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RESEARCH PAPER

Expectancy violation during exposure therapy: A pilot randomized controlled trial

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Abstract Despite empirical support for the efficacy of exposure-based therapy for anxiety-related disorders, many individuals do not respond to this intervention or else experience a return of fear after treatment. Inhibitory learning theory has informed novel approaches to exposure therapy delivery that aim to improve both short- and long-term outcomes. One exposure optimization strategy is to maximize expectancy violation (i.e., the difference between expected and actual outcomes), which is thought to strengthen inhibitory (i.e., non-threat) associations and enhance long-term fear extinction. In practice, exposure therapy is traditionally preceded by cognitive restructuring to lessen the magnitude of harm expectancies. Yet this technique may restrict the discrepancy between expected and actual outcomes, thus reducing the potency of exposure and limiting the durability of treatment gains. The present study examined the effects of manipulating the timing of cognitive techniques during exposure-based therapy by randomly assigning 45 participants with spider phobia to one of three conditions: (a) cognitive restructuring before exposure (CR-EXP; $n = 15$), (b) exposure before cognitive restructuring (EXP-CR; $n = 15$), and (c) stress management control (SM; $n = 15$). Although both CR-EXP and EXP-CR were more effective than SM, there were no significant differences between CR-EXP and EXP-CR on measures of fear, avoidance, spider-related cognitions, or change in harm expectancy. Clinical implications, study limitations, and future directions are discussed.
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Anxiety-related disorders have an estimated lifetime prevalence of 33.7%, affecting nearly 40 million adults in the United States each year (Bandelow and Michaelis, 2015; Kessler et al., 2005). Cognitive-behavioral treatment (CBT) is the first-line intervention for these conditions (Abramowitz, Deacon, & Whiteside, 2019; Arch & Craske, 2009), and meta-analytic findings suggest that exposure therapy is a critical element in this approach (Kaczkurkin & Foa, 2015). Two leading theories seek to explain the mechanisms underlying the efficacy of exposure therapy: emotional processing theory (EPT) and inhibitory learning theory (ILT).

According to EPT (Foa & Kozak, 1986; Foa & McNally, 1996; Rachman, 1980), exposure therapy works via a process of ''corrective learning,'' in which non-threat associations (e.g., spiders are generally not dangerous) replace fear-based associations (e.g., spiders are dangerous; Foa & Kozak, 1986; Foa et al., 2006; Foa & McNally, 1996). Although decades of research on exposure therapy delivered from an EPT perspective point to its effectiveness (Abramowitz et al., 2019), available evidence does not provide consistent support for the principles of EPT (Craske et al., 2008; Rupp et al., 2017). Consequently, Craske et al. (2008) proposed an inhibitory learning framework (Lang et al., 1999; Myers & Davis, 2007) that suggests fear-based associations are not ''replaced'', but rather ''inhibited'', by non-threatening associations acquired during exposure. Successful extinction, therefore, occurs when new associations are sufficiently robust to consistently inhibit original (fear-based) associations.

Craske et al. (2008, 2014) highlight ''expectancy violation'', the discrepancy between an individual's anticipated (negative) outcome and the actual (positive or benign) outcome of an exposure trial, as an essential process that promotes inhibitory learning. This perspective has raised questions about the widely employed clinical practice of using cognitive interventions prior to exposure to ''kickstart'' the process of reducing overestimates of threat and make exposure more palatable (e.g., Barlow, 2014). Specifically, when considered from an ILT perspective cognitive restructuring (CR) used in this way may be deleterious if it attenuates the gap between expected and actual outcomes of exposure (i.e., expectancy violation; Craske et al., 2014). Despite the theoretical plausibility and clinical importance of this hypothesis, however, it has not yet been tested empirically.

Accordingly, the current study compared three single-session interventions:

(a) CR before exposure (CR-EXP);
(b) exposure before CR (EXP-CR), and;
(c) a stress management comparison condition that involved neither exposure nor CR (Stress Management; SM).

We recruited adults with spider phobia given the relatively high prevalence of this diagnosis (e.g., Oosterink et al., 2009), sizeable literature on ILT that used spiders as exposure stimuli (e.g., Blakey et al., 2019; Shiban et al., 2015), and established efficacy of one session of exposure therapy for specific phobia (Zlomke & Davis, 2008). Participants were randomly assigned to condition, and multimodal assessments of exposure outcomes were administered before and after the session.

We hypothesized that CR-EXP and EXP-CR would both result in a greater reduction in spider fear, avoidance, and threat-based cognitions relative to the SM group at post-treatment and follow-up. Drawing from ILT, we also predicted EXP-CR would support greater reductions across primary outcomes when compared to CR-EXP. We further hypothesized that changes in harm expectancies from pre- to post-exposure would be significantly greater in the EXP-CR group than the CR-EXP group.

Method

Participants

A sample of 45 adults with a DSM-5 (American Psychiatric Association, 2013) diagnosis of specific phobia of spiders participated in this study. Thirty-nine participants (86.7%) identified as female, five as male, and one as gender non-binary. The sample had a mean age of 30.91 years (SD = 14.41). Most participants (75.6%, $n = 34$) self-identified as white, 20.0% ($n = 9$) as Black or African American, 2.2% ($n = 1$) as Asian, and 2.2% ($n = 1$) as mixed race. Demographic data are presented in Table 1.

Participants were recruited from a large, southeastern university and surrounding community between January 2018 and March 2020. The target enrollment was 90 adults; however, recruitment efforts were halted in March 2020 due to the COVID-19 pandemic and associated precautions that precluded in-vivo assessment and treatment sessions. Eligibility criteria included:

(a) at least 18 years of age;
(b) English fluency, and;
(c) presence of DSM-5 specific phobia related to spiders.

Participants were deemed ineligible if they did not meet the above inclusion criteria or:

(a) were allergic to spiders or bee stings;
(b) endorsed current psychosis, mania, or a substance use disorder, or;
(c) completed 10 of 13 possible steps (i.e., touched the spider) during a behavioral approach task (BAT) at pre-treatment (see Measures).

Procedure

Treatment setting and providers

Four doctoral students served as therapists under the supervision of the principal investigator (PI), who was supervised by a licensed clinical psychologist with expertise in anxiety-related disorders. This clinical trial was approved by the university's Institutional Review Board and was registered at http://www.clinicaltrials.gov (NCT03410264). Two non-venomous tarantulas were used in this study. The PI managed randomization, enrollment, and group assignment.

Table 1 Sociodemographic characteristics of participants at baseline.

	CR-EXP ($n = 15$)		EXP-CR ($n = 15$)		SM ($n = 15$)	
	n	%	*n*	%	*n*	%
Gender identity						
Female	13	86.7	14	93.3	12	80
Male	2	13.3	1	6.7	2	13.3
Non-binary	0	0	0	0	1	6.7
Race						
Asian	1	6.7	0	0	0	0
Black or African American	1	6.7	4	26.7	4	26.7
Mixed race	0	0	0	0	1	6.7
White	13	86.7	11	73.3	10	66.7
Highest education level						
High school/GED/equivalent	2	13.3	0	0	1	6.7
Some college	4	26.7	6	40	7	46.7
Associate's degree/certificate	0	0	1	6.7	0	0
Bachelor's degree	3	20	3	20	2	13.3
Some graduate school	1	6.7	1	6.7	0	0
Master's degree	4	26.7	3	20	3	20
Doctorate or professional degree	1	6.7	1	6.7	1	6.7

Participants were on average 30.91 years old and participant age did not differ by condition.

Study timeline

The study involved two study appointments, totaling approximately 141 min. The study participant flow and assessment schedule are presented in Fig. 1.

Pre-treatment procedures

Consenting participants completed the demographics form and self-report measures of spider phobia symptoms and cognitions via Qualtrics, a secure online survey tool. Participants then completed the BAT with an assessor blind to study hypotheses and condition assignment.

Treatment procedures

All 45 participants received one 60-minute intervention session (CR-EXP $n = 15$; EXP-CR $n = 15$; SM $n = 15$). Fig. 2 displays the CONSORT participant flow diagram and Fig. 3 displays the CONSORT checklist. Five participants were lost to follow-up for unknown reasons—two in the EXP-CR group and three in the SM group. The five participants who were lost to follow-up did not significantly differ from study completers on any baseline measures (all $ps > .05$).

Psychoeducation

The therapist provided an explanation of the cognitive-behavioral model of spider phobia (Abramowitz et al., 2019).

Randomization to study conditions

Consenting participants were randomized by Microsoft Excel's random number generator function to one of the three study conditions. Study procedures were identical in CR-EXP and EXP-CR condition, except for the order of component delivery. The SM intervention did not include CR or EXP components (see ''Treatment procedures'', below).

CR intervention

All participants in CR-EXP and EXP-CR groups received a 15-minute CR intervention, adapted from Antony et al. (1995). The therapist explained common ''thinking mistakes'' that contribute to spider phobia and used a thought challenging form to help the participant reconsider their predictions about aversive outcomes.

Exposure intervention

All individuals in CR-EXP and EXP-CR conditions participated in a 30-minute in-vivo exposure task with the tarantula. The therapist and participant stayed in a room with a terrarium containing the tarantula for the duration of the exposure, and the therapist encouraged the participant to approach and handle the spider. The therapist was trained not to provide reassurance or verbally challenge cognitions during the exposure, in order to ensure this intervention did not include explicit cognitive techniques.

SM intervention

All participants in the SM group participated in a 45-minute discussion of stress management skills, based on Abramowitz, 2012, that included open-ended questions about stress and coping, and provided psychoeducation about general physical, mental, and behavioral responses to stress.

Treatment fidelity

Three study assistants blinded to study hypotheses and condition assignment double-coded a randomly selected 27% ($n = 12$) of session recordings, in accordance with Lombard et al.'s (2002) recommendations to evaluate a minimum 10% of treatment units. Thirteen items assessing therapeutic skills were derived from the Beck Cognitive Therapy Scale (Young & Beck, 1980). Twenty-four additional items assessing content were derived from study treatment manuals.

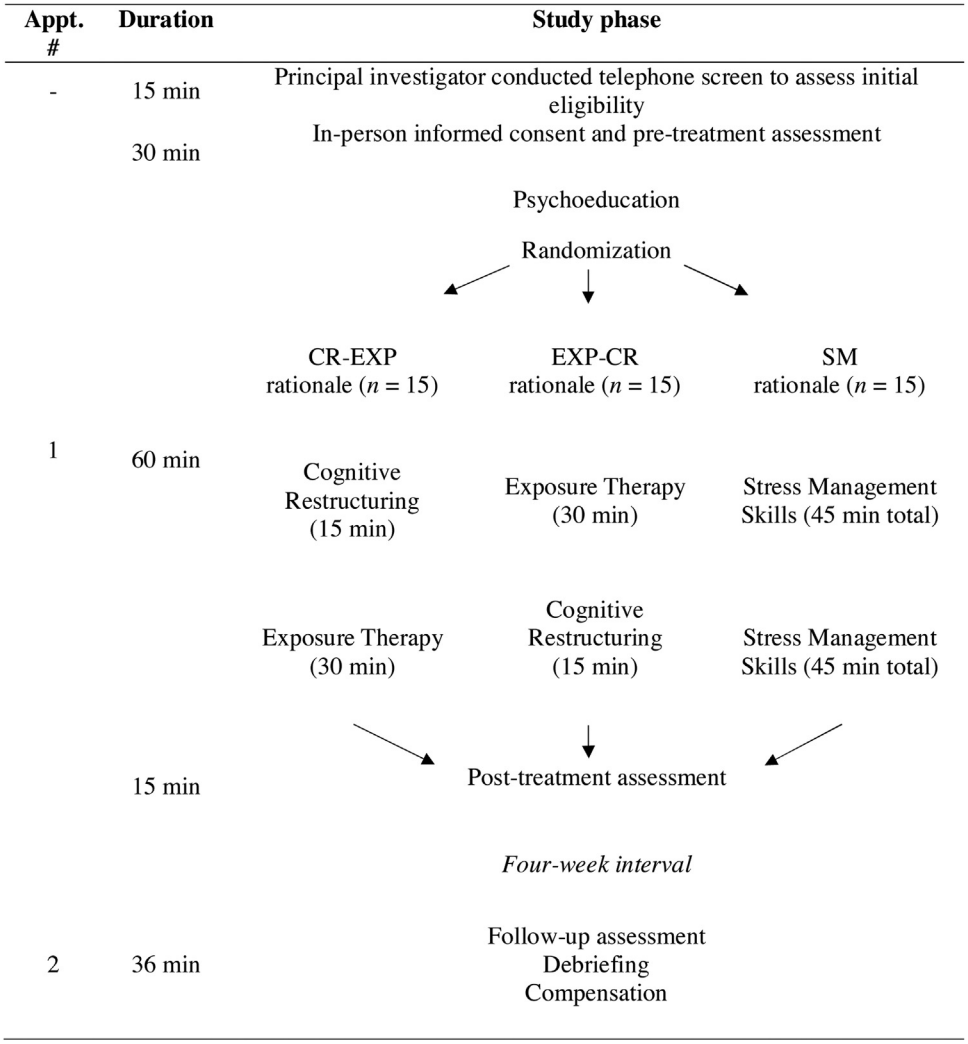

Figure 1 Participant flow.

All items were rated on a 0 (poor) to 6 (excellent) scale or marked as ''not applicable.'' Fidelity coders were trained by the PI. All coders demonstrated 100% simple agreement with nominal items and a difference score of ≤ 1 for continuous ratings compared with the PI's ratings of three session recordings (one for each condition) before coding tapes independently. Interrater reliability of the current study's fidelity coders was excellent (95.9% of items rated identically). Therapists received ratings of 6 on 96.8% of all items.

Post-treatment assessment

Participants completed questionnaires and the BAT at post-treatment and were scheduled for a four-week follow-up visit.

Follow-up assessment

Participants were scheduled for their follow-up visit following completion of their treatment session. They completed self-report and behavioral measures and were subsequently debriefed.

Measures

Anxiety Disorders Interview Schedule for DSM-5 (ADIS-5; Brown & Barlow, 2014)

The ADIS-5 is a semi-structured standardized clinical interview that assesses current anxiety-related diagnoses according to DSM-5 criteria. The specific phobia module was administered to all participants during an initial telephone screening for spider phobia. This module assesses DSM-5 symptoms and associated interference and distress, which are rated separately on a 0 (none) to 8 (very severe) scale. Eligibility required endorsing a score of 4 (moderate fear/sometimes avoids) on either the interference or distress item.

Fear of Spiders Questionnaire (FSQ; Szymanski & O'Donohue, 1995)

The FSQ is an 18-item self-report measure of spider phobia. Participants rated their agreement with each statement (e.g., ''If I saw a spider now, I would think it will harm me'') on a scale of 0 (totally disagree) to 7 (totally agree), with higher scores indicating greater spider fear. The

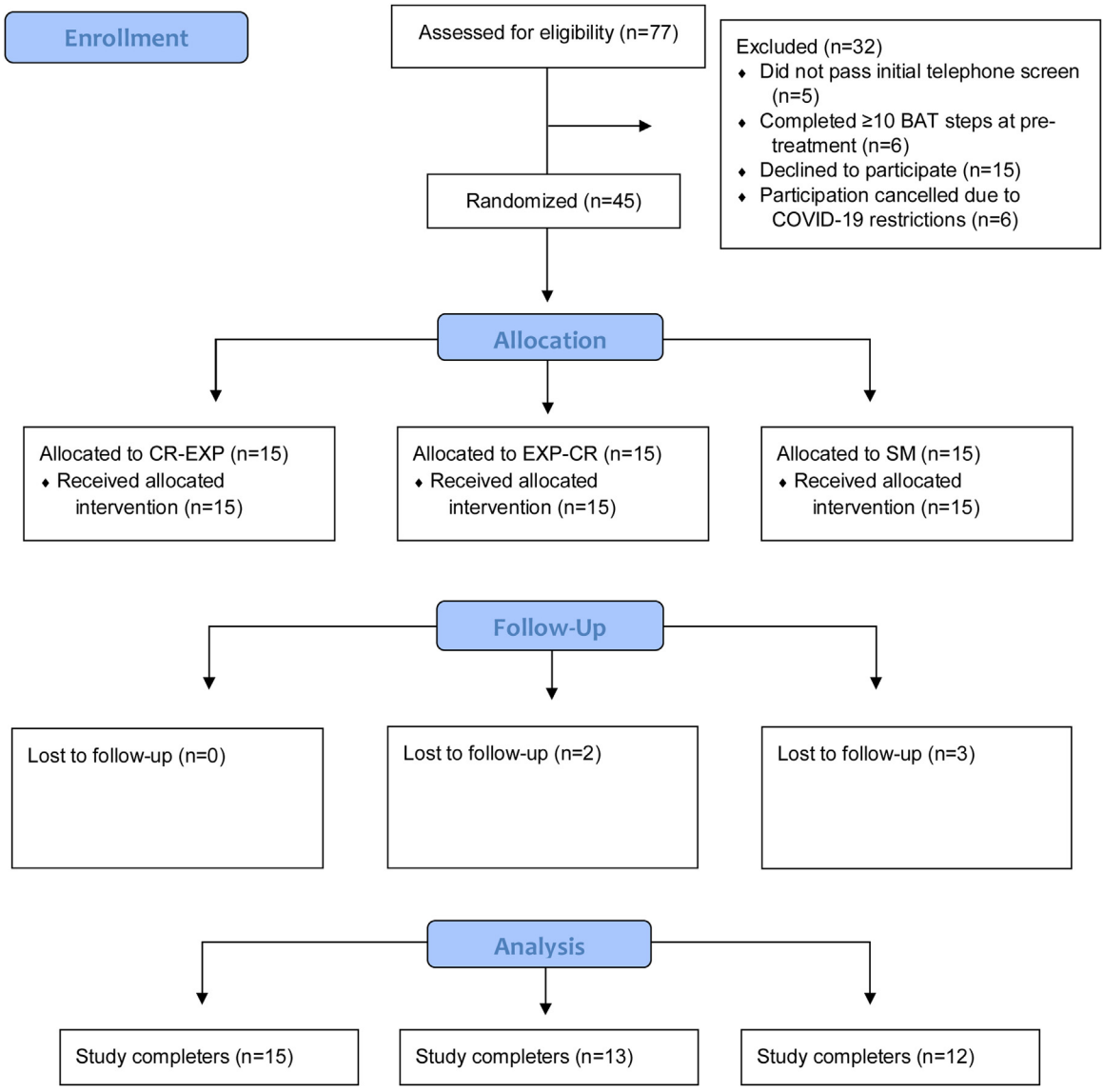

Figure 2 CONSORT flow diagram.

FSQ has shown high internal consistency, high test-retest reliability, and adequate convergent validity in previous work (Szymanski & O'Donohue, 1995), as well as sensitivity to therapeutic change during behavioral therapy (Muris & Merckelbach, 1996). The FSQ was administered at pre-treatment, post-treatment, and follow-up. Internal consistency was excellent in the current sample ($\alpha_{Pre} = 0.93$, $\alpha_{Post} = 0.96$, $\alpha_{Follow\text{-}up} = 0.97$).

Tarantula behavioral approach task (BAT; Blakey et al., 2019)

A Tarantula BAT served as the behavioral outcome variable in this study. The BAT includes 13 rank-ordered steps ranging from ''stand at the opposite end of a room containing a tarantula enclosed in a covered terrarium'' to ''allow tarantula to crawl up your arm.'' Participant must have performed a BAT step for 5 full seconds for the step to count as completed. The highest step completed for each participant was recorded at pre-treatment, post-treatment, and follow-up. As noted previously, participants who reached the 10th BAT step at pre-treatment (i.e., touched the spider) were excluded from participation.

Spider Phobia Beliefs Questionnaire (SBQ; Arntz et al., 1993)

The SBQ comprises 48 items measuring dysfunctional beliefs (e.g., ''When there is a spider in my vicinity, I believe that the spider is deadly'') on visual analogue scales from 0 (not at all) to 100 (completely). Higher scores reflect more unrealistic beliefs. The SBQ was administered at pre-treatment, post-treatment, and follow-up. Internal consistency was excellent in the current sample ($\alpha_{Pre} = 0.97$, $\alpha_{Post} = 0.98$, $\alpha_{Follow\text{-}up} = 0.98$).

Harm Expectancy

Immediately before and after the exposure, participants in the CR-EXP and EXP-CR groups were asked to verbally report how strongly they believed that their idiographic negative

Section/Topic	Item No	Checklist item	Reported on page No
Title and abstract			
	1a	Identification as a randomised trial in the title	1, 3
	1b	Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts)	3
Introduction			
Background and objectives	2a	Scientific background and explanation of rationale	3-4
	2b	Specific objectives or hypotheses	4
Methods			
Trial design	3a	Description of trial design (such as parallel, factorial) including allocation ratio	7
	3b	Important changes to methods after trial commencement (such as eligibility criteria), with reasons	N/A
Participants	4a	Eligibility criteria for participants	5
	4b	Settings and locations where the data were collected	5
Interventions	5	The interventions for each group with sufficient details to allow replication, including how and when they were actually administered	7-8
Outcomes	6a	Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed	5-6
	6b	Any changes to trial outcomes after the trial commenced, with reasons	N/A
Sample size	7a	How sample size was determined	5
	7b	When applicable, explanation of any interim analyses and stopping guidelines	N/A
Randomisation:			
Sequence generation	8a	Method used to generate the random allocation sequence	7
	8b	Type of randomisation; details of any restriction (such as blocking and block size)	7
Allocation concealment mechanism	9	Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned	7
Implementation	10	Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions	7
Blinding	11a	If done, who was blinded after assignment to interventions (for example, participants, care providers, those assessing outcomes) and how	7
	11b	If relevant, description of the similarity of interventions	7-8
Statistical methods	12a	Statistical methods used to compare groups for primary and secondary outcomes	9
	12b	Methods for additional analyses, such as subgroup analyses and adjusted analyses	9
Results			
Participant flow (a diagram is strongly recommended)	13a	For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analysed for the primary outcome	7, 25
	13b	For each group, losses and exclusions after randomisation, together with reasons	7, 25
Recruitment	14a	Dates defining the periods of recruitment and follow-up	5
	14b	Why the trial ended or was stopped	N/A
Baseline data	15	A table showing baseline demographic and clinical characteristics for each group	22
Numbers analysed	16	For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups	7, 25
Outcomes and estimation	17a	For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval)	10-12
	17b	For binary outcomes, presentation of both absolute and relative effect sizes is recommended	N/A
Ancillary analyses	18	Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing pre-specified from exploratory	10-12
Harms	19	All important harms or unintended effects in each group (for specific guidance see CONSORT for harms)	N/A
Discussion			
Limitations	20	Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses	14-15
Generalisability	21	Generalisability (external validity, applicability) of the trial findings	14-15
Interpretation	22	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence	12-15
Other information			
Registration	23	Registration number and name of trial registry	7
Protocol	24	Where the full trial protocol can be accessed, if available	7
Funding	25	Sources of funding and other support (such as supply of drugs), role of funders	1

Figure 3 CONSORT Checklist.

Table 2 Descriptive data for primary outcome variables by condition and time point.

	CR-EXP ($n = 15$)			EXP-CR ($n = 15$)			SM ($n = 15$)		
	M	SD	Range	M	SD	Range	M	SD	Range
FSQ									
Pre-treatment	84.21	25.15	32–110	79.93	25.09	29–115	91.47	21.44	31–125
Post-treatment	42.79	27.64	3–94	41.14	26.01	10–93	74.80	25.79	11–104
Follow-up	37.07	37.07	2–101	34.62	20.64	2–85	63.67	29.49	14–116
BAT steps									
Pre-treatment	6.87	1.77	4–9	7.60	1.50	5–10	6.33	2.29	1–9
Post-treatment	10.27	2.43	5–13	10.13	2.32	8–13	7.20	2.57	1–9
Follow-up	10.64	2.44	6–13	10.42	2.15	7–13	8.27	1.74	4–11
SBQ									
Pre-treatment	3005.47	1432.75	593–6082	2648.27	1370.27	419–5738	2836.40	1160.60	509–4720
Post-treatment	915.07	708.81	58–2468	1033.40	1148.72	90–4593	2225.13	1220.40	89–4749
Follow-up	1044.33	828.42	35–2870	1147.69	1242.45	193–4496	1916.08	1549.05	51–4795

BAT: Behavioral Approach Test; FSQ: Fear of Spiders Questionnaire; SBQ: Spider Phobia Beliefs Questionnaire; CR-EXP: Cognitive restructuring before exposure condition; EXP-CR: Exposure before cognitive restructuring condition; SM: Stress management control condition.

harm prediction (i.e., their primary phobic belief) would occur, using a scale of 0 (0% certain) to 100 (100% certain).

Data analytic strategy

Treatment outcome analyses

To examine group differences in spider phobia symptom changes from pre- to post-treatment and follow-up, three separate 3 (condition) × 3 (time) mixed model ANOVAs were conducted with FSQ, BAT, and SBQ scores as individual dependent variables. Planned contrasts were performed to test each hypothesis. The five participants lost to follow-up were excluded from analyses.

Exposure process analyses

A 2 (condition) × 2 (time) repeated measures ANOVA was conducted to examine group differences (CR-EXP and EXP-CR) in expectancy change from pre- to post-exposure. Planned follow-up independent sample t-tests were conducted to examine mean differences in expectancy change, pre-exposure expectancy ratings, and post-exposure expectancy ratings.

Results

Effects of Treatment on Spider Phobia Symptom Measures

FSQ scores

Table 2 displays mean FSQ scores by time and treatment condition. Relative to the SM group, significantly larger overall decreases in FSQ scores were observed in both the CR-EXP group, $F(2, 75) = 6.76$, $p < .01$, $\eta_p^2 = .15$, and EXP-CR group, $F(2, 75) = 4.58$, $p < .05$, $\eta_p^2 = .12$. There were no significant overall differences between the CR-EXP and EXP-CR groups, $F(2, 75) = 0.37$, $p = .69$, $\eta_p^2 = .01$. Planned contrasts showed that, relative to the SM group, FSQ scores decreased significantly more from pre- to post-treatment in the CR-EXP group, $t(75) = -3.21$, $p < .01$, and in the EXP-CR group, $t(75) = -2.87$, $p < .01$. Similarly, relative to SM, FSQ scores decreased significantly more from pre-treatment to follow-up in the CR-EXP group, $t(75) = -3.12$, $p < .01$, and in the EXP-CR group, $t(75) = -2.20$, $p < .05$. There were no significant differences in FSQ scores between the CR-EXP and EXP-CR groups from pre- to post-treatment, $t(75) = -0.34$, $p = .74$, or from pre-treatment to follow-up, $t(75) = -0.85$, $p = .40$. Fig. 4 depicts changes in FSQ scores by condition over time.

BAT steps

Table 2 displays mean BAT scores by time and treatment condition. Relative to participants who received SM, participants had significantly larger overall increases in BAT steps in the CR-EXP group, $F(2, 76) = 9.35$, $p < .001$, $\eta_p^2 = .20$, and EXP-CR group, $F(2, 76) = 3.81$, $p < .05.$, $\eta_p^2 = .09$. There were no significant overall differences between the CR-EXP and EXP-CR groups, $F(2, 76) = 1.25$, $p = .29$, $\eta_p^2 = .03$. Planned contrasts showed that, relative to the SM group, participants completed significantly more BAT steps at post- versus pre-treatment in the CR-EXP group, $t(76) = 3.98$, $p < .001$, and in the EXP-CR group, $t(76) = 2.62$, $p < .05$. Relative to SM, participants completed significantly more BAT steps at follow-up versus pre-treatment in the CR-EXP group, $t(76) = 3.34$, $p < .05$, though this difference did not reach significance for the EXP-CR group, $t(76) = 1.96$, $p = .05$.

There were no significant differences in BAT steps completed between the CR-EXP and EXP-CR groups from pre- to post-treatment, $t(76) = 1.36$, $p = .18$, or from pre-treatment to follow-up, $t(76) = 1.35$, $p = .18$. Fig. 5 depicts changes in BAT scores by condition over time.

SBQ scores

Table 2 displays mean SBQ scores by time and treatment condition. Relative to participants who received SM, participants had significantly larger overall decreases in SBQ scores in the CR-EXP group, $F(2, 79) = 9.55$, $p < .001$, $\eta_p^2 = .19$,

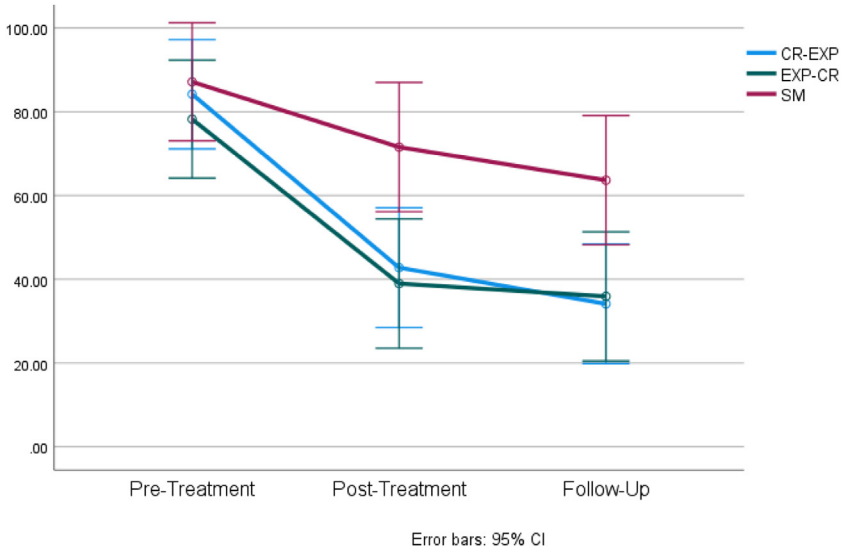

Figure 4 Mean FSQ Scores by Group at Pre-Treatment, Post-Treatment, and Follow-Up. FSQ: Fear of Spiders Questionnaire; CR-EXP: Cognitive restructuring before exposure condition; EXP-CR: Exposure before cognitive restructuring condition; SM: Stress management control condition.

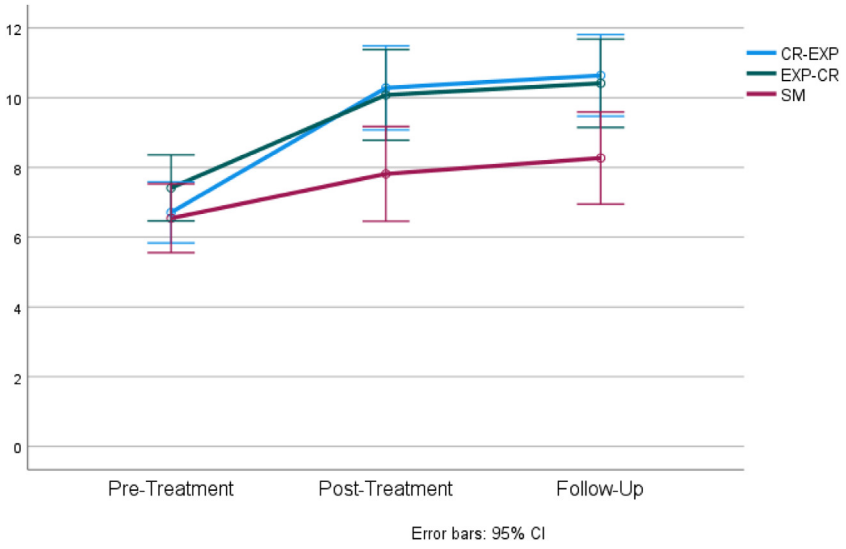

Figure 5 Mean BAT Scores by Group at Pre-Treatment, Post-Treatment, and Follow-Up. BAT: Behavioral Approach Test; CR-EXP: Cognitive restructuring before exposure condition; EXP-CR: Exposure before cognitive restructuring condition; SM: Stress management control condition.

and EXP-CR group, $F(2, 79) = 4.18$, $p < .05$, $\eta_p^2 = .10$. There were no significant overall differences between CR-EXP and EXP-CR, $F(2, 79) = 1.13$, $p = .33$, $\eta_p^2 = .03$. Planned contrasts showed that, relative to the SM group, SBQ scores decreased significantly more from pre- to post-treatment in the CR-EXP group, $t(79) = -4.11$, $p < .001$, and in the EXP-CR group, $(79) = -2.79$, $p < .01$. Relative to SM, SBQ scores decreased significantly more from pre-treatment to follow-up among participants in the CR-EXP group, $t(79) = -3.28$, $p < .01$, although this difference did not reach significance in the EXP-CR group, $t(79) = -1.98$, $p = .05$.

There were no significant differences in SBQ scores between the CR-EXP and EXP-CR groups from pre- to post-treatment, $t(79) = -1.32$, $p = .19$, or from pre-treatment to follow-up, $t(79) = -1.27$, $p = .21$. Fig. 6 depicts changes in SBQ scores by condition over time.

Exposure Process Variables

Expectancy change

Table 3 presents mean harm expectancy ratings at pre- and post-exposure for the CR-EXP and EXP-CR groups. Analyses revealed a significant main effect of time, indicating overall change in harm expectancies (i.e., expectancy violation) from pre- to post-exposure, $F(1, 27) = 19.42$, $p < .001$, $\eta_p^2 = .42$. The time $\times$ condition interaction, however, was not significant, $F(1, 27) = .033$, $p = .86$, $\eta_p^2 = .001$.

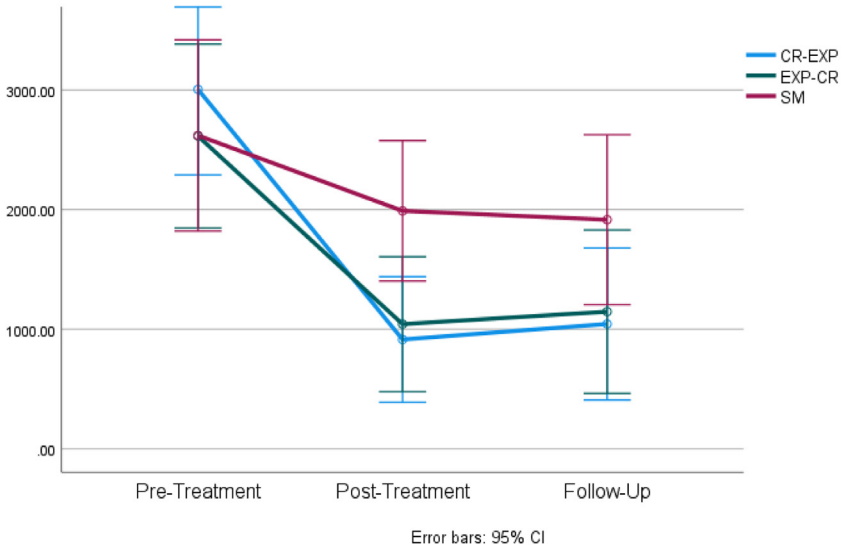

Figure 6 Mean SBQ Scores by Group at Pre-Treatment, Post-Treatment, and Follow-Up. SBQ: Spider Beliefs Questionnaire; CR-EXP: Cognitive restructuring before exposure condition; EXP-CR: Exposure before cognitive restructuring condition; SM: Stress management control condition.

Table 3 Descriptive data at pre-exposure and post-exposure.

	CR-EXP ($n = 15$)			EXP-CR ($n = 15$)			
	M	SD	Range	M	SD	Range	*p*
Pre-exposure expectancy rating	28.60	24.15	0—70	47.33	29.87	0—95	.07
Post-exposure expectancy rating	4.36	8.25	0—30	23.20	26.13	0—80	< .001
Expectancy Change	24.53	21.61	0—70	24.13	37.40	−60—85	.97

Expectancy Change: Pre-exposure expectancy rating - Post-exposure expectancy rating; CR-EXP: Cognitive restructuring before exposure condition; EXP-CR: Exposure before cognitive restructuring condition.

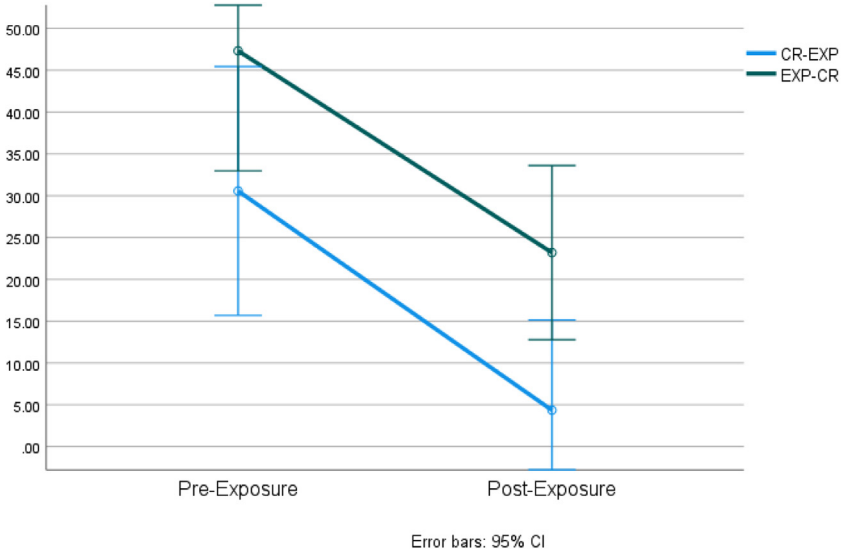

Figure 7 Mean Harm Expectancy Ratings at Pre-Exposure and Post-Exposure for CR-EXP and EXP-CR Groups. CR-EXP: Cognitive restructuring before exposure condition; EXP-CR: Exposure before cognitive restructuring condition.

An independent samples *t*-test did not detect a significant mean difference in expectancy change (e.g., difference in perceived likelihood of feared outcome) between the CR-EXP and EXP-CR conditions, $t(28) = .036$, $p = .97$. There was also no significant mean difference in pre-exposure expectancy ratings between the CR-EXP and EXP-CR conditions, $t(28) = -1.89$, $p = .07$, $d = .69$. There was, however, a significant mean difference in post-exposure expectancy ratings between the CR-EXP and EXP-CR conditions, whereby the EXP-CR group evidenced greater post-exposure harm expectancies ($M = 23.20$) than the CR-EXP group ($M = 4.36$), $t(27) = -2.58$, $p < .001$, $d = .97$. Fig. 7 depicts changes in harm expectancies.

Discussion

This randomized controlled trial tested a key clinical implication of ILT: that CR is counterproductive when delivered prior to exposure due to its interference with expectancy violation (Craske et al., 2014). This hypothesis is relevant to clinical practice given that many exposure-based treatment manuals suggest using CR as a prelude to exposure in order to help patients reduce overestimates of threat and feel less anxious about the exposure task itself (e.g., Barlow, 2014). Findings from this study build on decades of work (e.g., Ilardi & Craighead, 1994) examining the most essential and potent components of CBT for various diagnoses.

Our first hypothesis—that the CR-EXP and EXP-CR groups would both show greater reductions in spider phobia relative to the SM group—was supported. Consistent with previous research on the efficacy of single-session exposure therapy for specific phobia (Zlomke & Davis, 2008), we observed medium to large effect sizes at post-treatment and follow-up. The effect of treatment condition was also significant for behavioral approach (BAT steps) and spider phobia cognitions (SBQ) at post-treatment, such that the CR-EXP and EXP-CR groups both evidenced greater improvements than the SM group. Findings were mixed, however, at follow-up. Specifically, changes in behavioral approach and spider phobia cognitions were larger in the CR-EXP group than the SM group, yet the differences between EXP-CR and SM groups were non-significant. Visual inspection of group means suggests that this pattern was driven, at least in part, by continued improvement among individuals in the SM group from post-treatment to follow-up across all outcome measures. One possible explanation is that although the BAT was designed purely as an assessment tool, it may have served as a brief exposure exercise for some participants. This might have maximized expectancy violation for all groups and reduced group differences. Another possibility is that the lack of difference between EXP-CR and SM groups at follow-up points to a meaningful limitation of EXP-CR that would be illuminated in a larger sample.

Our ILT-derived hypotheses—that CR-EXP would be deleterious relative to EXP-CR—were not supported at post-treatment or follow-up. First, there were no significant differences in improvement in spider fear or related cognitions when CR was delivered before or after exposure. Moreover, although ILT suggests that maximizing expectancy violation inhibits the return of fear, both CR-EXP and EXP-CR groups maintained their fear reduction at follow-up.

Even when we examined expectancy violation more closely, this hypothesis was not supported. Consistent with previous research (Deacon et al., 2013; De Kleine et al., 2017; Scheveneels et al., 2019), harm expectancy ratings decreased over the course of exposure therapy. In concert, these findings are inconsistent with the predictions of ILT and suggest that implementing CR before exposure does not attenuate changes in harm expectancies or overall outcome. It is indeed possible that because exposure is such a powerful intervention for phobias, the method of implementation is not consequential enough to influence variables such as harm expectancy or symptom-related outcome. Along similar lines, it is possible that the benefits of maximizing expectancy violation and reducing threat appraisals via cognitive restructuring are similar. Indeed, findings from a recent meta-analysis (Draheim & Anderson, 2021) point to the effectiveness of cognitive behavioral therapy for improving patients' ability to make more realistic appraisals of threat. Importantly, however, symptom assessments occurred before and after the complete treatment package was delivered rather than after the exposure component, so it remains possible that exposure potency was enhanced by postponing CR, even if there were no differences in overall outcomes.

Further comparison of group expectancy ratings yielded interesting findings. Whereas the mean difference scores were nearly identical between groups, expectancy scores before exposure tended to be lower for participants in the CR-EXP group (who received cognitive restructuring prior to providing ratings) relative to those in the EXP-CR group (who did not). Although this difference did not quite reach statistical significance pre-exposure, the trend suggests that in the CR-EXP group, the cognitive intervention changed beliefs about the likelihood of an adverse event when confronting the spider. Rather than restricting the magnitude of expectancy violation as suggested by ILT, however, the cognitive intervention appeared to ''promote'' lower expectancy ratings at the end of exposure. That is, although the magnitude of change was comparable between groups, negative expectancies after exposure were rated lower when cognitive restructuring was delivered before exposure. Future research with larger samples and varying doses of exposure therapy is needed to confirm the robustness of these findings.

Findings from this study should be considered within the context of several limitations. First, the relatively small sample size may have limited our power to detect statistically significant differences. Second, our sample lacked diversity with respect to demographic variables (e.g., race, ethnicity, gender). Participants who identify as Black or African American, Asian, and/or Hispanic/Latinx were underrepresented, which is consistent with the broader racial/ethnic inequity and exclusion in anxiety-related disorders research. Given the underrepresentation of individuals with these identities in clinical trials and evidence-based treatment programs (e.g., Williams et al., 2013; Chavira et al., 2014; Ching & Williams, 2019), it is imperative that future trials recruit more diverse samples (e.g., Williams, Beckmann-Mendez, & Turkheimer). Third, our findings might be specific to individuals with spider phobia. Finally, all study therapists received comprehensive training, which does not reflect the heterogeneity of

outpatient programs and community clinics and might have impacted the large treatment effects we observed.

In summary, we did not observe the hypothesized attenuation of negative expectancies or expectancy violation associated with implementing CR before exposure for either short- or long-term treatment outcomes for spider phobia. Results from this study do, however, underscore the efficacy of brief, exposure-based CBT interventions for specific phobia, which do not appear to be contingent upon ILT-informed treatment delivery. Extending these findings to clinical practice, therapists may not need to be concerned with the order of treatment components when delivering CBT for specific phobia.

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Disclosure of interest

The authors declare that they have no competing interest.

References

Abramowitz, J. S. (2012). *The stress less workbook: Simple strategies to relieve pressure, manage commitments, and minimize conflicts*. Guilford Publications.

Abramowitz, J. S., Deacon, B. J., & Whiteside, S. P. H. (2019). *Exposure therapy for anxiety, second edition: Principles and practice*. Guilford Publications.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Antony, M. M., Barlow, D. H., & Craske, M. G. (1995). *Mastery of your specific phobia*. Graywind Publications Incorporated.

Arch, J. J., & Craske, M. G. (2009). First-line treatment: A critical appraisal of cognitive behavioral therapy developments and alternatives. *Psychiatric Clinics of North America*, *32*(3), 525—547. https://doi.org/10.1016/j.psc.2009.05.001

Arntz, A., Lavy, E., van den Berg, G., & van Rijsoort, S. (1993). Negative beliefs of spider phobics: A psychometric evaluation of the spider phobia beliefs questionnaire. *Advances in Behaviour Research and Therapy*, *15*(4), 257—277. https://doi.org/10.1016/0146-6402(93)90012-Q

Bandelow, B., & Michaelis, S. (2015). Epidemiology of anxiety disorders in the 21st century. *Dialogues in clinical neuroscience*, *17*(3), 327. https://doi.org/10.31887/DCNS.2015.17.3

Barlow, D. H. (Ed.). (2014). *Clinical handbook of psychological disorders: A step-by-step treatment manual*. Guilford publications.

Blakey, S. M., Abramowitz, J. S., Buchholz, J. L., Jessup, S. C., Jacoby, R. J., Reuman, L., & Pentel, K. Z. (2019). A randomized controlled trial of the judicious use of safety behaviors during exposure therapy. *Behaviour Research and Therapy*, *112*, 28—35. https://doi.org/10.1016/j.brat.2018.11.010

Brown, T. A., & Barlow, D. H. (2014). *Anxiety and Related Disorders Interview Schedule for DSM-5 (ADIS-5) - Lifetime Version: Client Interview Schedule 5-Copy Set. Treatments That Work*.

Chavira, D. A., Golinelli, D., Sherbourne, C., Stein, M. B., Sullivan, G., Bystritsky, A., & Craske, M. (2014). Treatment engagement and response to CBT among Latinos with anxiety disorders in primary care. *Journal of Consulting and Clinical Psychology*, *82*(3), 392—403. https://doi.org/10.1037/a0036365

Ching, T. H., & Williams, M. T. (2019). The role of ethnic identity in OC symptom dimensions among Asian Americans. *Journal of Obsessive-compulsive and Related Disorders*, *21*, 112—120. https://doi.org/10.1016/j.jocrd.2019.03.005

Craske, M. G., Kircanski, K., Zelikowsky, M., Mystkowski, J., Chowdhury, N., & Baker, A. (2008). Optimizing inhibitory learning during exposure therapy. *Behaviour Research and Therapy*, *46*(1), 5—27. https://doi.org/10.1016/j.brat.2007.10.003

Craske, M. G., Treanor, M., Conway, C. C., Zbozinek, T., & Vervliet, B. (2014). Maximizing exposure therapy: An inhibitory learning approach. *Behaviour Research and Therapy*, *58*, 10—23. https://doi.org/10.1016/j.brat.2014.04.006

De Kleine, R. A., Hendriks, L., Becker, E. S., Broekman, T. G., & van Minnen, A. (2017). Harm expectancy violation during exposure therapy for posttraumatic stress disorder. *Journal of Anxiety Disorders*, *49*, 48—52. https://doi.org/10.1016/j.janxdis.2017.03.008

Deacon, B., Kemp, J. J., Dixon, L. J., Sy, J. T., Farrell, N. R., & Zhang, A. R. (2013). Maximizing the efficacy of interoceptive exposure by optimizing inhibitory learning: A randomized controlled trial. *Behaviour Research and Therapy*, *51*(9), 588—596. https://doi.org/10.1016/j.brat.2013.06.006

Draheim, A. A., & Anderson, P. L. (2021). Does cognitive behavioral therapy for anxiety disorders improve threat reappraisal?: A meta-analysis. *Journal of Behavioral and Cognitive Therapy*, *31*(2), 125—135. https://doi.org/10.1016/j.jbct.2020.12.004

Foa, E. B., & Kozak, M. J. (1986). Emotional processing of fear: Exposure to corrective information. *Psychological Bulletin*, *99*(1), 20—35. https://doi.org/10.1037/0033-2909.99.1.20

Foa, E. B., & McNally, R. J. (1996). Mechanisms of change in exposure therapy. In R. Rapee (Ed.), *Current controversies in the anxiety disorders* (pp. 329—343). Guilford Press.

Ilardi, S. S., & Craighead, W. E. (1994). The role of nonspecific factors in cognitive-behavior therapy for depression. *Clinical Psychology: Science and Practice*, *1*(2), 138.

Kaczkurkin, A. N., & Foa, E. B. (2015). Cognitive-behavioral therapy for anxiety disorders: an update on the empirical evidence. *Dialogues in Clinical Neuroscience*, *17*(3), 337—346. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4610618/

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*, *62*(6), 593—602. https://doi.org/10.1001/archpsyc.62.6.593

Lang, A. J., Craske, M. G., & Bjork, R. A. (1999). Implications of a new theory of disuse for the treatment of emotional disorders. *Clinical Psychology: Science and Practice*, *6*(1), 80—94. https://doi.org/10.1093/clipsy/6.1.80

Lombard, M., Snyder-Duch, J., & Bracken, C. C. (2002). Content analysis in mass communication: Assessment and reporting of intercoder reliability. *Human Communication Research*, *28*, 587—604. https://doi.org/10.1093/hcr/28.4.587

Muris, P., & Merckelbach, H. (1996). A comparison of two spider fear questionnaires. *Journal of behavior therapy and experimental psychiatry*, *27*(3), 241—244. https://doi.org/10.1016/S0005-7916(96)00022-5

Myers, K. M., & Davis, M. (2007). Mechanisms of fear extinction. *Molecular Psychiatry*, *12*(2), 120—150. https://doi.org/10.1038/sj.mp.4001939

Oosterink, F.M. D., De Jongh, A., & Hoogstraten, J. (n.d.). UvA-DARE (Digital Academic Repository) Prevalence of dental fear and phobia relative to other fear and phobia subtypes. https://doi.org/10.1111/j.1600-0722.2008.00602.x.

Rachman, S. (1980). Emotional processing. *Behaviour Research and Therapy*, *18*(1), 51—60. https://doi.org/10.1016/0005-7967(80)90069-8

Rupp, C., Doebler, P., Ehring, T., & Vossbeck-Elsebusch, A. N. (2017). Emotional Processing Theory Put to Test: A Meta-Analysis on the Association Between Process and Outcome Measures in Exposure Therapy. *Clinical Psychology & Psychotherapy*, *24*(3), 697—711. https://doi.org/10.1002/cpp.2039

Scheveneels, S., Boddez, Y., De Ceulaer, T., & Hermans, D. (2019). Ruining the surprise: The effect of safety information before extinction on return of fear. *Journal of Behavior Therapy and Experimental Psychiatry*, *63*, 73—78. https://doi.org/10.1016/j.jbtep.2018.11.001

Shiban, Y., Schelhorn, I., Pauli, P., & Mühlberger, A. (2015). Effect of combined multiple contexts and multiple stimuli exposure in spider phobia: A randomized clinical trial in virtual reality. *Behaviour Research and Therapy*, *71*, 45—53. https://doi.org/10.1016/j.brat.2015.05.014

Szymanski, J., & O'Donohue, W. (1995). Fear of Spiders Questionnaire. *Journal of Behavior Therapy and Experimental Psychiatry*, *26*(1), 31—34. https://doi.org/10.1016/0005-7916(94)00072-T

Williams, M. T., Beckmann-Mendez, D. A., & Turkheimer, E. (2013). Cultural barriers to African American participation in anxiety disorders research. *Journal of the National Medical Association*, *105*(1), 33—41. https://doi.org/10.1016/S0027-9684(15)30083-3

Young, J., & Beck, A. T. (1980). *Cognitive Therapy Scale: Rating manual. In Unpublished manuscript*. University of Pennsylvania. https://doi.org/10.1016/S0005-7894(70)80030-2

Zlomke, K., & Davis, T. E. (2008). One-session treatment of specific phobias: a detailed description and review of treatment efficacy. *Behavior Therapy*, *39*(3), 207—223. https://doi.org/10.1016/j.beth.2007.07.003