychosis symptom.

to large significant, positive association between delusion severity and trauma-related beliefs ($r = 0.43$, 95% CI 0.31–0.54, $z = 6.42$, $p < 0.001$; see Fig. 3). Heterogeneity was in the moderate range ($Q = 15.05$, df = 7, $p = 0.040$, $I^2 = 49.45$). Visual inspection of the funnel plot showed publication bias to be unlikely. This was confirmed by Egger's test which found no evidence of publication bias ($p = 0.47$). One study removed analysis revealed that no study had substantial influence on the results.

Paranoia

Four studies investigated the relationship between paranoia and trauma-related beliefs and Pearson's r correlations were available for the four studies ($n = 668$). The meta-analysis showed a significant large, positive association between paranoia and trauma-related beliefs ($r = 0.58$, 95% CI 0.49–0.66, $z = 10.27$, $p < 0.001$; see Fig. 4). Heterogeneity was in the moderate range ($Q = 5.63$, df = 3, $p = 0.131$, $I^2 = 51.72$). Visual inspection of the

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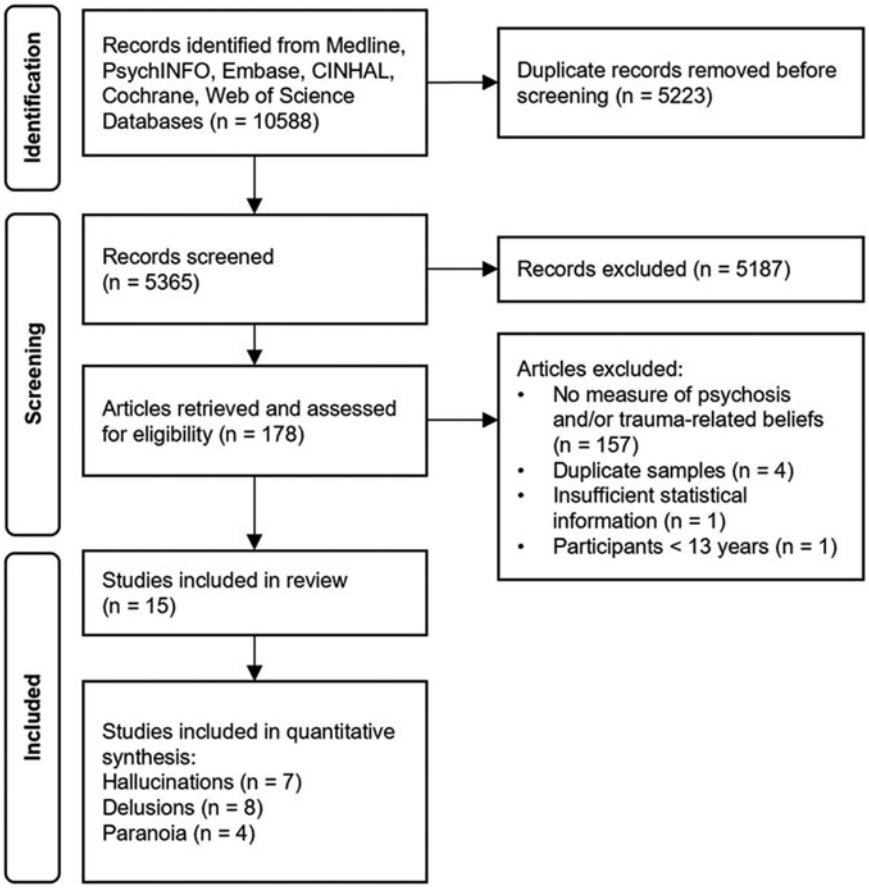

Figure 1. PRISMA flow diagram.

funnel plot showed publication bias to be unlikely. This was confirmed by Egger's test which found no evidence of publication bias ($p = 0.95$). One study removed analysis revealed that no study had substantial influence on the results.

Negative symptoms and trauma-related beliefs

Data from four studies were available regarding the association between negative symptoms and trauma-related beliefs (Mazor, Gelkopf, & Roe, 2020; Mueser et al., 2015; Peach, Alvarez-Jimenez, Cropper, Sun, & Bendall, 2019; Steel et al., 2017). Only three studies included Pearson's *r* correlation coefficient; therefore, a meta-analysis was not conducted as the number of studies was below the threshold set at pre-registration. All studies were conducted amongst clinical samples. Evidence concerning the association between negative symptoms and trauma-related beliefs was mixed. A significant association between trauma-related beliefs and negative symptom severity was reported amongst a sample of individuals with serious mental

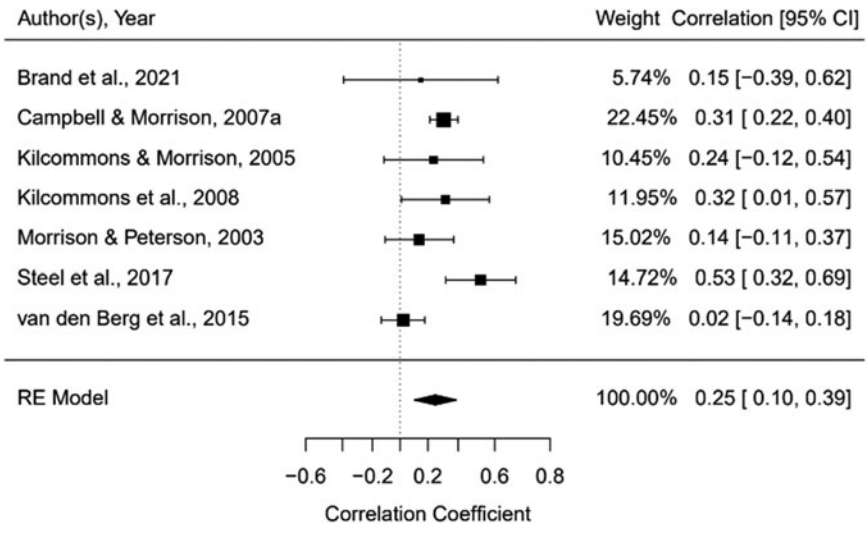

Figure 2. Forest plot of the relationship between trauma-related beliefs and hallucinations.

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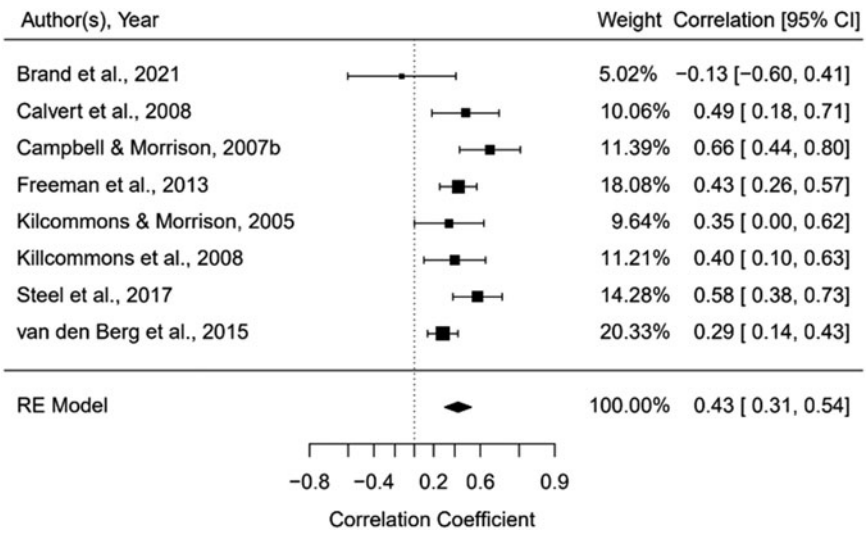

Figure 3. Forest plot of the relationship between trauma-related beliefs and delusions.

illness and co-occurring PTSD (Mueser et al., 2015). Two studies did not find evidence of a significant association between trauma-related beliefs and negative symptoms; the studies were conducted amongst a sample with co-occurring schizophrenia and co-occurring PTSD (Steel et al., 2017) and with first-episode psychosis (Peach et al., 2019). Diagnostic heterogeneity across the study samples may account for the differences between study findings.

Another study which measured trauma-related beliefs using the Core Beliefs Inventory (CBI; Cann et al., 2010) reported a significant association with negative symptoms (Mazor et al., 2020). The CBI measures disruption to a person's assumptive world following traumatic life events (Cann et al., 2010). Lower levels of negative symptoms were associated with higher levels of re-examination of core beliefs, which led to higher levels of posttraumatic growth. Overall, there was mixed evidence regarding the association between negative symptoms and trauma-related beliefs.

Discussion

The present review systematically examined research investigating the associations between trauma-related beliefs and psychosis symptoms, including hallucinations, delusions, paranoia, and negative symptoms, and the magnitude of these associations. The review identified 15 studies eligible for inclusion, with 11 studies eligible for inclusion in the meta-analyses.

The meta-analyses findings provide evidence for significant positive associations between trauma-related beliefs and psychosis symptoms, including hallucinations, delusions, and paranoia. A large association was observed between trauma-related beliefs and paranoia severity, a moderate to large association between trauma-related beliefs and delusion severity, and a small to moderate association between trauma-related beliefs and hallucination severity. The strength of the association observed for paranoia and delusions is similar to that observed in meta-analyses examining the association between trauma-related beliefs and PTSD (de La Cuesta et al., 2019; Mitchell et al., 2017). It is possible that trauma-related beliefs may have a greater influence on paranoia and delusions compared to hallucinatory experiences given how they are both primarily conceptualized as appraisal-based phenomena. Accordingly, paranoia assessments focus on appraisals and their impact, whereas for hallucinations the emphasis is on their sensory-perceptual characteristics and effects.

The results provide support for cognitive-behavioral models of psychosis, which highlight the role of trauma-related beliefs in the development and maintenance of psychosis (Garety et al., 2001; Hardy, 2017; Morrison, Frame & Larkin, 2003). It is theorized that trauma-related beliefs, characterized by threat and vulnerability, influence the content and appraisals of unusual or anomalous experiences, resulting in hallucinations and delusions, consistent with their hypothesized role in re-experiencing symptoms in PTSD (Ehlers & Clark, 2000). Trauma-related beliefs are also

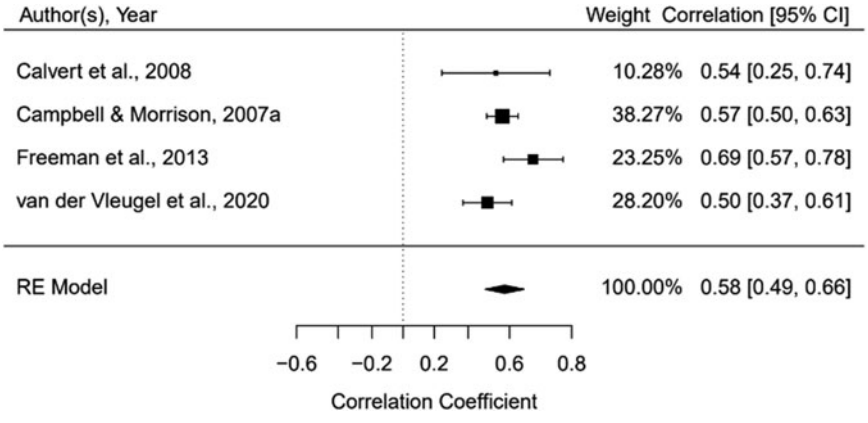

Figure 4. Forest plot of the relationship between trauma-related beliefs and paranoia.

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likely to interact with other putative mechanisms, such as PTSD symptoms of hyperarousal, avoidance, dissociation, emotions, memories, and nightmares, in influencing psychosis. However, little is known about the relative contributions of trauma-related mechanisms to psychosis. Network analyses of clinical and non-clinical samples indicate potential associations between emotions, emotional regulation (particularly dissociation), interpersonal relating, trauma-related beliefs, and psychosis symptoms (Barnes, Emsley, Garety, & Hardy, 2023; Chung et al., 2021; Cui et al., 2020; Fung et al., 2024; Hardy, O'Driscoll, Steel, van der Gaag, & van den Berg, 2021; Isvoranu et al., 2017). In support of this, a large ecological momentary sampling study of PTSD and psychosis symptoms conducted over 6 days found complex PTSD symptoms (i.e. negative self-concept, emotional regulation, and interpersonal difficulties) played a greater role than PTSD symptoms (i.e. re-experiencing, avoidance, hyperarousal) in predicting paranoia, voices, and visions from moment-to-moment (Panayi et al., in press). This finding may seem paradoxical, given that targeting trauma memories is a core element of trauma therapies and has been found to reduce paranoia and voice severity (Brand, Bendall, Hardy, Rossell, & Thomas, 2021; Keen, Hunter, & Peters, 2017; Ison, Medoro, Keen, & Kuipers, 2014; Paulik, Steel, & Arntz, 2019; van der Vleugel et al., 2020; Varese et al., 2024). However, focusing on memories of past experiences, alongside supporting emotional regulation, may assist the processing or management of associated beliefs, emotions, and coping styles that contribute to PTSD and psychosis symptoms. Future research should aim to better understand the interplay between PTSD and psychosis symptoms, and the interventions that optimally target them.

The narrative synthesis summarized research regarding the association between trauma-related beliefs and negative psychosis symptoms. A meta-analysis was not conducted given the limited number of studies and data required for the analysis. Whilst some studies provided evidence of a significant association (Mazor et al., 2020; Mueser et al., 2015) others did not (Peach et al., 2019; Steel et al., 2017). It is plausible that trauma could result in negative symptoms, as self-efficacy and self-defeatist beliefs are theorized to underlie negative symptoms (Grant & Beck, 2009), which could relate to trauma-related beliefs including self-blame and negative beliefs about the self. Alternatively, trauma-related threat beliefs may lead to withdrawal and avoidance, which could further contribute to negative symptoms (Hardy et al., 2020). Further work is required to better understand whether trauma-related beliefs play a role in negative symptoms of psychosis.

The present review has several limitations. There was a relatively small number of studies available for inclusion which were conducted across different populations (e.g. adolescents and adults from non-clinical and clinical samples, with heterogeneous diagnoses). In the meta-analyses moderate to high levels of heterogeneity were observed. The findings may be influenced or explained by methodological variation in the included studies, the true effect size could be smaller or larger than estimated. In addition, as requested data from authors were not provided in some cases, mean correlations for subscales were used in the meta-analysis. As computing a correlation is non-linear, the meta-analytic results should be interpreted with caution. The quality rating for most studies was weak to moderate which may introduce the risk of bias. Studies with a strong quality rating are required to assess the generalizability of the review findings. Given the limited number of studies it was not possible to conduct meta-regression analysis to account for the impact of methodological differences across studies. A further limitation of the review was the exclusion of unpublished studies and grey literature. It is possible relevant studies with null findings may have been omitted (Rosenthal, 1979). Most eligible studies were of a cross-sectional design. There were few longitudinal studies included in the review and further research is required to investigate the causal role of trauma-related beliefs in psychosis, such as the currently underway STAR and ReProcess trials (Burger et al., 2022; Peters et al., 2022).

The experience of trauma and psychosis has been associated with poorer treatment outcomes and symptom persistence (Hassan & De Luca, 2015; Thomas et al., 2019; Trotta et al., 2015). An increased understanding of the mechanisms implicated in the relationship between trauma and psychosis may contribute to efforts to improve clinical outcomes for individuals across the psychosis continuum with a history of trauma exposure. Although a range of trauma-related mechanisms have been implicated in the relationship between trauma and psychosis, trauma-related beliefs may represent a key treatment target (e.g. Alameda et al., 2020; Bloomfield et al., 2021; Hardy et al., 2021; Humphrey et al., 2021; Sideli et al., 2020; Williams et al., 2018). There is increasing research interest regarding the use of trauma-focused therapies among individuals presenting with schizophrenia spectrum disorders (Burger et al., 2022; Hardy, Good, Dix, & Longden, 2022; Keen et al., 2017; Peters et al., 2022; Steel et al., 2017; van den Berg et al., 2015). It was found that changes in trauma-related beliefs mediated change in paranoia in a trial of trauma therapies for PTSD in psychosis (van der Vleugel et al., 2020). We therefore hypothesize that trauma-focused therapies developed for PTSD which target threat, vulnerability, and self-blame may, in turn, reduce psychosis symptoms (Brand et al., 2021; Hardy et al., 2022; van den Berg et al., 2015). However, further longitudinal research, which considers a range of possible mediating or moderating variables, is required to test this hypothesis.

In conclusion, this review is the first to provide empirical evidence for a specific association between trauma-related beliefs and positive psychosis symptoms. The findings provide support for cognitive-behavioral models regarding the role of trauma in psychosis and the targeting of trauma-related beliefs in psychological therapy to improve psychosis outcomes.

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