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Changes in Posttraumatic Cognitions Mediate the Effects of Trauma-Focused Therapy on Paranoia

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Background: **Evidence suggests that in individuals with psychosis, paranoia is reduced after trauma-focused therapy (TFT) aimed at comorbid posttraumatic stress disorder (PTSD).*Objective:* To identify mediators of the effect of TFT on paranoia.*Method:* In a multicenter single-blind randomized controlled trial 155 outpatients in treatment for psychosis were allocated to 8 sessions Prolonged Exposure (PE; *n* = 53), 8 sessions Eye Movement Desensitization and Reprocessing (EMDR) therapy (*n* = 55), or a waiting-list condition (WL; *n* = 47) for treatment of comorbid PTSD. Measures were performed on (1) paranoia (GPTS); (2) DSM-IV-TR PTSD symptom clusters (CAPS-IV; ie, intrusions, avoidance, and hyperarousal); (3) negative posttraumatic cognitions (PTCI; ie, negative self posttraumatic cognitions, negative world posttraumatic cognitions and self-blame); (4) depression (BDI-II); and (5) cognitive biases (ie, jumping to conclusion, attention to threat, belief inflexibility, and external attribution), cognitive limitations (ie, social cognition problems and subjective cognitive problems), and safety behaviors (DACOBS). Outcome in terms of symptoms of paranoia (1) and potential mediators (2–5) were evaluated at posttreatment, controlling for baseline scores.*Results:* The effects of TFT on paranoia were primarily mediated by negative self and negative world posttraumatic cognitions, representing almost 70% of the total indirect effect. Safety behaviors and social cognition problems were involved in the second step mediational pathway models.*Conclusions:* Targeting the cognitive dimension of PTSD in TFT in psychosis could be an effective way to influence paranoia, whereas addressing safety behaviors and social cognition problems might enhance the impact of TFT on paranoia.**

Key words: PTSD/psychosis/mechanism of change/prolonged exposure/EMDR therapy

Introduction

Knowledge concerning the relationship between trauma, posttraumatic stress disorder (PTSD), and psychosis is increasing. Studies show that 50%–98% of people with psychosis have been exposed to traumatic events, with 2- to 4-fold odds of emotional, physical and sexual abuse compared to the general population.[1–4] Childhood trauma is a major risk factor associated with 33% of the prevalence and elevating the odds of developing psychosis in a dose-response fashion.[5] The prevalence of PTSD in psychosis is estimated at 12.4%[6] to 16%[7] and, reversely, psychotic symptoms are present in 15%–64% of people with PTSD.[8] Evidence suggests that PTSD has a pervasive impact on the prognosis of psychosis, and is associated with poorer social functioning and a higher risk of relapse.[9,10]

Evidence regarding the mechanisms involved in the relationship between PTSD and psychosis is scarce.[11] There are several reasons for this paucity of studies: (1) in clinical practice both exposure to traumatic events in the past, and the presence of a diagnosis of PTSD are missed in most patients with psychosis[7]; (2) clinicians are reluctant

to target memories of traumatic events in individuals with psychosis, assuming that it could destabilize the patient and lead to exacerbation of symptoms[12–14]; and (3) randomized controlled trials (RCTs) testing psychological interventions for PTSD tend to exclude participants with psychosis.[15] To improve psychosis-focused therapies that include trauma in the formulation of presenting problems (eg, cognitive behavior therapy for psychosis; CBTp) and trauma-focused therapies that address posttraumatic stress symptoms (eg, Prolonged Exposure [PE] or Eye Movement Desensitization and Reprocessing; EMDR therapy), it is essential to understand how posttraumatic stress and psychosis factors interact. An intervention-causal paradigm could be a useful model to disentangle a hypothesized causal mechanism and examine its effects on other variables.[11,16] In other words, analyzing the mechanisms associated with the impact of trauma-focused treatments (TFT) on symptoms of psychosis could identify potential pathways to improve clinical outcomes for traumatized people with psychosis.

TFT is feasible for individuals with PTSD and psychosis.[17,18] The efficacy of TFT (ie, PE and EMDR therapy) was demonstrated in a sample of 155 patients, showing a significant decrease not only of PTSD symptoms[19] but also of paranoia,[20] in comparison with a waiting-list (WL) control condition.

The aim of the present study was to identify which factors mediate the effect of TFT on paranoia. As putative mechanisms that could be implicated based on the literature, we selected the following mediators, all of which are known to decrease after TFT: (1) PTSD symptoms,[21] that may directly or indirectly affect paranoia,[22,23] and potentially exacerbate symptoms of psychosis[24–26]; (2) Negative posttraumatic cognitions,[27] which are considered to be involved in the development of paranoid symptoms,[22,28,29] and are likely to mediate the relationship between childhood emotional neglect and paranoid ideation[30]; and (3) symptoms of depression,[31] which have repeatedly been found to be associated with paranoia.[29,32–34]

Likewise, there is substantial evidence that neurocognitive problems and cognitive biases are intimately involved in paranoia and psychosis in general,[35,36] and could play a role in the effects of TFT on paranoia: (4) cognitive biases, which are highly prevalent in both psychosis[37–41] and clinically high-risk populations,[42] have been found to moderate the relationship between social stressors and paranoid ideation[43]; (5) cognitive limitations, which are present in individuals with psychosis even before the psychosis onset,[44–48] potentially contribute to the misinterpretation of other's motivations, thoughts and feelings, and characterize the progression and persistence of paranoia[49]; and lastly (6) safety behaviors may have an impact on maintaining paranoia,[50,51] and have been found to mediate the effects of Virtual Reality (VR-)CBT on paranoia.[52]

Due to the lack of previous research in this area, the present study is exploratory and aims to identify mediational pathways between TFT and reductions in paranoia in individuals with PTSD and psychosis, using the aforementioned potential mediators.

Methods

Design

The present study is a secondary analysis based on the multicenter single-blind RCT of van den Berg et al[19] investigating PTSD treatment in patients with a psychotic disorder. The trial design was approved by the Medical Ethics committee of the VU University Medical Center and registered at isrctn.com (ISRCTN79584912). Participants gave written informed consent before enrollment. For full details of the study methods and selection of participants see the study protocol.[53]

Participants

Participants were recruited in Dutch outpatient services for patients with severe mental illnesses. Inclusion criteria were (1) age 18–65 years, (2) lifetime diagnosis of psychotic disorder or mood disorder with psychotic features according to the Mini-International Neuropsychiatric Interview-Plus (MINI-Plus),[54] and (3) meeting full criteria for chronic PTSD on the past month version of the Clinician-Administered PTSD Scale (CAPS-IV).[55]

Exclusion criteria were (1) extremely high acute suicide risk, defined as meeting all 3 of the following criteria: current high suicidality score on the MINI-Plus, serious suicide attempt within the past 6 months, and depression score of ≥35 on the Beck Depression Inventory–II (BDI-II)[56,57]; (2) changed antipsychotic or antidepressant medication regimen within 2 months before the assessment; (3) insufficient competence in the Dutch language; (4) estimated IQ < 70; (5) unable to visit the outpatient service; and (6) current involuntary admission in a closed ward.

Recruitment led to the inclusion and randomization of 155 participants with various and severe comorbid conditions, thereby strengthening the study's generalizability[58] and clinical relevance.[59] The mean age of the sample was 41.2 (SD = 10.5) years and 45.8% was male. The sample was characterized by long-standing psychotic disorders (duration $M = 17.7$, $SD = 11.8$ years). MINI-Plus diagnoses were: 61.3% schizophrenia, 29.0% schizoaffective disorder, 4.5% bipolar disorder with psychotic features, 2.6% psychotic disorder not otherwise specified, 1.9% depression with psychotic features, and 0.6% brief psychotic disorder. At baseline, participants reported current delusions (61.9%), auditory verbal hallucinations (40.0%), a medium to high suicide risk (45.2%, MINI-Plus), moderate to severe depression (78.7%, BDI-II), and substance abuse or dependence (24.5%). Most participants experienced repeated and severe childhood traumatization. At baseline, there were no significant differences on any of the variables between participants randomized to TFT or WL.

Measures

The following instruments were administered:

1. The Green Paranoid Thoughts Scale (GPTS)[60] was used as the outcome variable. It is a self-report measure of paranoid experiences and ideas of reference. The GPTS has good internal consistency, is valid, reliable and sensitive to clinical change.[60]
2. The CAPS-IV was used to establish a PTSD diagnosis, and to index the severity of PTSD symptoms. It comprises the subscales intrusions, avoidance, and hyperarousal and has excellent reliability, convergent and discriminant validity, diagnostic utility, and sensitivity to clinical change.[61]
3. The Posttraumatic Cognitions Inventory (PTCI)[62] measures trauma-related cognitions on 3 subscales: negative self posttraumatic cognitions, negative world posttraumatic cognitions, and self-blame. Internal consistencies are excellent, the test-retest reliability is good, and the PTCI discriminates better between individuals with and without PTSD than other tools for assessing trauma-related cognitions.[62] Sensitivity and specificity are also good.[63]
4. Severity of depression was measured with the BDI–II. Good psychometric properties have been found for the original BDI[64] and for the revision BDI-II.[57] The BDI-II shows good validity and has high internal consistency.[56]
5. Cognitive biases, cognitive limitations, and safety behaviors were assessed with the Davos Assessment of Cognitive Biases Scales (DACOBS).[49] This self-report measure comprises the following subscales, each represented with 6 items: jumping to conclusions, confirmation bias/dogmatism, selective attention for threat, self as target, theory of mind problems, subjective cognitive failure and avoidance behavior. It is reliable and validated.[49]

Procedure

After screening and inclusion, participants completed a baseline assessment. Next, 155 consenting individuals were randomly assigned to PE (n = 53), EMDR therapy (n = 55) or a WL condition (n = 47). Both the outcome and the potential mediator variables were assessed at baseline and posttreatment. Blinded assessors performed the measurements throughout the study.

Treatment

Participants in the treatment conditions received 8 weekly 90-min treatment sessions, following treatment manuals for PE[65] and EMDR[66] therapy. Participants in the WL condition were provided treatment of choice after 6 months.

Statistical Analysis

Analyses were conducted with SPSS v. 23 (IBM Corp., United States). The primary model tested the direct and indirect effects of TFT (compared with WL) on paranoia, using the first layer of parallel potential mediators. The second step model consisted of 2 parallel multiple mediation analyses performed to examine the mediating effects of TFT on paranoia compared to the WL control condition in more detail. PROCESS macro[67] was employed to perform linear regression analyses to estimate indirect effects according to the methods recommended by Hayes and Rockwood[68] for clinical studies. This method is based on a modern framework and, in contrast to the causal steps approach in which a series of criteria are required to establish mediation,[69] it focuses solely on quantification of indirect effects. Posttreatment scores of the outcome and potential mediator variables were used, with baseline scores being included in the model as covariates. Least-square path analysis and bootstrap confidence interval (5000 permutations) were applied to estimate indirect effects. Partially standardized indirect effect sizes were reported following the recommendations of Hayes[67] for dichotomous predictors. Bootstrap confidence intervals for pairwise comparisons between specific indirect effects were performed to allow a test for significant differences between indirect effects.[67] Finally, Pearson's chi-square provided the correlation effect sizes between all continuous variables at baseline (table 1). To reduce noise and variability in the results, only data of participants that completed both assessments were analyzed.

TFT targeted PTSD symptoms, and the outcome of interest was paranoia. Therefore, potential mediators were distinguished accordingly and ordered serially. The first layer of parallel mediators comprised variables that were reported in previous studies to be reduced by TFT: DSM-IV-TR PTSD symptom clusters (intrusions, avoidance, hyperarousal), negative posttraumatic cognitions (negative self posttraumatic cognitions, negative world posttraumatic cognitions and self-blame) and depression. The model with these variables was the primary hypothesis to test. The second layer of parallel mediators contained the variables that had an association with paranoia; cognitive biases (jumping to conclusions, attention to threat, external attribution and belief inflexibility), cognitive limitations (social cognition and subjective cognitive problems) and safety behaviors. To our knowledge, no previous study has examined the effects of TFT on these variables; therefore, they were expected to have an association only with the outcome and not with the intervention. In the second layer, the variables that had a significant association with paranoia continued to the second step model that included both layers. In other words, the mediators that were significantly reduced by the intervention and also had a significant effect on the

Table 1. Pearson's Correlations Between all Variables at Baseline

	Intrusions (CAPS)	Avoidance (CAPS)	Hyperarousal (CAPS)	Negative Cognitions Self (PTCI)	Negative Cognitions World (PTCI)	Self-blame (PTCI)	Depression (BDI-II)
Intrusions (CAPS)	1						
Avoidance (CAPS)	.202*	1					
Hyperarousal (CAPS)	.241**	.334**	1				
Negative cognitions Self (PTCI)	.094	**.357****	**.266****	1			
Negative cognitions World (PTCI)	.041	**.349****	**.368****	**.624****	1		
Self-blame (PTCI)	−.075	.033	−.028	.369**	.157	1	
Depression (BDI-II)	**.217****	**.436****	**.237****	**.651****	**.411****	.141	1
Paranoia (GPTS total)	.157	**.163***	**.219****	**.442****	**.504****	**.225****	**.395****
Jumping to conclusions bias (DACOBS)	.085	.062	**.171***	.137	**.218****	.066	.148
Belief inflexibility bias (DACOBS)	−.077	.053	.107	**.400****	**.195***	.055	**.239****
Attention to threat bias (DACOBS)	−.009	.085	.140	**.308****	**.460****	.032	**.187***
External attribution bias (DACOBS)	.016	**.188***	.075	**.376****	**.457****	.031	**.296****
Social cognition problems (DACOBS)	−.048	.101	.096	**.535****	**.428****	**.264****	**.422****
Subjective cognition problems (DACOBS)	.063	.118	**.184***	**.546****	**.243****	**.208****	**.451****
Safety behaviors (DACOBS)	−.109	−.023	.066	**.298****	**.296****	.106	**.212****

Note: CAPS, Clinician-Administered PTSD Scale; DACOBS, Davos Assessment of Cognitive Biases Scales; PTCI, Posttraumatic Cognitions Inventory; BDI, Beck Depression Inventory–II; GPTS, Green Paranoid Thoughts Scale. Numbers printed in **bold** are significant correlations between 2 variables that do not share the same instrument.
*$P < .05$, **$P < .01$.

outcome proceeded to the second step analysis. In this way, the model construction was based both on the literature and the observed statistical associations. The first rationale guides the selection of mediators that could be involved in the process and how to allocate them (first or second layer). The second "filters" the mediators in the preliminary analysis, selecting only the significant ones and including them in the second step model with both layers.

All analyses considered both treatments arms of the study (ie, PE and EMDR therapy) combined in one TFT intervention condition compared with the WL control condition. This decision was based on the similar results achieved in the primary outcomes[19] and to increase the statistical power of the study.

Results

Main Model With DSM-IV-TR PTSD Symptom Clusters, Negative Posttraumatic Cognitions, and Depression as Potential Mediators (First Parallel Mediator Layer)

Compared to WL control, TFT had a significant effect on all mediators except for self-blame (figure 1 and table 2). The total effect of the model was significant and predicted 41% of the variance in paranoia ($R^2 = .417$, $P < .001$). The total effect is the sum of the direct and indirect effects of the model. However, after inclusion of the mediator variables, the total direct effect of the intervention on paranoia was nonsignificant ($P = .764$). The total indirect effect model was significant (partially standardized total indirect effect = −.383, 95% CI −.552, −.197). The total indirect effect of the intervention represented 90% of the total effect of the model.

Within this model, only negative self and negative world posttraumatic cognitions showed significant unique effects on paranoia ($b = .383$, $P = .026$; $b = .801$, $P = .027$, respectively). Bias-corrected bootstrap confidence intervals confirmed these results, TFT influenced paranoia indirectly through negative self and negative world posttraumatic cognitions (indirect effect = −.224, 95% CI −.440, −.031; indirect effect = −.143, 95% CI −.285, −.015 respectively). Negative self and negative world posttraumatic cognitions represented approximately 69% (42% and 27%, respectively) of the total indirect effect of TFT on paranoia. Negative self and negative world posttraumatic cognitions were included in the first layer of mediators of the second step model.

Paranoia (GPTS total)	Jumping to Conclusions Bias (DACOBS)	Belief Inflexibility Bias (DACOBS)	Attention to Threat Bias (DACOBS)	External Attribution Bias(DACOBS)	Social Cognition Problems (DACOBS)	Subjective Cognition Problems (DACOBS)	Safety Behaviors (DACOBS)
1							
.335**	1						
.249**	.378**	1					
.459**	.346**	.277**	1				
.525**	.491**	.478**	.538**	1			
.556**	.372**	.435**	.578**	.564**	1		
.266**	.196*	.475**	.359**	.334**	.623**	1	
.361**	.306**	.499**	.462**	.490**	.558**	.367**	1

Preliminary Analysis for the Second Parallel Mediator Layer (Cognitive Biases, Cognitive Limitations, and Safety Behaviors)

With regard *to cognitive biases*, compared to WL the attention to threat and external attribution biases had a significant effect on paranoia (b=1.102, $P = .005$; b=1.254, $P = .023$, respectively). Of the *cognitive limitations*, compared to WL only social cognition problems had a significant effect on paranoia ($b = 2.195$, $P < .001$). Concerning *safety behaviors*, compared to WL, these had a significant effect on paranoia ($b = 2.372$, $P < .001$). Based on these results, attention to threat bias, external attribution bias, social cognition problems, and safety behaviors were included in the second step model.

Second Step Model With Both Parallel Layers

The first layer of mediators of the second step model contained negative self and negative world posttraumatic cognitions. The second layer included attention to threat bias, external attribution bias, social cognition problems, and safety behaviors. Overall, the total effect model was significant and explained 42% of the effect of TFT on paranoia ($R^2 = .422$, $P < .001$). The total indirect effect of TFT on paranoia was significant (partially standardized total indirect effect = −.310; 95% CI −.495, −.093) representing 72% of the total effect of the model. The direct effect of TFT on paranoia was no longer significant ($P = .345$) (table 3). Also, in this second step model, TFT had a significant effect on negative self ($b = -19.186$, $P < .001$) and negative world posttraumatic cognitions ($b = -5.587$, $P < .001$) (figure 2). There was a significant between layer interaction. Negative self posttraumatic cognition had a significant effect on safety behaviors ($b = .092$, $P = .005$). Negative world posttraumatic cognitions had a significant effect on attention to threat bias ($b = .497$, $P < .001$), external attribution bias ($b = .215$, $P = .007$) and social cognition problems ($b = .354$, $P < .001$). Three variables in this model had a significant unique impact on changes in paranoia: negative self posttraumatic cognitions ($b = .260$, $P = .042$), social cognition problems ($b = 1.174$, $P = .017$) and safety behaviors ($b = .941$, $P = .021$).

Within the indirect effects of TFT on paranoia, 2 significant pathways were identified: (1) TFT decreased negative self posttraumatic cognitions, which had a positive

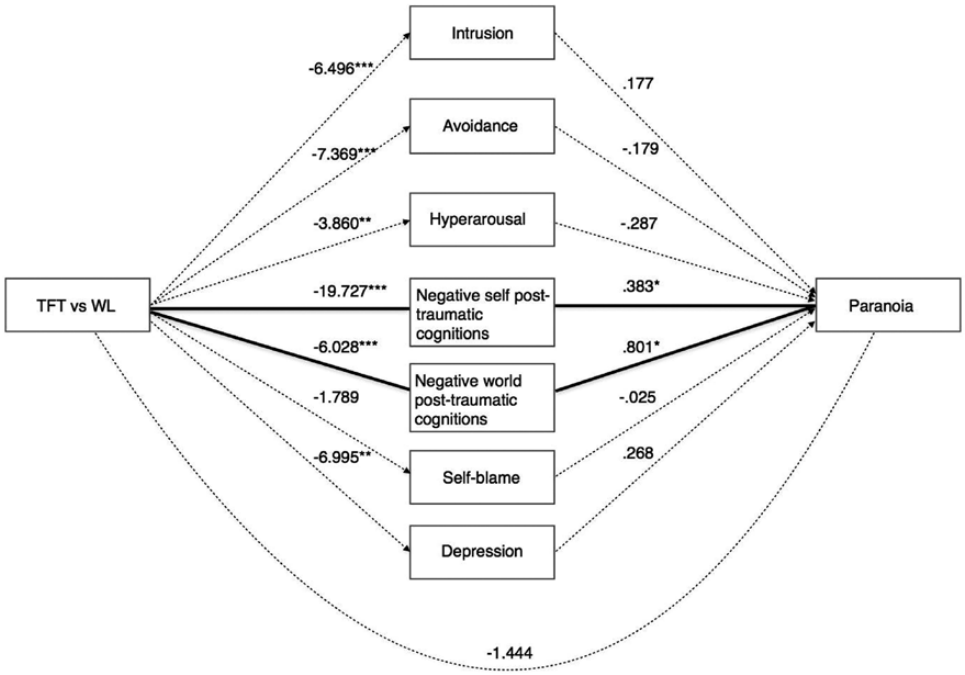

Fig. 1. Main model. Standardized regression coefficients for the relationship between the intervention effect and paranoia reduction mediated by intrusion, avoidance, hyperarousal, negative self and negative world posttraumatic cognition, self-blame, and depression controlling for waiting-list control. Black arrows indicate a significant mediation effect. *$P < .05$, **$P < .01$, ***$P < .001$.

Table 2. Main Model: *P*-values and Partially Standardized Indirect Effects of the Mediators

Main Model	$n = 130$		
First Layer Mediators	Effect	*P*	95% CI Bootstrap
Total effect	−0.426	.006	
Direct effect	−0.043	.764	
Total indirect effect	−0.383		−0.552, −0.197
Indirect effect intrusions	−0.034		−0.208, 0.109
Indirect effect avoidance	0.039		−0.087, 0.199
Indirect effect hyperarousal	0.033		−0.072, 0.154
Indirect effect negative self posttraumatic cognitions	−0.224		−0.440, −0.031
Indirect effect negative world posttraumatic cognitions	−0.143		−0.285, −0.015
Indirect effect self-blame	0.001		−0.057, 0.057
Indirect effect depression	−0.055		−0.190, 0.056

association with safety behaviors, and the latter had a positive association with paranoia (partially standardized indirect effect = −.049; 95% CI −.132, −.005); and (2) TFT decreased negative world posttraumatic cognitions, which had a positive association with social cognition problems, and the latter had a positive association with paranoia (partially standardized indirect effect = −.069; 95% CI −.146, −.012). Pathways A and B represent approximately 10% and 14%, respectively, of the total indirect effect of the model (24% in total).

Finally, a reversed version of the second step model was conducted to evaluate bidirectional effects between variables (figure 2). TFT had a significant effect on social cognition problems ($b = −3.149$, $P = .009$), negative self posttraumatic cognitions ($b = −14.593$, $P < .001$), negative world posttraumatic cognitions ($b = −3.074$, $P = .015$) and a trend toward significance on attention to threat bias ($b = −2.456$, $P = .050$). There was a significant layer of interaction. Safety behaviors and attention to threat had a significant effect on negative self posttraumatic cognitions ($b = .890$, $P = .017$; $b = .809$, $P = .048$, respectively). Attention to threat bias had a significant effect on negative world posttraumatic cognitions ($b = .625$, $P < .001$). Similar to the previous model, negative self posttraumatic cognitions, social cognition problems, and safety behaviors had a significant effect on paranoia ($b = .260$, $P = .041$; $b = 1.174$, $P = .016$; $b = .941$, $P = .021$, respectively). There was only one significant path in the reversed model: TFT reduced social cognition problems and the latter had a positive

Table 3. Second Step Model: *P*-values and Partially Standardized Indirect Effects of the Mediators

Second Step Model	*n* = 130		
First and Second Layer Mediators	Effect	*P*	95% CI bootstrap
Total effect	−0.431	.005	
Direct effect	−0.121	.345	
Total indirect effect	−0.310		−0.495, −0.093
Negative self posttraumatic cognitions	−0.148		−0.313, 0.010
Negative world posttraumatic cognitions	−0.037		−0.161, 0.091
Attention to threat bias	−0.003		−0.038, 0.028
External attribution bias	0.015		−0.017, 0.084
Social cognition problems	−0.019		−0.100, 0.046
Safety behaviors	0.052		−0.010, 0.160
Negative self posttraumatic cognitions → Attention to threat bias	0.001		−0.019, 0.025
Negative self posttraumatic cognitions → External attribution bias	−0.011		−0.056, 0.012
Negative self posttraumatic cognitions → Social cognition problems	−0.022		−0.081, 0.015
Negative self posttraumatic cognitions →Safety behaviors	−0.049		−0.132, −0.005
Negative world posttraumatic cognitions → Attention to threat bias	0.020		−0.059, 0.101
Negative world posttraumatic cognitions → External attribution bias	−0.016		−0.059, 0.015
Negative world posttraumatic cognitions → Social cognition problems	−0.069		−0.146, −0.012
Negative world posttraumatic cognitions → Safety behaviors	−0.024		−0.074, 0.005

association with paranoia (partially standardized indirect effect = −.109; 95% CI −.226, −.017) which was already significant in the non-reversed model. Therefore, despite the bidirectional effects found between some mediators, these results suggest that the second step model provided a clearer picture of the causality chains regarding TFT effects on paranoia compared with the reversed second step model.

Discussion

The present study aimed to identify potential mediators of the effect of trauma-focused therapy (TFT) on paranoia in individuals with psychosis and comorbid PTSD. Of the 7 mediators in the primary model, only negative self and negative world posttraumatic cognitions significantly mediated the effect of TFT on paranoia, representing almost 70% of the total indirect effect. In other words, the results suggest that TFT significantly reduced negative posttraumatic cognitions that, in turn, had significant positive associations with paranoia. This notion would be in line with the results of a recent review[70] that showed that negative posttraumatic cognitions play a key role in the change of trauma-related symptomatology. However, contrary to our expectations, which were based on the theoretical model of Mueser et al,[71] in our study DSM-IV-TR PTSD symptom clusters (ie, intrusions, avoidance, and hyperarousal), although significantly reduced, were not found to be significant mediators of the effects of TFT on paranoia. Similarly, depression did not appear to be involved in this process, although an association with paranoia has repeatedly been reported.[29,32–34]

The second step model allowed us to examine the pathways from TFT to paranoia reduction in more detail. Two serial pathways were found; ie, (A) via negative self posttraumatic cognitions and safety behaviors, and (B) via negative world posttraumatic cognitions and social cognition problems. Several cognitive models of paranoia postulate safety behaviors as a central maintaining factor.[50,51] The construct of social cognition problems as measured with DACOBS mainly refers to Theory of Mind (ToM) problems, indicating the capability to understand other's motives and actions.[49] Interestingly, similar to our results, Pot-Kolder et al[52] reported that safety behaviors and social cognition problems mediated the effects of virtual reality (VR) cognitive behavior therapy on paranoia, suggesting that these factors may be important agents of change in psychological treatment of paranoia.

Regarding pathway A, it could be postulated that TFT reduces beliefs of powerlessness and weakness (negative self posttraumatic cognitions), which may make a person feel less vulnerable and more inclined to consequently drop safety behaviors, which is an important step in overcoming paranoia.[72] In addition, experimental studies revealed that in persons with paranoid ideation, an induction of negative self cognitions leads to an increase of paranoia.[73,74] Moreover, levels of belief conviction have been found to be associated with the amount of safety behaviors.[75] Interestingly, in the present study negative self posttraumatic cognitions and safety behaviors had a bidirectional relation, which suggests that once safety behaviors abate individuals feel more resilient. This is in accordance with a VR intervention on safety behaviors in individuals with paranoia that showed that reducing safety behaviors made participants feel safer.[72]

Regarding pathway B, if TFT reduces the premise that the world is a dangerous place (negative world posttraumatic cognitions), people may start to feel safer

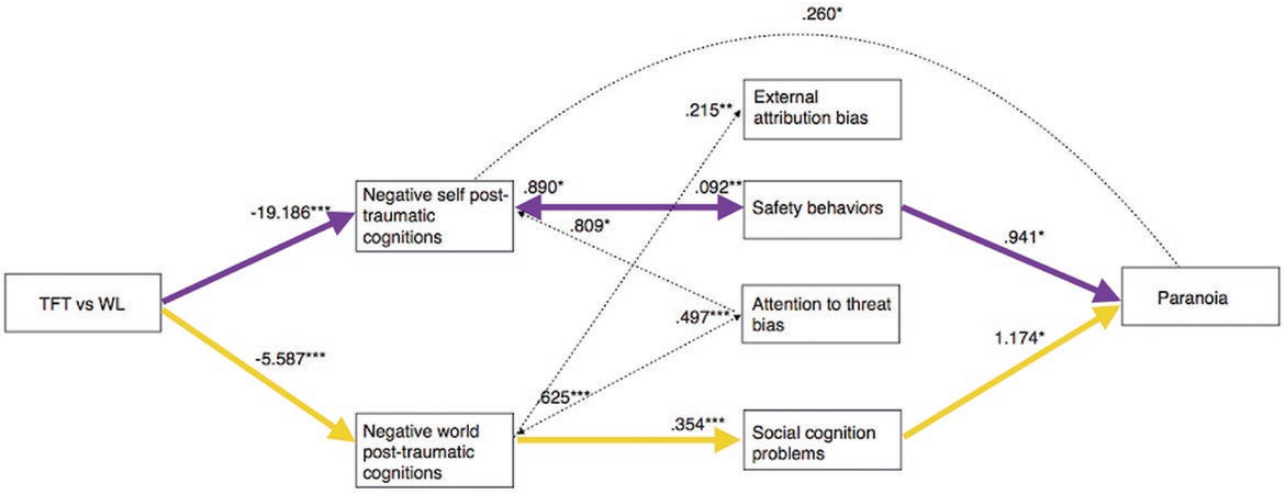

Fig. 2. Second step model with reversed interactions included. Standardized regression coefficients for the relationship between the intervention and paranoia reduction mediated by negative self and negative world posttraumatic cognitions (first layer), attention to threat bias, external attribution bias, social cognition problems, and safety behaviors (second layer) controlling for waiting-list control. Only significant associations are displayed. *$P < .05$, **$P < .01$, ***$P < .001$.

and less distressed, which may, in turn, enhance the cognitive capacity to recognize other's motives (diminishing social cognition problems), which may reduce paranoia. This notion is supported by recent findings indicating that negative world views in trauma survivors influence expectations in ambiguous situations.[76] Although ToM problems are considered a trait marker of psychosis and clinical high-risk for psychosis,[77] our results suggest that ToM skills may be enhanced in individuals with psychosis and PTSD by reducing negative world posttraumatic cognitions.

Compared to the main model, the second step model only contributed 1% to the explained variance of change in paranoia. Moreover, the total indirect effect of the main model represented 90% of the total effect model, while in the second step model, this was 72%. Therefore, the main model appears to be the more accurate representation of the TFT effects on paranoia in individuals with PTSD and psychosis.

It should be noted that the present study has several limitations. One is the cross-sectional nature of the data, implying that the observed outcomes are associational and not causal in nature. To show that a variable mediates an effect, temporal precedence is required.[78] Another limitation is that the associations between parallel mediators within one layer were not considered. It is, for instance, probable that negative self and negative world posttraumatic cognitions interacted. Future studies may use longitudinal mediation models with modern techniques such as structural equation modeling to bypass these limitations. Furthermore, larger sample sizes are warranted to permit analyses on distinct therapies.

The results of the present study may have important clinical relevance in that targeting the cognitive dimension of posttraumatic stress could be an efficacious way to beneficially affect paranoia in traumatized individuals with psychosis. Perhaps the direct exposure component of TFT affects negative posttraumatic cognitions, by targeting the episodic-perceptual level of memories.[11] Therefore, it would be meaningful to examine whether it has additional value to combine TFT interventions with CBT for psychosis (CBTp) in traumatized individuals with paranoia. Firstly, by diminishing negative self and negative world posttraumatic cognitions using TFT, and then challenging paranoia with CBTp, using behavioral experiments to reduce safety behaviors. This notion is supported by a meta-analysis showing that interventions that focus on factors potentially involved in the formation and maintenance of delusions were more effective in changing delusions than interventions that focused on the delusions per se.[79] The results of the present study also raise the question whether evidence-based treatments for PTSD that more directly address posttraumatic cognitions and require less direct memory exposure yield the same results. A replication study with an extra condition of Cognitive Restructuring,[80] enabling a head-to-head comparison of TFT with and without direct trauma memory processing in patients with psychosis and PTSD, is being conducted at this moment (ISRCTN registration number: 56150327). Considering the importance of the posttraumatic cognitions factor and taking into account that the majority of people with psychosis experienced trauma exposure, measuring posttraumatic cognitions in CBTp may add to the formulation of the relationship between trauma and paranoia at the individual level, even when PTSD criteria are not fully met.

In summary, the present findings support the relevance of the cognitive dimension in PTSD as a mediator of the effects of TFT on paranoia in individuals with PTSD and psychosis, and suggest that safety behaviors and social

cognition problems are relevant factors to investigate in future research.

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