Transdiagnostic Written Exposure Therapy: Piloting an Online Intervention

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Abstract

This is where the abstract goes.

Keywords: Core threats, Transdiagnostic anxiety, Written Exposure Therapy

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Written interventions have long been part of the psychological toolbox (Ruini & Mortara, 2022). They have been used both as an aid and as a central technique (Riordan, 1996; Smyth et al., 2008). Expressive writing is a therapeutic technique in which individuals freely write about emotional or traumatic experiences (Pennebaker, 1997). Evidence indicates that expressive writing has a consistent but limited effect (e.g., Frattaroli, 2006). However, there is evidence that expressive writing is highly effective in specific contexts. In particular, writing treatments have been found to be effective for PTSD in meta-analyses (e.g., Emmerik et al., 2013; Gerger et al., 2021) though evidence is mixed (Mogk et al., 2006).

Written Exposure Therapy (WET) is a structured, brief intervention designed to treat traumatic experiences through expressive writing. Originally developed as a focused application of imaginal exposure (IE), WET was created to offer a streamlined, accessible alternative to more traditional therapies. Studies have shown that WET yields strong effects, comparable to established treatments like Cognitive Processing Therapy and Prolonged Exposure (Sloan et al., 2012; Sloan et al., 2023; Sloan & Marx, 2019; Thompson-Hollands et al., 2019). While WET has traditionally been applied specifically to PTSD, recent studies have extended its use to generalized anxiety (Goldman et al., 2007; Ovanessian et al., 2019) including an online format (Roch-Gagné & Talbot, 2019), indicating its potential for broader, transdiagnostic applications.

This paper introduces Transdiagnostic WET, a variation of WET tailored for a transdiagnostic population. Since WET integrates elements of both IE and expressive writing, we address the foundations of each approach to fine-tune Transdiagnostic WET. Two key insights drive the modifications to WET: exposure needs to be a) focused and b) immersive.

Meta-analyses have found that more directive instructions yield better outcomes in

expressive writing (Frattaroli, 2006; Reinhold et al., 2018). Indeed, WET for PTSD focuses on the most distressing traumatic event that the client has (Sloan & Marx, 2019). Furthermore, WET has been found to be more effective when focusing on a single fear rather than alternating between different fears, both in GAD and PTSD (Fracalanza et al., 2014; Sloan et al., 2005). In PTSD, WET focuses on the central issue of anxiety - the traumatic event - by default . We propose to improve the focus of WET by explicitly focusing on core threats: the ultimate feared consequence of one's fear or anxiety (Huppert & Zlotnick, 2012; Zlotnick & Huppert, 2025). Clinicians suggest that focusing on core threats in psychological treatments improves efficacy, enhances generalizability, and reduces relapse (Foa & Kozak, 1986; Gillihan et al., 2012; Murray et al., 2016). We have developed an online questionnaire to reliably identify core threats (Zlotnick, 2025). Thus, to ensure that the intervention is accurately focused, we help participants identify their core threats and then instruct them to focus on these idiosyncratic core threats throughout their writing.

A second set of accommodations to the WET protocol is to help participants create an immersive script. Building on the work of Lang (1977), emotional processing theory contends that emotional activation is necessary for emotional processing to occur (Foa et al., 2006; Foa & Kozak, 1986). Indeed, IE protocols typically involve conjuring a vivid, detailed image of one's worst case scenario from a first person perspective (e.g., Abramowitz, 2006; Foa et al., 2012). Furthermore, focusing on the emotional aspects in writing is more beneficial than focusing on cognitive or control conditions (Sloan et al., 2007). Moreover, individuals undergoing WET show signs of physiological distress, supporting the idea that emotional activation is necessary for successful treatment (Wisco et al., 2016). However, the WET protocol for PTSD emphasizes recounting traumatic experiences from a distancing perspective (e.g., "as you look back upon it now") rather than an immersed perspective (e.g., "as if it were happening right now;" Sloan & Marx, 2019). This approach is based on the idea that a distanced perspective better facilitates "working through" difficult life experiences (Kross & Ayduk, 2011; e.g., Kross & Ayduk, 2017). We argue that this approach is

appropriate for PTSD, where a major aspect of the intervention is to reconstruct the traumatic narrative. Indeed, the WET protocol explicitly states this goal: "By repeatedly recounting the event, you will be able to correct for the splintered fashion in which the memory may have been stored." (Sloan & Marx, 2019, p. 53). We contend that for a transdiagnostic, non-traumatized population increased emotional activation is needed. Thus, we direct participants to immerse themselves in the writing by using first person, providing detailed sensory and emotional descriptions, and periodically closing their eyes and calling upon their imaginations.

The primary goal of this study was to develop and validate the efficacy of future-oriented WET. However, it is clear that a greater understanding of the underlying mechanisms of interventions will allow more precise interventions (Niv et al., 2021). Moreover, a holistic theory that integrates their theory is needed (Brewin, 1996; Hofmann & Hayes, 2019; Huppert et al., 2020). Thus, we aim to explore several potential mechanisms underlying WET's functioning (cf. Rousseau & Belleville, 2018).

1. Fear reduction: Early studies suggested that imaginal exposure promotes habituation of pathological anxiety (e.g., Foa & Chambless, 1978). Repeated exposure to the same scenario may lead to fear reduction through habituation—a decreased response to the imagined scenario—or through extinction, wherein the imagined scenario becomes neutral after breaking its association with an aversive stimulus (cf. Cooper et al., 2017). Fear reduction was assessed through self-reported responses to the imagined scenario before and after the intervention, measured both within and across sessions (see Foa & Kozak, 1986; Rupp et al., 2017).

2. Specific reactions to memories: While metacognitive beliefs apply to all mental events, specific memories or images may evoke distinct reactions, such as distress, intrusiveness, or avoidance. Changes in these reactions may occur without altering broader metacognitive beliefs. We measured participants' reported reactions to specific memories,

assessing changes in distress, intrusiveness, and avoidance.

3. Distress tolerance (DTS): Distress tolerance has been suggested as a critical factor in the efficacy of exposure therapy, potentially more important than fear reduction itself (Craske et al., 2008; Hayes et al., 1999). Repeated exposure to intense, negative emotional events may enhance participants' ability to tolerate distress. We predict that DTS will increase as a result of participants' engagement with the WET protocol.

4. Thought fusion: The belief that thoughts have direct causal effects on the world, behavior, and objects—referred to as thought fusion—has been linked to intrusive thoughts and OCD as well as other anxiety disorders (Rassin et al., 1999, 2001; Thompson-Hollands et al., 2013). Exposure to negative imagery without adverse consequences may reduce the perceived importance of thoughts, leading to improved outcomes. We hypothesize that WET will reduce thought fusion, supporting better symptom management.

5. Negative beliefs about images and memories: In addition to thought fusion, other metacognitive beliefs about images and memories can maintain distress. These include beliefs that recalling a memory is dangerous and may lead to losing control, "going crazy," or emotional collapse. Such beliefs about uncontrollability and danger may perpetuate avoidance and distress. WET aims to challenge these beliefs by encouraging safe engagement with distressing memories, fostering cognitive restructuring.

This study aims to extend WET in three ways: a) applying it to a transdiagnostic population; b) exploring its utility for coping with anticipated future threats rather than past events; and c) assessing its effectiveness as a self-administered, online intervention. Our goal is to provide individuals across a transdiagnostic range of anxiety-related disorders with tools to manage anxiety independently. To date, WET has not been widely tested within this type of sample or setting. Thus, our primary aim is to evaluate its effectiveness in reducing anxiety symptoms. We hypothesized that WET will yield greater reductions in

anxiety symptoms and improvements in well-being compared to both active control (written distraction imagery) and waitlist control conditions.

An additional aim is to investigate the mechanisms underlying WET's effects, enhancing our understanding of how it facilitates therapeutic change. More insight into mechanisms could help to fine tune theory, optimize therapeutic processes and improve outcomes (Huppert et al., 2020; Niv et al., 2021). We measured potential mechanisms that might drive WET's effects, focusing on both threat-specific processes (e.g., fear reduction, reactions to distressing memories) and threat-agnostic processes [e.g., distress tolerance, thought fusion, and negative metacognitions regarding memories or images; Rousseau and Belleville (2018)].

To explore these processes, we examined whether WET elicits changes in these factors and, if so, whether these changes correlate with reductions in anxiety symptoms. We anticipate that changes in mechanisms will align with symptom changes, supporting their role in the intervention's therapeutic process. This experiment was pre-registered prior to data collection doi.org/10.17605/OSF.IO/2CEHR.

Methods

This study was a randomized controlled trial (RCT) in which participants were randomly assigned to one of two groups: the treatment group (WET) or the control group (Neutral Imagery Writing, NIW). Additionally, data from a waitlist control group was incorporated, collected from a prior study with the same structure and inclusion/exclusion criteria (see Sorka et al., in preparation). This provided both a passive control and an active control for comparison. The study employed a double-blind design to ensure objectivity. Study personnel had no direct interaction with participants, and both experimenters and participants were unaware of group assignments until the one-week follow-up. The primary outcome was defined as the change in OASIS scores, with changes in WSAS scores and other proposed mechanisms serving as secondary outcomes. Covariations between changes in

147 OASIS and changes in each potential mechanism were also explored.

148   Supplementary materials, including datasets, analysis scripts, and detailed

149 methodological documentation, are available on GitHub at

150 https://github.com/eladzlot/transdiagnostic.wet-2025-public. To protect participant

151 confidentiality, the datasets have been redacted to include only quantitative information, as

152 the core threats and other open-ended responses could potentially identify specific

153 individuals. These resources enhance transparency and facilitate replication of the findings.

154 **Participants**

155   Participants were recruited through the Prolific platform, compensated at £9/hour.

156 Inclusion criteria included high pathological anxiety (greater than 4 on the OASIS), and

157 impaired daily function (at least one item scored above 2 on WSAS). Exclusion criteria were

158 severe depression (greater than 14 on the PHQ; Kroenke et al., 2009), post-trauma (greater

159 than 6 on the brief PCL-5; Zuromski et al., 2019), or psychotic symptoms (evaluated via

160 items 19 and 20 from the DIAMOND screener; Tolin et al., 2018). In addition, English as a

161 fluent language was required. Furthermore, participants who had reported head injury or

162 reading and writing difficulties in the Prolific system were excluded. Finally, only

163 experienced users on the Prolific platform with an approval rate of above 95, and with

164 minimum previous submissions of 300 were allowed to participate in this study. An

165 ethnically diverse sample was requested from Prolific.

166   A power analysis indicated that a sample size of 148 participants would provide 0.8

167 power, but due to financial constraints, Bayesian stopping criteria allowed for early

168 termination. Recruitment continued until region of practical equivalence (ROPE) showed no

169 significant difference could be found between WET and NIW conditions.

170   Participants were randomly assigned to the treatment and control groups in a 2:1

171 ratio, using block randomization ($OASIS \geq 8$), aiming to ensure equal distribution of

172 anxiety severity between groups. The randomization process was integrated into the

173 experiment program code.

Measures

175   The *Overall Anxiety Severity and Impairment Scale* (OASIS; Norman et al., 2006)

176 assesses the frequency, intensity, and functional impairment of anxiety and fear over the past

177 week. Participants rate their anxiety on a 5-point scale from 0 (little or none) to 4 (extreme

178 or all the time). Higher scores indicate more severe anxiety-related impairment, with a

179 cut-off score of eight recommended for distinguishing anxiety disorders and a change of four

180 points considered clinically significant (Moore et al., 2015). The OASIS has strong

181 psychometric properties, with an omega coefficient of 0.86 across timepoints in our sample,

182 indicating high reliability.

183   The *Work and Social Adjustment Scale* (WSAS; Mundt et al., 2002) was used to

184 assess functional impairment due to anxiety symptoms. The scale consists of five items, each

185 rated on a 9-point Likert scale (0 = no impairment to 8 = severe impairment), evaluating

186 the extent of difficulty in work, home management, social leisure, private leisure, and close

187 relationships. In our sample, the omega coefficient was 0.80, indicating high reliability.

188   The *Thought-Action Fusion Scale Revised* (TAF-R; Shafran et al., 1996) measured

189 the degree to which individuals equate thoughts with actions. It includes 19 items rated on a

190 5-point Likert scale (0 = disagree strongly to 4 = agree strongly), with higher scores

191 indicating a stronger tendency toward thought–action fusion. The scale comprises two

192 subscales: **TAF-Moral**, which reflects the belief that having unacceptable thoughts is

193 morally equivalent to performing them, and **TAF-Likelihood**, which captures the belief

194 that thinking certain thoughts increases the likelihood of them occurring. We analyzed these

195 subscales separately. In our sample, the omega coefficient for moral and likelihood TAF was

196 0.94 and 0.97 respectively, indicating excellent reliability.

197   The *Brief Core Schema Scale* (BCSS; Fowler et al., 2006) was employed to assess

198   positive and negative cognitive self-schemas. It consists of 24 items regarding the self or

199   others (e.g., "I am talented"; "I am loved"), divided into two subscales each (e.g.,

200   self-positive and self-negative). Each item is rated on a 5-point Likert scale (0 = Don't

201   Believe it to 4 = Believe it totally). In our sample, the omega coefficients for each scale were

202   at least 0.87, indicating excellent reliability.

203   The *Distress Tolerance Scale* (DTS; Simons & Gaher, 2005) assessed participants'

204   ability to tolerate distressing emotions and situations. The DTS consists of 15 items rated

205   on a 5-point Likert scale (1 = strongly agree to 5 = strongly disagree), evaluating various

206   aspects of distress tolerance, including participants' perceived ability to withstand negative

207   emotions without engaging in impulsive behaviors. Due to a coding mistake, item 6 was

208   missing and item 7 was repeated twice, thus we dropped item 6 completely from all analyses.

209   In our sample, the omega coefficient was 0.93, indicating excellent reliability.

210   The *Metacognition Questionnaire-30* (MCQ-30; Wells & Cartwright-Hatton, 2004)

211   was employed to evaluate metacognitive processes and beliefs related to anxiety. The

212   MCQ-30 consists of 30 items rated on a Likert scale ranging from 1 (do not agree) to 4

213   (agree very much). It assesses five factors of metacognition: cognitive confidence, positive

214   beliefs about worry, cognitive self-consciousness, negative beliefs about the uncontrollability

215   of thoughts and danger, and beliefs about the need to control thoughts. In our sample, the

216   omega coefficients were at least 0.89, indicating excellent reliability.

217   The *Self-Compassion Scale-Short Form* (SCS-SF; Raes et al., 2011) assessed

218   participants' levels of self-compassion. The SCS-SF consists of 12 items rated on a 5-point

219   Likert scale (1 = almost never to 5 = almost always). Higher scores indicate a greater

220   frequency of self-compassionate thoughts and behaviors. In our sample, the omega coefficient

221   was 0.85, indicating excellent reliability.

The *Impact of Future Event Scale* (IFES; Deeprose et al., 2011) assessed the impact of intrusive prospective, personally-relevant imagery. Participants completed 24 items evaluating intrusive pre-experiencing, avoidance, and hyper-arousal, responding to how frequently each statement was true for them over the past seven days. Responses were given on a 5-point scale (0 = not at all to 4 = frequently). For example, one item asked, "Pictures about the future popped into my mind." In our sample, the omega coefficient was 0.89, indicating excellent reliability.

The *Brief State Anxiety Measure* (BSAM; Berg et al., 1998) was used to assess participants' state anxiety in response to their core threat. The BSAM consists of six items (relaxed, steady, strained, comfortable, worried, tense) adapted from the State-Trait Anxiety Inventory (STAI). These items are designed to provide a brief and efficient measure of state anxiety. Each item is rated on a 7-point scale (1 = Not at all, 4 = Very much so), with higher scores indicating greater levels of anxiety. In this study, participants were asked to imagine their core threat script for a few moments both before and after each writing session. They then completed the BSAM to report their current anxiety levels. The BSAM demonstrated excellent internal consistency in our sample, as indicated by an omega coefficient of 0.96.

The *Treatment Credibility Questionnaire* (Devilly & Borkovec, 2000) was used to evaluate treatment credibility. Credibility was assessed once, at the middle of Session 1, following the presentation of the overall treatment rationale and before the intervention itself. Patients rated the therapy on a scale from 0 (not at all) to 8 (very), assessing both how they felt about the intervention and how effective they believed it would be. The scale has demonstrated strong internal consistency and test–retest reliability (Devilly & Borkovec, 2000).

Procedure

The final protocol consists of several steps. In the initial phase, participants identified and articulated their core threats, which represent the ultimate fears underlying their

anxiety. They then developed a concise script connecting proximal threats to core threats,

creating a clear narrative of how these threats were expected to unfold. Participants engaged

in four 20-minute writing sessions designed to facilitate emotional processing, followed by

two follow-up sessions: the first one week after completing the intervention and the second

two months later (see Figure 1). Outcomes were measured at each session, while mechanisms

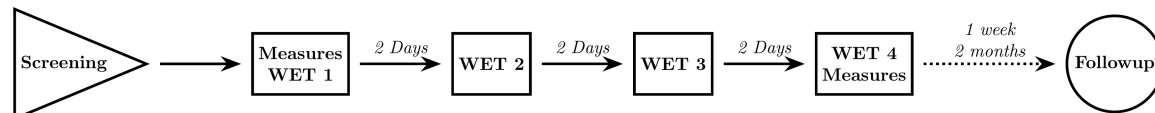were assessed pre- and post-intervention to observe the dynamics of change (see Kazdin,

2007).

Figure 1

The timeline of the experiment. WET stands for writing for both WET and NIW groups.
The waitlist control group completed the questionnaires at time equivalent to WET 1, WET 4,
and the 1 week follow-up

Symptoms, measured using the OASIS, were assessed before each writing session,

except for the final session, where symptoms were measured after writing. Additionally,

symptoms were measured at both follow-up sessions. Functioning, measured using the

WSAS, was assessed at pre-intervention, post-intervention, and both follow-ups. Mechanisms

were evaluated at pre-intervention (before the first writing session) and post-intervention

(after the fourth writing session).

Participants were divided into three groups: WET, NIW, and waitlist. The WET

group was instructed to expand on their threat script, focusing on repeated and detailed

exposure to distressing content, while the NIW group was guided to identify and describe a

neutral situation emphasizing sensory details without emotional valence. Both groups were

instructed to write vividly and in detail, describing their thoughts and emotions during the

exercise. The WET group received standard exposure-based psychoeducation, which

emphasized how confronting distressing material could reduce emotional impact over time.

In contrast, the NIW group received psychoeducation highlighting the value of distraction and mental control in fostering emotional regulation. The waitlist group, which served as a control, completed the OASIS and WSAS three times at one-week intervals to mirror the timepoints of pre-intervention, post-intervention, and one-week follow-up. Full instructions for both WET and NIW, including psychoeducation materials, are available in the supplementary materials.

Statistical Analysis

Change Model

In this study, we employ a multilevel ANCOVA design to account for the nested structure of the data, where anxiety responses are measured repeatedly within individuals over time (Bodner & Bliese, 2018; van Breukelen, 2013). The data collected is hierarchical in nature, with multiple measurements nested within each individual. This nested structure can lead to dependencies among observations within the same individual, violating the assumption of independence in traditional ANCOVA. For example, rate of change during the treatment is likely correlated to baseline symptom levels. Multilevel modeling, addresses these dependencies by incorporating random effects to capture the variability within and between individuals. By accounting for both within- and between-subject variability, multilevel modeling reduces bias that could arise from unaccounted dependencies in repeated measures, thus providing more precise estimates of the treatment effects. Furthermore, it becomes possible to investigate individual as well as group level effects (Raudenbush & Bryk, 2002).

To understand change, the estimand is the group level rate of change at each time point. In the first part of the study, efficacy was examined by the *fixed effects* — the average rates of change across individuals. These fixed effects allow us to assess the overall population-level impact of the interventions on anxiety symptoms and mechanisms at different time points.

In the second part of the study, symptom-mechanisms covariation was examined by modeling the *random effects* — the individual deviations from the group-level trends. These random effects allow us to capture individual differences in rates of change and explore how these differences relate to the proposed change-driving mechanisms. By modeling both fixed and random effects, we can explore not only the general efficacy of the intervention but also the individual variability in response to treatment, which may reveal underlying mechanisms.

To account for follow-up measurements at varying time lags (e.g., 1 week, 2 months), we employ a **piecewise growth model**, allowing for separate slopes at different follow-up times (Andersson et al., 2013; Bollen & Curran, 2006). This model enables us to estimate distinct rates of change during different phases of the study. Combined with the measurement model described below, this is in essence a latent change score model (Cáncer et al., 2021; McArdle, 2009).

The equation for this linear model is as follows:

$$\theta_{ti} = \beta_{0i} + \beta_{1i} \cdot \min(t - 1, 3) \cdot 1_{\{t>1\}} + \beta_{2i} \cdot 1_{\{t>5\}} + \beta_{3i} \cdot 1_{\{t=6\}}$$

$$\beta_{ji} = \bar{\beta}_{j,\text{condition}} + u_{ji}$$

The latent symptom severity (θ) is linearly modeled as a baseline effect (β_{0i}) for each individual and the rate of change after the first session and up to the fourth session (β_{1i}). Separate terms (β_{2i}) and (β_{3i}) represent the rate of change at follow-up (1 week, 2 months), allowing for flexible modeling of changes at different time intervals. The individual-specific effects, (β_{ji}), are modeled as deviations from the group-level effects, ($\bar{\beta}_{j,\text{condition}}$), to capture both individual and group variability.

Measurement Model

Given that anxiety was measured using an ordinal scale, we linked latent symptom severity (θ) to the observed ordinal responses using an ordered logit model with a cumulative

317 link function (McCullagh, 1980). This model assumes that ordinal responses are generated

318 by an underlying continuous latent variable, with thresholds (κ) defining the response

319 categories. The ordered logit function estimates the probability (ϕ) of endorsing each

320 response category based on the latent symptom severity trait (θ).

321   To account for measurement error and the multidimensionality of the anxiety

322 construct, we adopted a graded response model (GRM) from the item response theory (IRT)

323 framework (Samejima, 2016). The GRM is well-suited for ordinal data, modeling the

324 probability of endorsing an item category as a function of both item-specific parameters

325 (discrimination: (α), and difficulty: (β) and the individual's latent trait level (θ).

326   The GRM allows us to model the latent symptom severity (θ) for each individual at a

327 specific time point, while accounting for the unique characteristics of each item. The

328 discrimination parameter (α) captures how well each item distinguishes between individuals

329 with different levels of anxiety, while the difficulty parameter (β) reflects the trait level

330 required to endorse higher response categories. This approach helps address known issues

331 with the reliability of change scores (Prieler & Raven, 2008; Rodebaugh et al., 2016).

332   In this framework, θ is estimated from the multilevel model described earlier,

333 capturing both individual-specific (random) effects and group-level (fixed) effects. The

334 integration of the GRM with the broader multilevel model allows us to model the latent trait

335 accurately, taking into account both item-level variability and individual differences in

336 anxiety over time.

337   The equation for the measurement model is as follows:

$$R_{itq} \sim \text{Ordered-logit}(\phi_{itq}, \kappa)$$

338

$$\phi_{itq} = \alpha_q \cdot (\theta_{it} - \beta_q)$$

339   Here, the likelihood function represents the probability of observing the ordinal

340 response (R), given the latent symptom severity (θ). The IRT model specifies the

341 relationship between the latent trait and the item parameters, providing a comprehensive

342 approach to modeling anxiety across individuals. Detailed specifications for this model are

343 provided in Appendix 1, and the full code is available in the supplementary materials.

Mechanisms

344

345   Our second research question investigates the role of various mechanisms in driving

346 changes in pathological anxiety. While establishing causality is notoriously difficult,

347 particularly in psychological research (Eronen, 2020), our goal is to identify correlations that

348 may signal possible causal relationships.

349   Mechanisms of change in psychotherapy refer to the processes or events through

350 which psychological interventions achieve their effects on symptoms or functioning.

351 Demonstrating that an intervention causes a change, does not explain *why* these changes

352 came about. Establishing a mechanism requires strong association between the treatment

353 and process, and between the process and the outcome (Kazdin, 2007). Thus, our task is to

354 establish an association between the process and outcome for each process that was found to

355 change by the treatment.

356   The question here focuses on the process of change, thus we're interested in an

357 association between *changes* in process and mechanism. We use multivariate latent curve

358 models to examine the association between symptoms and process as they change through

359 time (Baldwin et al., 2014; Damian, 2010; MacCallum et al., 1997). This approach extends

360 common univariate growth models by allowing the simultaneous examination of multiple

361 outcomes, capturing both the relationships between individual processes and how they evolve

362 over time. Specifically, we model both anxiety (as measured by the OASIS) and the process

363 of interest in parallel, using a single covariance matrix to estimate the random effects for

364 both processes. Detailed specifications for this model are provided in Appendix 2, and the

full code is available in the supplementary materials.

By incorporating a shared covariance matrix, we capture the correlations between baseline values (intercepts) and changes (slopes) both within and across the two outcomes. This enables us to test whether baseline levels of a mechanism predict changes in anxiety (moderation) and whether changes in the mechanism correlate with changes in anxiety (mediation). These cross-process correlations help identify which mechanisms are most strongly associated with changes in anxiety, guiding future research aimed at testing causal pathways.

Although this analysis does not establish causality, it offers valuable insights into potential intervention targets. For example, identifying mechanisms that strongly correlate with changes in anxiety could inform more focused treatments by highlighting which processes to target for clinical improvement. Further research will need to extend these findings by extending them into full mediation models (Hilley & O'Rourke, 2022).

Missing Data and Estimation

All participants who began the intervention were included in the analysis. Missing data were imputed via Bayesian imputation, assuming that missingness may be affected by baseline trait levels and task completion difficulty.

We used Bayesian methods to estimate the parameters of the model using Markov Chain Monte Carlo (MCMC) algorithms implemented in Stan (Carpenter et al., 2017), and via the rethinking interface (McElreath, 2020). We specified weakly informative priors for the regression coefficients, the thresholds, and the item parameters. We assessed the convergence and the fit of the model using posterior predictive checks, trace plots, and effective sample sizes. We use a credible interval of 89% (McElreath, 2020).

<center>**Results**</center>

Participants

Recruitment began August 6, 2023, and ended September 25, 2023, and the final assessment occurred December 2, 2023. Of 375 individuals initially screened, 89 were randomly assigned at a 2:1 ratio to WET (n = 60, 67.4%) or NIW (n = 29, 32.6%) conditions. The age of participants in the NIW group was significantly lower than that of participants in the WET group (Wilcoxon test, $W = 628.00$, $p = .044$). Fisher exact test indicated no significant group differences in ethnicity or sex, and Wilcoxon tests showed no significant group differences for pre-treatment symptom measures ($ps > 0.36$).

Given the similarity in post-treatment outcomes between the treatment and control groups, we incorporated additional data (n = 73) from a waitlist control group. This data was collected in a similar study conducted between February 1 and February 24, 2023 (Sorka et al., in preparation). This was done in order to make sure that the changes found during the intervention were not due to chance. These subjects were randomly assigned to a waitlist control group for a study that focused on mechanisms of imagery rescripting. Given the identical inclusion/exclusion criteria and the minor time gap between data collection periods, we expect no systematic differences between the groups. The CONSORT flowchart (see Figure 2) provides a detailed overview of the recruitment, randomization, and follow-up processes across the two active groups.

The large majority of participants (n = 73, 82.0%) completed all assessments. Study completion rates did not differ between treatment (81.7%) and control (82.8%); Fisher's exact test, $p > .999$. Female participants had a significantly lower attrition rate (11.5%) compared to males (32.1%); Fisher's exact test, $p = 0.034$. Fisher's exact and Wilcoxon tests revealed no significant differences between study completers and non-completers in terms of age, ethnicity, or symptom measures ($ps > 0.24$). A detailed breakdown of pre-treatment demographic and symptom characteristics can be found in Table 1.
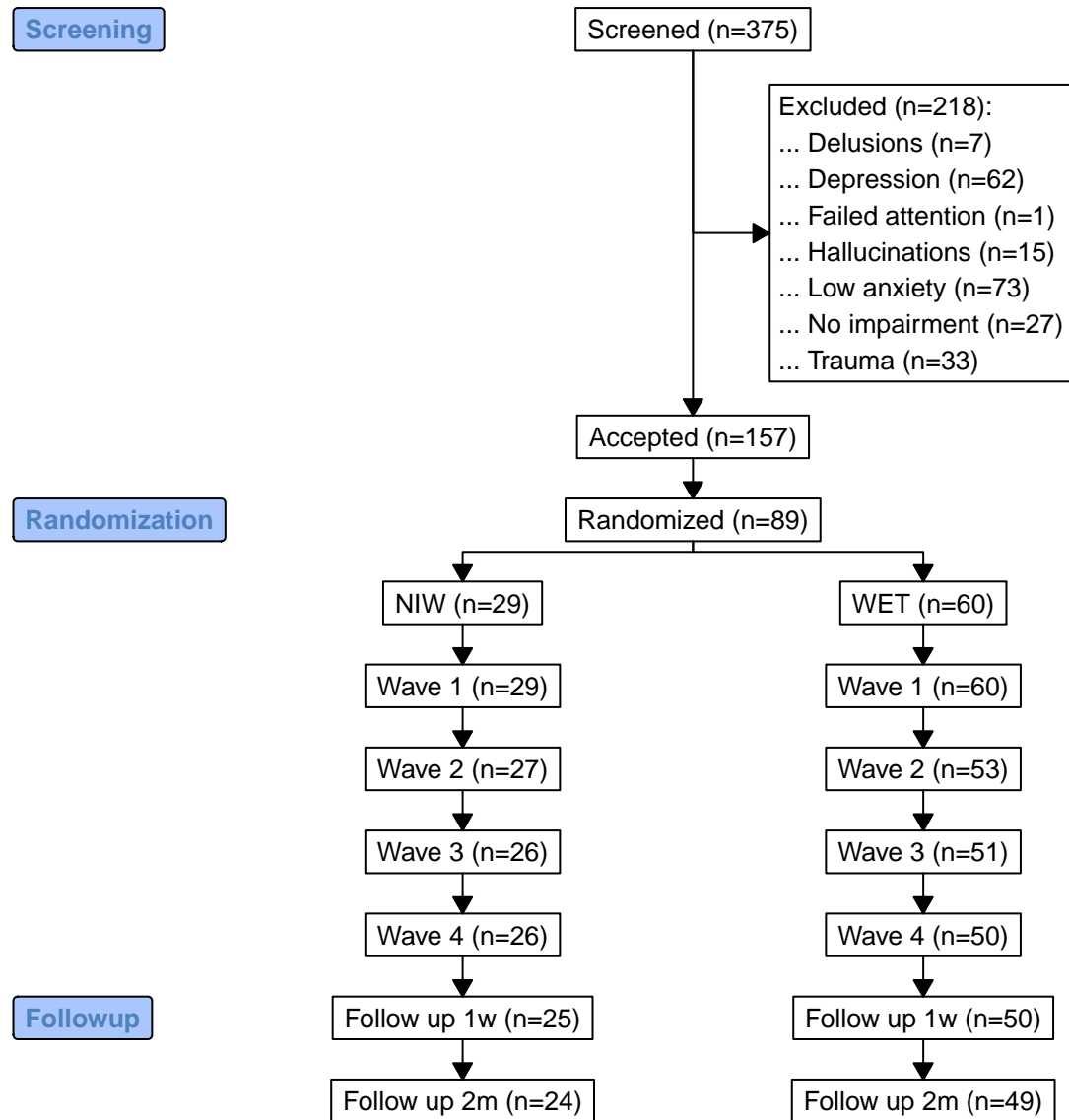
Figure 2

A CONSORT flowchart providing a detailed overview of the recruitment, randomization, and follow-up processes across the two active groups.

Table 1

Pre-treatment and Demographic Characteristics of Intent-to-Treat Sample.
WET = Written Exposure, NIW = Neutral Imagery Writing, Waitlist
group were added as a reference from a different study (Sorka et al., in
preparation).

Characteristics	Conditions			
	NIW	WET	Waitlist	Total
N	29	60	73	162
Age M (SD)	36 (11.9)	42.6 (15.3)	42.6 (13)	41.4 (13.8)
Gender Female	22 (75.9%)	39 (65%)	48 (65.8%)	109 (67.3%)
Gender Male	7 (24.1%)	21 (35%)	25 (34.2%)	53 (32.7%)
Ethnicity				
Asian	3 (10.3%)	7 (11.7%)	3 (4.1%)	13 (8%)
Black	4 (13.8%)	2 (3.3%)	1 (1.4%)	7 (4.3%)
White	22 (75.9%)	51 (85%)	69 (94.5%)	142 (87.7%)
Outcomes				
OASIS M (SD)	8.3 (3)	7.6 (2.7)	7.8 (2.8)	7.8 (2.8)
WSAS M (SD)	15.3 (6.8)	12.5 (6.4)	12.5 (6.4)	13 (6.5)

Note. Data are presented as number (percentage) of patients unless
otherwise indicated.

Intervention Quality

Both WET and NIW were rated highly on the Devilly Credibility Scale, indicating strong credibility in both interventions. On the cognitive subscale, WET scored 20.0 (6.5), while NIW scored 20.5 (7.1). Similarly, on the feeling subscale, WET scored 8.7 (3.8) and NIW scored 9.4 (4.1). These results suggest that participants found both interventions to be highly credible in terms of both their perceived logic and their intuitive appeal.

Participants generally found the writing task acceptable, though some in the WET condition reported it as difficult, while some in the NIW condition described it as progressively boring.

Participants in the WET condition successfully created powerful exposure scripts that addressed their core threats. For instance, an excerpt from the script of a socially anxious individual reads:

What am I doing here? I am a nobody. I know nothing. I feel almost sick now with nerves and dread. What if I just left now? Would anyone even notice? But it's too late...
I am to speak first, so I can't even steal other people's ideas...
[They're thinking] Who is this idiot? I stumble on and on. I want to stop and for it all to be over, but I can't. It just goes on forever. It is like dying in slow motion.

Adherence in the NIW condition was less strict, with some participants writing scripts that focused on positive outcomes rather than neutral events. For example, one participant wrote:

I feel enthusiastic about starting my day on a positive and productive day. Today instead of going through my phone for an hour on social media, I start with

438   making my bed and cleaning my room. ... I start applying for opportunities

439   that align with my qualifications and a bit of me is worried but still hopeful that

440   I get recognized and recruited.

441   This type of writing is similar to what is done in imagery rehearsal (cf. Krakow &

442 Zadra, 2006).

Symptom Measures

444   We fit a Bayesian latent growth curve model to assess the efficacy of the interventions

445 (see Figure 3 for a visualization of the model's estimated trajectories). We calculated the

446 standardized mean change (SMC) for each group using the pre-treatment standard deviation

447 as the denominator (Becker, 1988). This standardization allows comparisons across measures,

448 with higher effect size values indicating better outcomes. Additionally, we report the

449 probability of direction, which quantifies the certainty that the outcome is greater than 0.

450 The probability of direction, marked in this paper as P($>$0), ranges from 0 to 1, where values

451 close to 0 indicate high certainty of a negative effect (symptom deterioration), and values

452 close to 1 indicate high certainty of a positive effect (symptom improvement See Makowski et

453 al., 2019).

454   Trait anxiety, as measured by the OASIS, significantly improved across all three

455 interventions at the one-week follow-up. The estimated raw score improvements were M =

456 2.73, 89% CI [2.14, 3.35], P($>$0) = 100% for the WET group, M = 2.59, 89% CI [1.74, 3.41],

457 P($>$0) = 100% for the NIW group, and M = 0.86, 89% CI [0.23, 1.45], P($>$0) = 98% for the

458 Waitlist group.

459   Participants in the WET group showed significant improvements during the treatment

460 period compared to the Waitlist group ($d = 0.35$, 89% CI [0.09, 0.62], P($>$0) = 99%). These

461 gains continued at a similar rate at the one-week follow-up, again compared to the Waitlist

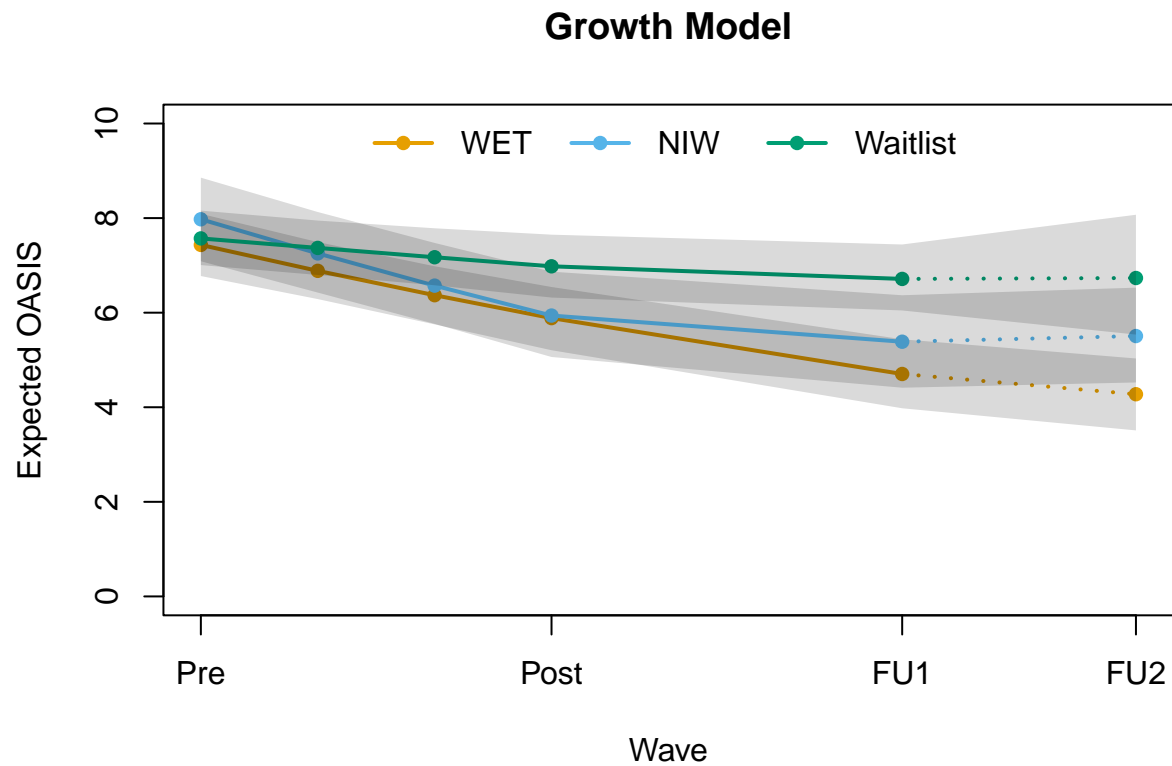462 group ($d = 0.34$, 89% CI [0.13, 0.56], P($>$0) = 99%). At the two-month follow-up, the gains

Figure 3

Estimated treatment trajectories for each intervention based on the latent growth model. Values are adjusted for gender. WET = Written Exposure Therapy; NIW = Neutral Imagery Writing. The time intervals between pre-treatment and post-treatment, and between post-treatment and followup 1 (FU1), were approximately one week. The interval between FU1 and followup 2 (FU2) was approximately two months, which is indicated by the dashed regression line. The shaded gray area represents the 89% credible interval (CI).

were likely continued at a slower rate relative to the projected Waitlist trajectory, as no

Waitlist data was collected at this time point ($d = 0.16$, 89% CI [-0.23, 0.57], P(>0) = 74%).

The improvement trajectory appeared linear, with consistent gains observed throughout the

intervention and continuing during both follow-ups. Total improvement when compared to

the projected Waitlist trend was $d = 0.85$, 89% CI [0.37, 1.37], P(>0) = 100%.

Participants in the NIW group also demonstrated significant improvements during

the treatment period compared to the Waitlist group ($d = 0.47$, 89% CI [0.18, 0.76], P(>0)

= 100%). These improvements were sustained at the one-week follow-up, again in

comparison to the Waitlist group ($d = 0.09$, 89% CI [-0.14, 0.33], P(>0) = 73%). At the

two-month follow-up, the gains were maintained relative to the projected Waitlist trajectory,

as no Waitlist data was collected at this time point ($d = -0.03$, 89% CI [-0.44, 0.38], P(>0)

= 43%). Although participants in the NIW group showed considerable overall improvement

($d = 0.52$, 89% CI [-0.02, 1.08], P(>0) = 94%). The L-shaped trajectory indicates that most

of the gains occurred during the treatment phase and then stabilized. From pre-treatment to

the two-month follow-up, WET demonstrated a slightly greater cumulative advantage over

NIW ($d = 0.33$, 89% CI [-0.05, 0.72], P(>0) = 91%). While participants in the NIW group

showed considerable overall improvement ($d = 0.52$, 89% CI [-0.02, 1.08], P(>0) = 94%), the

L-shaped trajectory suggests that most of the gains occurred during the treatment phase and

then stabilized. From pre-treatment to the two-month follow-up, WET demonstrated a

slightly greater cumulative advantage over NIW ($d = 0.33$, 89% CI [-0.05, 0.72], P(>0) =

91%).

Contrary to our hypothesis, the NIW group had a slight advantage over WET during

the treatment phase ($d = -0.11$, 89% CI [-0.41, 0.18], P(>0) = 27%). However, WET

outperformed NIW at both the one-week follow-up ($d = 0.25$, 89% CI [0.03, 0.47], P(>0) =

96%) and the two-month follow-up ($d = 0.20$, 89% CI [-0.09, 0.49], P(>0) = 86%).

These findings suggest that both WET and NIW interventions effectively reduce trait

489 anxiety compared to the Waitlist control. However, while NIW showed slightly greater gains

490 during the treatment phase, WET exhibited stronger and more sustained improvements

491 post-treatment. This pattern highlights the potential of WET for achieving longer-term

492 symptom reduction.

493   Functional impairment, assessed using the WSAS, showed significant improvement

494 across all three interventions. At one-week follow-up, the estimated improvement in WSAS

495 scores was M = 3.39, 89% CI [2.20, 4.60], P($>$0) = 100% for WET, M = 3.53, 89% CI [1.59,

496 5.36], P($>$0) = 100% for NIW, and M = 1.56, 89% CI [0.39, 2.72], P($>$0) = 98% for the

497 waiting list. Both WET (d = 0.29, 89% CI [0.03, 0.56], P($>$0) = 96%) and NIW (d = 0.27,

498 89% CI [-0.06, 0.59], P($>$0) = 91%) resulted in greater improvements in functional

499 impairment compared to the waiting list at the one week followup. However, no significant

500 differences were observed between them (d = 0.02, 89% CI [-0.31, 0.35], P($>$0) = 54%).

501 These outcomes were kept at the 2 month followup.

502 **Treatment Processes**

503   We now shift our focus to understanding the processes underlying change in WET.

504 Our second, exploratory hypothesis proposed that the identified mechanisms of change would

505 improve during therapy. Detailed results for WET are presented in Table 2. Below, we

506 highlight the significant findings in WET, alongside the corresponding effects observed in the

507 NIW group. Difference between the groups is reported in all places where it is significant.

508 This comparison aims to identify differential effects while maintaining a primary focus on

509 WET, which is the central topic of this paper. Full results for NIW are available in the

510 supplementary materials.

511   Distress tolerance (DTS) improved significantly in the WET group (d = 0.29, 89% CI

512 [0.07, 0.51], P($>$0) = 98%), while it may have deteriorated in the NIW group (d = -0.17,

513 89% CI [-0.41, 0.08], P($>$0) = 14%). The difference between the groups was statistically

514 significant (d = 0.46, 89% CI [0.14, 0.75], P($>$0) = 99%), aligning with our expectations.

Table 2

Process estimates for each of the proposed mechanisms in WET.

Measure	Mean		Change		
	Pre	Post	d	89% CI	P(>0)
DTS †	24.43	27.71	-0.29	[-0.51,-0.07]	0.02*
SCS †	20.45	20.43	0.00	[-0.13,0.14]	0.51
IFES	29.99	25.96	0.31	[0.13,0.49]	1.00*
TAF					
Morality	15.07	15.05	0.00	[-0.20,0.21]	0.52
Likelihood	3.79	2.81	0.14	[-0.03,0.31]	0.90
BCSS					
Self negative	4.25	3.80	0.11	[-0.05,0.26]	0.86
Other negative	6.10	6.12	-0.01	[-0.21,0.19]	0.48
Self positive	11.13	12.39	-0.23	[-0.37,-0.09]	0.01*
Other positive	13.07	13.40	-0.08	[-0.24,0.09]	0.22
MCQ					
(Lack of) Cognitive Confidence	3.43	2.21	0.29	[0.12,0.47]	0.99*
Positive Beliefs about Worry	4.10	4.09	0.00	[-0.18,0.19]	0.50
Cognitive Self-Consciousness	8.67	8.55	0.03	[-0.13,0.19]	0.62
Uncontrollability and Danger	6.62	5.71	0.21	[0.08,0.35]	1.00*
Need to Control Thoughts	4.58	4.29	0.09	[-0.08,0.26]	0.79

Note. † Indicates a measure of strength or positive attributes and negative change should be interpreted as improvement

515 WET likely encouraged participants to tolerate distress through structured exposure,

516 whereas NIW may have reinforced avoidance behaviors.

517   Positive self-schemas, as measured by the BCSS, increased significantly in WET ($d =$

518 0.23, 89% CI [0.09, 0.37], P(>0) = 99%), suggesting that the intervention fostered more

519 adaptive self-beliefs. In contrast, no significant change was found in the NIW group ($d =$

520 0.11, 89% CI [-0.08, 0.30], P(>0) = 84%).

521   Perceived impact of future events (IFES) decreased significantly in the WET group (d

522 = 0.31, 89% CI [0.13, 0.49], P(>0) = 100%). No significant change was observed in the NIW

523 group ($d = 0.05$, 89% CI [-0.14, 0.25], P(>0) = 67%).

524   For metacognitions measured by the MCQ, both (lack of) cognitive confidence ($d =$

525 0.29, 89% CI [0.12, 0.47], P(>0) = 99%) and negative beliefs about uncontrollability and

526 danger ($d = 0.21$, 89% CI [0.08, 0.35], P(>0) = 100%) increased significantly in WET.

527 However, no significant changes were found in the NIW group for either (lack of) cognitive

528 confidence ($d = $ -0.08, 89% CI [-0.34, 0.16], P(>0) = 30%) or negative beliefs about

529 uncontrollability and danger ($d = 0.07$, 89% CI [-0.08, 0.22], P(>0) = 77%).

530   These findings suggest several potential mechanisms of change for WET, which we

531 investigate in the upcoming section. The other mechanisms did not improve and thus will

532 not be analyzed.

533 **Mechanisms of Change**

534   We examined each process affected by WET to assess whether changes in these

535 processes corresponded with symptom change. Detailed results, including specific changes in

536 processes and symptom levels, can be found in Table 3.

537   The only process found both to respond to WET and to change alongside symptoms

538 was distress tolerance (DTS). The correlation between changes in DTS and symptoms during

treatment was r = -0.35, 89% CI [-0.61, -0.06], P($>$0) = 3%. Given that NIW actively

decreased distress tolerance, we investigated the effect of change in distress tolerance on

change in symptoms within NIW as well. We found that in contrast with WET, in NIW an

increase in distress tolerance was actually correlated with an increase in symptoms r = 0.29,

89% CI [-0.03, 0.59], P($>$0) = 93%. This suggests a differential process where in WET

distress tolerance decreases anxiety whereas in NIW anxiety is decreased via distraction and

avoiding stress.

No processes were significantly predictive of change at follow-up. However,

improvements in positive self-schema (r = -0.30, 89% CI [-0.63, 0.07], P($>$0) = 10%),

cognitive confidence (r = -0.28, 89% CI [-0.64, 0.11], P($>$0) = 13%), and a reduction in

negative beliefs about uncontrollability and danger (r = -0.42, 89% CI [-0.78, 0.06], P($>$0) =

7%) all weakly predicted change at follow-up.

Thus, these four processes warrant additional research when investigating the

mechanisms of WET.

Response to Core Threats

Alongside global mechanisms and metacognitions, we explored how participants'

threat responses changed in relation to their core threat. To investigate this, we examined

state anxiety before and after each writing session using the BSAM. Participants rated their

state anxiety while vividly imagining their core threat script. This approach allowed us to

assess both within-session and between-session changes in anxiety levels (see Figure 4).

Our findings revealed distinct differences between the groups. Both began with

similarly high levels of state anxiety. During the first session, the NIW group experienced a

significant reduction in anxiety, reflecting their instruction to distract themselves from the

threat. In contrast, the WET group's anxiety levels remained high and stable, consistent

with their instruction to focus on the core threat.

Table 3

Proposed mechanisms of change. Correlations between symptom change (during treatment and follow-up) and processes that have been found to change in WET.

Measure	Treatment			Followup		
	r	89% CI	P($<$0)	r	89% CI	P($>$0)
DTS †	-0.37	[-0.39, -0.34]	0.03*	0.13	[0.11, 0.16]	0.74
BCSS Self positive	-0.23	[-0.25, -0.20]	0.15	-0.31	[-0.34, -0.27]	0.10
IFES	0.26	[0.23, 0.29]	0.92	-0.07	[-0.10, -0.04]	0.37
(Lack of) Cognitive Confidence	0.13	[0.10, 0.16]	0.72	-0.29	[-0.32, -0.26]	0.13
Uncontrollability and Danger	0.42	[0.39, 0.46]	0.91	-0.45	[-0.48, -0.41]	0.07

Note. † Indicates a measure of strength or positive attributes, and negative correlation should be interpreted as alignment

564   By the second session, both groups had established new patterns: the NIW group

565   maintained the reduced anxiety achieved after session one, while the WET group

566   experienced a significant reduction in anxiety even below that of the NIW group. This

567   between-session reduction in state anxiety predicted improvements in trait anxiety (OASIS),

568   in line with meta-analysis showing that between session habituation is correlated with

569   treatment outcome (e.g., Rupp et al., 2017). However, stronger correlations were found in

570   the WET group ($r = 0.39$, 89% CI [0.13, 0.61], P($>$0) = 99%) than in the NIW group ($r =$

571   0.28, 89% CI [-0.04, 0.58], P($>$0) = 92%). It is reasonable to assume that the reduction in

572   trait anxiety in response to the core threat is caused by decrease in DTS, as seen above.

573   However, no correlation was found between change in DTS and change in state anxiety ($r =$

574   -0.03, 89% CI [-0.32, 0.26], P($>$0) = 43%).

575   The distinct trajectory of state anxiety in the WET group suggests a unique
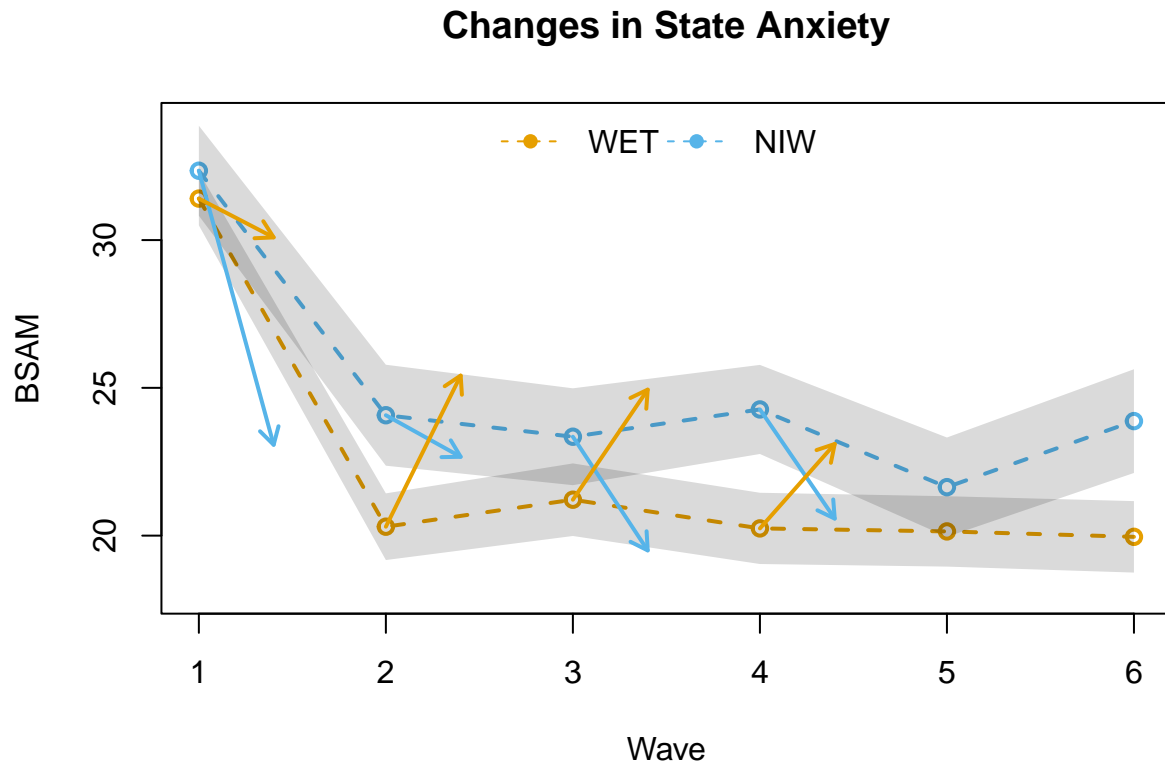
Changes in State Anxiety

Figure 4

Trajectory of state anxiety as a function of time. Dashed lines are the trajectory of pre intervention measurements. Arrows are within session changes, pointing at the post intervention measure.

576 mechanism of change. Specifically, the larger decrease in state anxiety between sessions in
577 the WET group may indicate deeper processing of core threats, which in turn is associated
578 with more robust symptom improvements.

579   Furthermore, within-session patterns diverged between the groups. For the NIW
580 group, writing reduced state anxiety, while for the WET group, it increased state anxiety.
581 This result serves as a manipulation check and aligns with the interventions' instructions:
582 WET participants were encouraged to actively engage with their fears, while NIW
583 participants were guided to distract themselves from them.

584   Interestingly, there was evidence of a slight reduction in the magnitude of
585 within-session anxiety increases over time in the WET group. This trend suggests that
586 participants may have become more accustomed to the task, potentially reflecting a process
587 of habituation.

Discussion

589   The results of this study suggest that future-oriented WET is an effective and
590 scalable intervention for treating transdiagnostic anxiety. Moreover, they highlight distress
591 tolerance and anxiety levels regarding one's core threat as key mechanisms of change.

Effectiveness of WET

593   Recent years have seen a growing interest in evidence-based self-help interventions,
594 including unguided (e.g., Morgan et al., 2017) and guided online treatments (Andersson et
595 al., 2019). These interventions often achieve effect sizes comparable to face-to-face therapy
596 (Esfandiari et al., 2021). Our findings contribute to this literature by demonstrating that
597 online future-oriented WET can achieve meaningful improvements and by emphasizing the
598 depth and personal engagement participants can achieve with thoughtfully designed prompts
599 and structured guidance. This raises potential for the incorporation of WET in
600 transdiagnostic or specific online protocols.

601   In a meta-analysis of online unguided self-help interventions, Wang and colleagues
602 (2023) reported small effects when treating anxiety ($d = -0.35$, 95% CI [-0.48, -0.22]).
603 Whereas in the current study, WET demonstrated a small effect size on anxiety during
604 treatment ($d = 0.35$) that developed into a medium effect size at one week follow-up
605 ($d = 0.69$) and was maintained at the two month followup (0.85). This change corresponds to
606 approximately 3.16 points on the OASIS, which is more than half the reliable change
607 threshold of 4.41 (Moore et al., 2015). Alongside the reduction in anxiety, we observed a
608 small but significant improvement in functional impairment, corroborating the clinical
609 relevance of the intervention.

610   These results suggest that while the current version of future-oriented WET is

611 effective, it should not be viewed as a standalone intervention. Instead, it should be

612 integrated as part of a larger, multi-component treatment framework and examined to see if

613 it improves outcomes.

614   Previous research has established WET's efficacy for specific disorders. For example,

615 Sloan and Marx demonstrated (when focusing on a past trauma) non-inferiority to

616 best-practice treatments for PTSD (Sloan et al., 2023; Thompson-Hollands et al., 2019).

617 Similarly, future-oriented WET has shown promise for treating generalized anxiety disorder

618 (Goldman et al., 2007; Ovanessian et al., 2019). Our findings extend these principles to

619 anxiety as a transdiagnostic phenomenon. Moreover, consistent with previous studies (Sloan

620 et al., 2018; Thompson-Hollands et al., 2018), we observed continued improvements

621 post-intervention, highlighting WET's potential for sustained effects.

622   The effectiveness of WET supports the notion that writing about one's future threats

623 enables emotional processing. Furthermore, it highlights that individuals are capable of

624 engaging in this process without the active guidance of a therapist. Beyond the implications

625 as an inexpensive and accessible intervention, WET provides a scalable method to

626 investigate processes in psychotherapy. It offers a relatively simple intervention that can

627 easily be adjusted to emphasize different aspects of the intervention process, such as focusing

628 on the first or third person, varying levels of immersion, or addressing past versus future

629 events. Additionally, WET generates rich textual data that can offer further insights into the

630 cognitive and emotional dynamics at play during emotional processing Thus, wet serves as

631 an important tool in the psychotherapy researcher's toolbox.

632 **Notes on Technique**

633   The WET protocol differs significantly from traditional, future-oriented imaginal

634 exposure flooding methods, introducing both key innovations and trade-offs (see Asnaani et

635 al., 2016). Traditional imaginal exposure typically involves recording a fixed threat script

that patients listen to repeatedly, emphasizing repetition and fostering immersion by encouraging patients to close their eyes and focus inward. In contrast, the WET protocol requires participants to rewrite their threat script during each session, sometimes multiple times. This approach creates a dynamic, evolving narrative that may facilitate deeper processing of the personal meanings associated with the threat. This technique is explicitly encouraged in the WET manual for PTSD (Sloan & Marx, 2019).

This approach introduces a tradeoff between immersion and reflective distance. While traditional imaginal exposure enhances internal focus through closed-eye immersion, WET requires writing with eyes open, which may reduce immersion but adds a layer of reflective distance. This act of writing allows participants to examine their feared experiences from new perspectives, encouraging deeper cognitive and emotional processing, even if it lacks the intense focus of imaginal exposure. To address this, participants are instructed to remain attuned to their emotions and sensations, and if they run out of content, briefly close their eyes to regain immersion.

Additionally, a unique challenge in imaginal exposure is the difficulty in assessing participants' levels of engagement and immersion. WET addresses this issue by creating a concrete, written record of participants' thoughts and experiences during exposure. Clinically, this written documentation provides valuable feedback, allowing therapists to guide participants on specific aspects to enhance (for example, advising them to focus more on physical sensations if needed). The written records are also useful for research, enabling analysis of factors like exposure duration, narrative detail, and the specific language used to describe the threat. This objective data allows for more nuanced understanding of how individuals process their fears and the therapeutic impact of the exposure.

NIW as an Intervention

At first glance, WET appears to have failed to improve immediate outcomes beyond the control condition. However, we argue that this interpretation may overlook a key factor:

662 NIW itself demonstrated significant effects, raising questions about its role as a "true"

663 placebo. Originally designed as a control condition, NIW produced unexpectedly robust

664 outcomes. Active control conditions in psychological interventions typically demonstrate

665 moderate effects. For example, research on internet-based cognitive behavioral therapy for

666 anxiety has shown that active control groups yield effect sizes around 0.5, using interventions

667 such as relaxation tasks or forum participation (Carlbring et al., 2011; Johansson et al., 2012;

668 Newby et al., 2018). The average effect size of expressive writing interventions is even lower

669 at 0.075 (Frattaroli, 2006). By contrast, NIW had an absolute effect size of 0.86 at the one

670 week follow-up. This level of effectiveness suggests that NIW cannot simply be dismissed as

671 a placebo.

672   Several mechanisms may explain NIW's unexpected efficacy. One possibility is the

673 role of *distancing*, a well-documented emotion regulation strategy (Kross & Ayduk, 2017;

674 Powers & LaBar, 2019). Writing about non-distressing topics may have helped participants

675 practice disengaging from threatening cognitions, facilitating emotional recovery. Indeed,

676 evidence suggests that such training reduces distress (Denny & Ochsner, 2014), and this was

677 the faux rationale given in the psychoeducation section. Alternatively, participants were

678 asked to evaluate their response to the core threat script twice every session in order to

679 evaluate their state anxiety, this could have acted as a sort of exposure. Additionally,

680 preliminary analyses of NIW scripts revealed that participants often produced highly positive

681 or meditative content. This suggests that mindfulness processes or the generation of positive

682 imagery may have contributed to the observed outcomes, consistent with findings that these

683 strategies improve emotional well-being (Hofmann et al., 2010; Pile et al., 2021). Similarly,

684 rehearsing positive ideation, even when unrelated to personal worries, has been shown to

685 counteract worry in individuals with generalized anxiety disorder (Eagleson et al., 2016).

686   Finally, baseline anxiety levels may also have influenced NIW's apparent effectiveness.

687 Participants in the NIW group started with slightly higher (though not significant) average

anxiety scores, which may have amplified their therapeutic gains. Greater baseline severity is often associated with larger improvements due to regression to the mean (Barnett et al., 2005) or the presence of more accessible pathology (Driessen et al., 2010). Thus, although the baseline difference was not statistically significant, it remains a potential confounder in interpreting the results.

Ultimately, the effectiveness of NIW highlights its potential as a therapeutic tool for training skills such as distancing, distraction, or disengagement. This experiment revealed contrasting trajectories between NIW and WET. NIW produced a rapid initial reduction in anxiety symptoms, demonstrating its utility as a short-term intervention. However, these gains plateaued over time. In contrast, WET showed slower initial progress but continued to reduce symptoms steadily, ultimately achieving greater long-term effectiveness.

These findings suggest that NIW may be valuable for immediate symptom relief, while WET provides more sustained benefits. The small sample size in the NIW condition (29 participants) limits the generalizability of these results, emphasizing the need for further research to confirm these effects and determine the optimal contexts for each approach.

How WET Works

It is clear that a greater understanding of the underlying mechanisms of interventions (Niv et al., 2021), and a holistic theory that integrates their theory is needed (Brewin, 1996; Hofmann & Hayes, 2019; Huppert et al., 2020). The current study aims to advance our understanding of treatment mechanisms by identifying potential mediators. Kraemer (2002) emphasizes that mediators are potential pathways linking treatment to outcomes, though not all mediators qualify as true causal mechanisms.

Rather than focusing on a specific process, we surveyed a range of potential mechanisms in order to identify candidates for mechanisms of change in WET. Of these, we focused on the processes that were found to change significantly in WET: distress tolerance

[713] (DTS), positive self-schema, perceived impact of future events, and metacognitive processes,

[714] including lack of cognitive confidence and negative beliefs about uncontrollability and danger.

[715] These processes were carried forward to investigate their roles in symptom reduction. Of

[716] these, only DTS was significantly correlated with symptom change in WET, providing

[717] evidence that DTS may serve as a key mechanism. Additionally, change in the anxious

[718] response to core threats was found to predict symptom change.

Distress Tolerance

[720] Distress tolerance, defined as an individual's ability to endure negative emotional

[721] states (Simons & Gaher, 2005), is increasingly recognized as a transdiagnostic factor

[722] implicated in emotional disorders. It has been linked to symptom severity and treatment

[723] outcome in conditions including depression (Lass & Winer, 2020), anxiety (Michel et al.,

[724] 2016), PTSD (Boffa et al., 2018), and substance use disorders (Leyro et al., 2010).

[725] Psychotherapies that enhance distress tolerance, such as dialectical behavior therapy, often

[726] improve patients' capacity to engage with distressing emotions, reducing avoidance behaviors

[727] and promoting resilience (Leyro et al., 2010). Indeed, prior research has demonstrated that

[728] DTS mediates change in mindfulness-based interventions (Li et al., 2023, 2024).

[729] Our findings suggest that WET fosters distress tolerance presumably by encouraging

[730] participants to engage with distressing thoughts and emotions. While these results support

[731] the role of DTS as a mechanism of change in WET, further research is needed to establish a

[732] causal connection between changes in DTS and symptom reduction (Kraemer et al., 2002).

[733] Specifically, longitudinal studies could clarify whether improvements in DTS precede or

[734] occur concurrently with symptom changes.

[735] Research suggests that specific subtypes of distress tolerance, such as intolerance of

[736] uncertainty and anxiety sensitivity, are stronger predictors of change than general DTS

[737] (Michel et al., 2016). This underscores the importance of refining our understanding of both

[738] the effects of WET on DTS and the role of DTS in symptom reduction. Future studies

739 would do well to investigate these subdomains, so that we can better delineate how WET

740 enhances specific facets of DTS and how these improvements contribute to therapeutic

741 outcomes. Breaking DTS into its components offers a more nuanced perspective, potentially

742 revealing differential pathways through which WET drives change. Such insights could guide

743 the development of tailored interventions that maximize the impact of DTS improvements

744 across diverse emotional disorders.

Responses to Core Threats

746 Central to pathological fear is the inflated sense of threat, making perceived threat

747 reduction a key mechanism for alleviating anxiety symptoms (Zlotnick & Huppert, 2025).

748 Our findings showed that WET not only reduced response to core threats but did so more

749 effectively than NIW. Notably, the rate of threat reduction between the first and second

750 sessions predicted symptom improvement by the fourth session, supporting the idea of a

751 causal relationship.

752 The majority of threat reduction in WET occurred between sessions one and two,

753 with minimal change thereafter despite ongoing symptom improvements. This pattern

754 suggests that repeated engagement with the core threat might exert its effects through other

755 mechanisms, such as DTS as seen above. Further research should explore whether improving

756 the writing script at each session to further engage in "hot spots" could improve threat

757 reduction across sessions. This approach aligns with practices in WET for PTSD, where

758 scripts are progressively refined each session (Sloan & Marx, 2019).

759 In this context, emotional engagement seems to be a prime target for improvement.

760 Evidence suggests that focusing on emotional rather than cognitive aspects of writing

761 enhances outcomes (Sloan et al., 2007). Future iterations of WET could integrate techniques

762 to deepen emotional processing at each session such as explicitly encouraging emotional

763 engagement or enhancing imagery realism (Holmes & Mathews, 2005, 2010). Furthermore,

764 improving the threat script itself, by better reflecting the core threat and decreasing

avoidance may also be important (Zlotnick & Huppert, 2025).

The distinct threat-response trajectories observed in WET and NIW illustrate their divergent mechanisms. In WET, sessions elevated threat-response, but the between-session reduction led to lower overall threat-response and to symptom improvement. In contrast, NIW provided short-term threat-response relief with smaller long-term benefits, likely reflecting its strategy of distraction rather than engagement with the core threat. This highlights the importance of targeting core threats in interventions designed to reduce anxiety.

Changes in both response to threats and distress tolerance predicted symptom reduction. It might be hypothesized that these two processes are related—for example, that a decrease in threat response results from an increase in distress tolerance. However, we found no significant correlation between these variables, suggesting that they operate as independent processes. This distinction highlights two complementary mechanisms underlying WET. First, distress tolerance represents a generic skill that applies across a wide range of distressing situations. In contrast, changes in threat response are more specific, addressing a particular threat that may manifest across various contexts. This is supported by the observed decrease in symptomatology, which is not tied to any single situation. Future research should investigate how these two processes interact to influence treatment outcomes. Exploring these complementary aspects could provide broader insights into therapeutic mechanisms beyond WET.

Advancing Mechanism-Driven Research with Transdiagnostic WET

As clinical psychology evolves from observational studies focusing primarily on intervention outcomes to hypothesis-driven research targeting specific mechanisms (see Hofmann & Hayes, 2019), there is a growing demand for scalable, flexible methodologies capable of exploring these mechanisms in depth. Addressing this need, the current study applies WET—an existing intervention designed to treat specific disorders—to a

transdiagnostic phenomenon: anxiety. Transdiagnostic WET represents a significant advancement by offering a concise, self-administered intervention that is easily delivered online. Beyond its demonstrated effectiveness in reducing anxiety and functional impairment, WET's adaptability is its true strength. Its structured yet flexible instructions can be modified to test various interventions, target different mechanisms, and assess their effects on a range of outcomes. This versatility positions WET as a valuable tool for mechanism-focused research.

The scalability of WET further enhances its utility, allowing for broad implementation on online platforms. This scalability not only increases accessibility but also facilitates the collection of detailed process data, paving the way for in-depth exploration of the mechanisms underlying therapeutic change. By leveraging these strengths, WET holds the potential to advance the field toward more personalized, effective interventions.

By enabling researchers to investigate both process and outcome across diverse populations and settings, WET moves the field closer to fulfilling the vision of process-focused, mechanism-driven research (Hofmann & Hayes, 2019). Future studies should continue to leverage WET's strengths to refine mechanistic understanding and develop interventions that are not only effective but also precisely targeted to underlying psychological processes.

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