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The effects of culturally adapted expressive writing interventions on depressive and anxiety symptoms among Chinese American breast cancer survivors: A randomized controlled trial

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Abstract

Background: Expressive writing interventions confer mental health benefits for non-Hispanic Whites. However, research is lacking in adapting this paradigm for minoritized groups. This study evaluated the impacts of two culturally adapted expressive writing interventions on depressive and anxiety symptoms and potential mediators (perceived stress and intrusive thoughts) among Chinese American breast cancer survivors (CABCS).

Methods and Results: CABCS (N = 136) were randomly assigned to one of three conditions to write three weekly essays: enhanced self-regulation condition (ESR) to write about stress and coping (Week 1), deepest feelings (Week 2), and finding benefits (Week 3); self-regulation condition (SR) to write about deepest feelings (Week 1), stress and coping (Week 2), and finding benefits (Week 3); and control condition to write about facts relevant to their cancer experience

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Credit statement

Qian Lu: Conceptualization, Methodology, Investigation and Data Collection, Writing – original draft, Review, & Editing, Supervision. **Nelson C. Y. Yeung:** Formal analysis, Writing – original draft, Review, & Editing. **William Tsai:** Writing – original draft, Review, & Editing. **Jacqueline H. J. Kim:** Writing – original draft, Review, & Editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.brat.2022.104244>.

(Weeks 1–3). Compared with the control condition, the ESR but not SR, reduced depressive and anxiety symptoms at all follow-up time points (1, 3, and 6-months) through reductions in perceived stress.

Conclusion: A cultural adaptation altering the order of expressive writing prompts resulted in the greatest benefit for CABCS’ depressive and anxiety symptoms. Research testing both the content and ordering of components may be vital to advance cultural adaptation science and optimize intervention efficacy.

Clinical trial registration number: [NCT02946619](https://clinicaltrials.gov/ct2/show/study/NCT02946619).

Keywords

Expressive writing intervention; Chinese American; Cancer survivors; Depressive and anxiety symptoms

1. Introduction

Breast cancer is the most common type of cancer among women (American Cancer Society, 2022). Breast cancer not only impacts physical health, but also influences survivors’ mental health, including greater risks of developing post-traumatic stress disorder and anxiety and depressive disorders (Pilevarzadeh et al., 2019). A meta-analysis of breast cancer survivorship studies reported that 32.2% of survivors experienced clinical levels of major depression and anxiety (Pilevarzadeh et al., 2019). As the number of breast cancer survivors grows due to improvements in prognosis, the need for treatment of cancer related mental health problems also becomes increasingly important.

In the United States, Asian Americans are the fastest growing minority group and are projected to double in population by 2050 (Pew Research Center, 2022). Of these, Chinese Americans represent the largest Asian subgroup. Asian American women have the fastest growing incidence rate of breast cancer in the United States, while the incidence rate for non-Hispanic White women have stabilized over the past two decades (Gomez et al., 2013). Despite these trends, evidence based and culturally sensitive interventions are lacking for this ethnic minority group.

Culturally sensitive interventions for Chinese Americans are especially important due to the cultural norms and barriers associated with the management of cancer related stress and negative emotions. For instance, Chinese collectivistic culture encourages emotion suppression as a strategy to maintain social harmony and a way to prevent burdening others with one’s distress (Kim, Atkinson, & Umemoto, 2001). Chinese breast cancer survivors experience ambivalence over emotion expression linked to depressive symptoms (Lu, Man, You, & LeRoy, 2015). Furthermore, stigma related to breast cancer is also highly prevalent and associated with lower quality of life (Tsai, Wu, & Lu, 2019) among Chinese breast cancer survivors, with many believing that breast cancer is punishment for previous misdeeds (Tsai & Lu, 2017). Chinese breast cancer survivors in the United States have smaller social networks, limited access to social support, and have more language related difficulties with navigating the healthcare system (Wen, Fang, & Ma, 2014). These cultural norms and related barriers also contribute to unmet mental health needs among Chinese

American breast cancer survivors, which further emphasize the importance of developing culturally sensitive interventions for this population.

1.1. Cultural adaptation of expressive writing

Interventions need to be sensitive to cultural variations in beliefs, values, and coping behaviors to effectively support the population of interest. In this vein, expressive writing may be a particularly relevant intervention for Chinese American breast cancer survivors. In a typical expressive writing intervention, participants are provided an opportunity to disclose their deepest emotions and thoughts over writing (Pennebaker & Beall, 1986; Pennebaker et al., 1997b, 2014). Expressive writing interventions, by design, can uniquely overcome many of the cultural barriers experienced by Chinese Americans in their successful adjustment during the survivorship stage. For instance, expressive writing provides an opportunity to reveal distressing emotions and thoughts privately through writing in their native language and without the fear of burdening others or disrupting social harmony.

Meta-analyses of expressive writing intervention studies have reported benefits in improving physical health, general functioning, and reducing psychopathology, including lower levels of depressive and anxiety symptoms (Frattaroli, 2006; Frisina, Borod, & Lepore, 2004). However, these interventions are primarily conducted among non-Hispanic Whites. Because the central assumption of traditional expressive writing is based on disclosing emotions whereas Asian cultural encourages emotional inhibition, new theoretical models and cultural adaptations are likely needed for expressive writing to be effective for Asians.

To guide the cultural adaptation of the expressive writing intervention, a self-regulation moderator of expressive writing (SMEW) model was developed (Lu & Stanton, 2010). In contrast to the essential role of emotional disclosure in the traditional model, the model emphasizes the essential role of cognitive reappraisal in producing health benefits. The model posits that cognitive reappraisal is a positive change in the evaluation of stressors and/or self. Cognitive reappraisal is theorized to improve health outcomes by reducing the impact of stress and helping individuals view their stressful experience more positively and obtain insights to better make sense of their experience. The combination of cognitive reappraisal and emotional disclosure constitutes a self-regulation process to produce health benefits. As predicted by the model, our study found that Asian American college students did not benefit from the traditional expressive writing condition (i.e., emotional disclosure writing only), but instead experienced greater reductions in physical symptoms and mood benefits in a novel writing condition that facilitated both cognitive reappraisal and emotional disclosure (Lu & Stanton, 2010). These findings support the SMEW theoretical model and point to the importance of theoretical guidance on the cultural adaptation of expressive writing interventions for minoritized groups.

However, when the adapted intervention was further tested among Chinese American breast cancer survivors, findings suggest further adaptation is needed. In the first randomized controlled trial of expressive writing with Chinese American breast cancer survivors (Lu et al., 2017), participants were randomly assigned to either a culturally adapted self-regulation condition (i.e., emotion disclosure in the first writing session, followed by cognitive reappraisal in the second writing session), traditional expressive writing condition (i.e.,

all emotion disclosure *only* writing sessions), or cancer-facts condition (Lu et al., 2017). Participants in the cancer-facts condition produced more insight and causal words and had the highest quality of life. The SMEW model suggests that cognitive reappraisal is essential and combining cognitive reappraisal and emotional disclosure produces health benefits. Although facilitating emotional disclosure first and then cognitive reappraisal did not improve outcomes, it is possible that facilitating cognitive reappraisal prior to emotional disclosure may work.

To incorporate stakeholders' perspective in further culturally adapt expressive writing, Lu, Gallagher, Loh, and Young (2018) elicit feedback from Chinese American breast cancer survivors on the writing instructions developed based on the SMEW model. Survivors reported being more comfortable with the cognitive reappraisal writing prompt, which involved disclosing their stressors and the impact cancer has had on their lives, in comparison with the typical traditional expressive writing prompts that focused only on disclosing cancer-related negative emotions. Specifically, participants noted that the expression of negative emotions required more time for them to comfortably reveal their negative emotions – even privately over writing. These qualitative findings are consistent with studies that have shown cultural differences in the values placed on emotion expression and their implications for psychological well-being (e.g., De Vaus, Hornsey, Kuppens, & Bastian, 2018; Tsai & Lu, 2018). Individuals with interdependent self-views place high value on emotion restraint as a way to preserve social harmony (Tsai et al., 2019). As such, they may benefit less from immediate and direct emotional disclosure, even over writing, as it is not culturally normative (see Tsai & Lu, 2018 for a review). It is possible that the *order* in which cognitive reappraisal or emotion disclosure is facilitated in the weekly writing sessions would result in distinct mental health outcomes.

Based on these focus group findings, prior empirical findings, and the SMEW model (Lu et al., 2017; Lu & Stanton, 2010), an *enhanced* self-regulation condition, in which cognitive reappraisal were facilitated in the first writing session and then followed by emotional disclosure in the second writing session, was created. This condition was examined in a subsequent randomized controlled trial of expressive writing among Chinese American breast cancer survivors with quality of life as the primary outcome (Lu et al., 2018). It was found that individuals in the enhanced self-regulation condition reported improved quality of life over time compared to those in the cancer-facts condition. Moreover, only a small and non-significant change in quality of life was found in the self-regulation condition (i.e., emotional disclosure in the first writing session, followed by cognitive reappraisal in the second writing session). This study was the first to our knowledge that demonstrated that modifications made to the order of writing prompts – specifically by ordering the writing prompts to be more *culturally congruent* for the Chinese Americans – have significant effects on quality of life. These findings provide empirical support for the Framework for Reporting Adaptations and Modifications-Enhanced (FRAME) guidelines that identify the ordering in which intervention components are delivered as a potential adaptation and modification target (Stirman, Baumann, & Miller, 2019). For example, prior work suggests that therapists who felt that evidence-based practices were not aligned with their typical approach were more likely to reorder the treatment elements to better serve their clients (Lau et al., 2017) . However, the *order* in which cognitive reappraisal or emotion disclosure is

facilitated in the weekly writing sessions would result in distinct mental health outcomes and the underlying mechanism have yet to be tested.

1.2. The current study

Given unmet mental health needs among Chinese breast cancer survivors, the current study involved analyses of a previously published randomized controlled trial of expressive writing (Lu et al., 2018) to examine depressive and anxiety symptoms as secondary outcomes of the expressive writing intervention (Aim 1). Given that the facilitation of cognitive reappraisal in the first writing session may be the most culturally normative for this population, we hypothesized that participants in the enhanced self-regulation (ESR) condition would report greater reductions in depressive and anxiety symptoms compared to those in the cancer-fact (CF) condition (i.e., hypothesis 1.1) and the self-regulation (SR) condition (i.e., hypothesis 1.2); those in the SR condition would report greater reductions in symptoms compared to those in the CF condition (i.e., hypothesis 1.3).

Furthermore, an important next step was to investigate the “active ingredients” of interventions, which helps to understand how we can maximize the intervention’s effectiveness in altering the outcomes of interest (Onken, Carroll, Shoham, Cuthbert, & Riddle, 2014) (Aim 2). Accordingly, an additional goal of this secondary analysis was to build on the evidence for the efficacy of this culturally adapted expressive writing intervention for Chinese American breast cancer survivors by investigating potential mediators in predicting reduced anxiety and depressive symptoms. The SMEW model (Lu & Stanton, 2010) theorizes that cognitive reappraisal improves health outcomes by reducing the impact of stress. The social cognitive processing model (Lepore, 2001) posits that intrusive thoughts contribute to depressive and anxiety symptoms. As such, we hypothesized that the ESR condition would decrease perceived stress and intrusive thoughts (i.e., hypothesis 2), which would serve as potential mediators in reducing anxiety and depressive symptoms for Chinese American breast cancer survivors (i.e., hypothesis 3). If participants in the SR condition experienced reductions in depressive and anxiety symptoms, we would also explore the effects of the potential mediators in this condition.

Finally, deliberate adaptations and modifications made to psychosocial interventions, may enhance outcomes particularly if the intervention can be adapted to increase the fit of the intervention with the target population to increase engagement, acceptability, and improve psychological well-being (Bernal & Domenech-Rodriguez, 2012; Hall et al., 2019; Stirman et al., 2019). A third goal of the present study was to examine whether differences in the order in which cognitive reappraisal and emotional disclosure were facilitated would result in differences in participant engagement (i.e., as assessed by self-reported emotional disclosure in the writing and meaning/value they obtained from completing the writing sessions) (Aim 3). We hypothesized that the cultural congruence of facilitating cognitive reappraisal in the first session of the ESR condition would result in greater participant engagement compared to the SR and CF conditions.

2. Methods

This study was a randomized controlled trial examining the effects of an expressive writing intervention on health among Chinese American breast cancer survivors. The effects of the intervention on the primary outcome (i.e., quality of life) were published elsewhere (Lu et al., 2018). The current paper focused on aspects of mental health as secondary outcomes, including depressive and anxiety symptoms. To culturally adapt the intervention, we used a community based participatory research approach to incorporate stakeholders' (i.e., community leaders, community staff, and cancer survivors) input into the intervention design and implementation, addressing both surface and deep levels structures. The cultural adaptation considered surface level structure such as where and how to deliver the intervention; deep level structure including how to deliver mental health benefits by promoting writing in a cognitive and emotionally compatible way among the target population.

2.1. Participants

Inclusion criteria were: (a) having a breast cancer diagnosis, (b) completing breast cancer primary treatment within the past 5 years, and (c) being comfortable writing and speaking Chinese (i.e., Mandarin or Cantonese). Participants were recruited from three metropolitan areas (i.e., Los Angeles, New York, and Houston) in collaboration with the Herald Cancer Association (HCA), a community-based Chinese cancer organization. Recruitment was from June 2012 through April 2015 and follow-ups were completed by December 2015. Power analysis revealed that 43 participants per group would yield 95% power to test the primary hypothesis 1.1 (i.e. difference between the ESR and control) with an estimated effect size of $d = 0.8$ derived from a previous study (Lu & Stanton, 2010). To account for 5% estimated attrition, 136 were enrolled in the study and included in the analysis. Participants reported living in the U.S. for an average of 18.51 years ($SD = 10.27$), and 93.4% reported liking to speak their native language, and only 19.6% reporting speaking English at home (Table 1).

2.2. Procedures

The study was approved by relevant institutional review boards (IRB#: 12,559-02, University of Houston; 16493-EX, MD Anderson Cancer Center). All study materials were mailed to participants with prepaid return envelopes. After consenting, participants completed the baseline questionnaire package at home and returned it by mail. One week after returning the baseline questionnaire, participants received writing instructions, completed the three weekly writings, and returned the written essays by mail. At 1, 3, and 6 months after finishing the last writing assignment, participants completed the follow-up questionnaires and returned them by mail.

2.3. Intervention

Randomization was conducted by well-trained research staff using 1:1:1 allocation to randomly assign participants to the three conditions: (a) self-regulation (SR); (b) enhanced self-regulation (ESR); and (c) cancer-facts (CF) (Fig. 1). Details of the randomization process were reported elsewhere (Lu et al., 2018). Researchers interacting with participants were blinded to the condition and participants were not made aware of whether they were

assigned to an experimental or a control condition. For the ESR condition, participants were asked to write about their most stressful experience relevant to cancer and corresponding coping strategies (Week 1), their deepest feelings and thoughts associated with their breast cancer experience (Week 2), and positive thoughts and feelings surrounding their breast cancer experience (Week 3). For the SR condition, individuals were given the same instructions as the ESR condition, but the order was switched for weeks 1 and 2. For the CF condition, individuals were asked to write about their cancer diagnosis and treatment as objectively and as detailed as possible for each of the three weekly sessions. The week-1 and week-2 writing instructions in the two self-regulation conditions were developed based on 1) the SMEW model (Lu & Stanton, 2010), 2) a pilot study among healthy Asian American young adults (Lu & Stanton, 2010), 3) a pilot study among Chinese American breast cancer survivors (Lu, Zheng, Young, Kagawa-Singer, & Loh, 2012), and 4) stakeholders' (i.e., cancer survivors) input during study design stage. The control condition writing instructions and the third week writing instructions in the two self-regulation conditions were adapted from Stanton et al. (2002). The instructions were translated to Chinese by bilingual research staff and the language was further modified based on stakeholder's input.

Notably, many prior studies conducted among non-Hispanic White cancer survivors had participants write in labs or hospitals (Merz, Fox, & Malcarne, 2014). Based on input from stakeholders, we decided to have participants write at home due to more convenience and privacy for the writing experience. For each session, participants were asked to write continuously until they completed one page of writing; traditional expressive writing interventions usually ask participants to write for up to 30 min. We incorporated stakeholders' input and used a one-page limit as a guideline for when to stop writing to reduce stress associated with the usual time limit of 30 min.

2.4. Measures

Depressive symptoms.—The 10-item Center for Epidemiologic Studies Depression Scale (Andresen, Malmgren, Carter, & Patrick, 1994) measured participants' severity of depressive symptoms over the past week. On a 4-point Likert scale (0 as *not at all*, 3 as *always*), a higher sum score indicated more depressive symptoms (total score ranging from 0 to 30). Its Chinese version was reliable and valid among Chinese American breast cancer patients (Tsai & Lu, 2017). The Cronbach's alpha was .92 in this sample at baseline.

Anxiety symptoms.—The 6-item Anxiety subscale of the Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983) measured participants' anxiety symptoms over the past week. On a 5-point Likert scale (0 as *not at all*, 4 as *extremely*), as a higher sum score represented more anxiety symptoms (total score ranging from 0 to 24). Its Chinese version was reliable and valid for Chinese American samples (Y. Lu, Alvarez, & Miller, 2019; Hoang, Shin, Xu, & Lu, 2020). The Cronbach's alpha was .96 in this sample at baseline.

Perceived stress.—The 4-item Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983) measured participants' perception of stress in the past month. On a 5-point Likert scale (0 as *never*, 4 as *very often*), a higher sum score indicates higher perceived stress (total score ranging from 0 to 16). The scale was reliable and valid among

Chinese cardiac patients (Leung, Lam, & Chan, 2010). The Cronbach's alpha was .86 in this sample at baseline.

Intrusive thoughts.—The 7-item intrusion subscale of the Impact of Event Scale (IES; Horowitz, Wilner, & Alvarez, 1979) measured the frequency of experiencing distressing cancer-related intrusive thoughts over the past week. On a 6-point Likert scale (0 as *not at all*, 5 as *often*), a higher sum score represented more intrusive thoughts (total score ranging from 0 to 35). The scale was reliable and valid among Chinese oral cancer patients (Chen, Lai, Liao, & Lin, 2005). The Cronbach's alpha was .89 in this sample at baseline.

Participant Engagement.—After the last writing session, participants rated the extents to which they revealed their emotions in the writings (i. e., “how much did you reveal your emotions in what you wrote?”) and they felt the study valuable/meaningful (“how valuable/meaningful has the study been for you?”) on a 7-point scale (0 as *not at all* to 6 as *a great deal*) (Lu et al., 2017).

Emotion and Cognitive Process.—Emotion and cognitive process words (Slatcher & Pennebaker, 2006) in participants' writings were analyzed using the Linguistic Inquiry and Word Count (LIWC 2007; Pennebaker & Chung, 2011). We used LIWC with its compatible Chinese dictionary developed and validated by Huang et al. (2012), following similar analytic strategies (Lu et al., 2018).

Demographic characteristics.—Demographic characteristics including age, marital status, education level, annual household income, and cancer-related characteristics (i.e., stage at diagnosis) and acculturation were measured in the study.

2.5. Statistical analysis plan

Attrition analysis was conducted to compare baseline differences between completers and non-completers; baseline equivalence tests were conducted to evaluate the success of randomization. The group means at baseline and the three follow-ups (1-month, 3-month, and 6-month) were compared across the conditions. All primary analyses were conducted as intent-to-treat analyses, in which all randomized participants were included in all analyses. The missing value analysis found that the missing values were at random ($p > .05$) across different time points, thus expectation-maximization data imputation was used to accommodate missing data in all analyses. For hypothesis 1, two longitudinal (residual change) regression models were conducted for depressive and anxiety symptoms as outcomes respectively, to test the effects of ESR and SR conditions in comparison to the CF condition. Similar regression models tested the effects of ESR in comparison to SR. For hypothesis 2, the regression models above were repeated with perceived stress and intrusive thoughts as outcomes. For hypothesis 3, multiple mediation models were conducted to test the mediating roles of intrusive thoughts and perceived stress in explaining the impact of writing conditions on the outcomes. Multiple mediation procedures allow the examination of multiple mediators in a single model (Preacher & Hayes, 2008). SPSS PROCESS macro was used to conduct bootstrapping analyses with 5000 bootstrapping resamples to produce the

95% confidence intervals (CIs) to calculate the indirect effects. Mediation effect is regarded as significant when the 95% CIs do not contain zero.

3. Results

3.1. Attrition and baseline equivalence analysis

Among the 136 participants, 36, 54, and 46 were assigned to the CF, ESR, and SR conditions respectively. Twenty-one participants withdrew from the study (with 4, 7, and 10 participants in CF, ESR, and SR conditions respectively) (Fig. 1). No significant difference was found in the percentage of attrition across conditions ($\chi^2 = 2.28, p > .05$). Independent-samples *t* tests and chi-square tests were conducted to compare those completing all assessments (completers) and those not completing all assessments (non-completers). Completers and non-completers did not differ on demographic variables (i.e., age, education level, employment, marital status), medical variables (i.e., cancer stage, time since diagnosis), or variables of interest (depressive/anxiety symptoms, perceived stress, intrusive thoughts) at baseline (all *ps* > .05). To determine the success of randomization, we also conducted ANOVA and chi-square tests to examine differences in demographic, medical, and baseline outcome variables (i.e., depressive/anxiety symptoms, perceived stress, intrusive thoughts) across the three conditions. Again, the three conditions did not differ in those variables (all *ps* > .05).

3.2. Participant engagement and Emotion and Cognitive Process

ANOVA was used to compare the ratings on participant engagement across the three conditions. Participants in the ESR condition revealed more emotions ($M = 4.60, SD = 1.36$) than those in the SR ($M = 3.74, SD = 1.81, p < .02$) and the CF conditions ($M = 2.74, SD = 1.63, p < .001$); participants in the SR condition revealed more emotions than those in the CF condition ($p < .02$). Participants in the ESR ($M = 5.04, SD = 1.18$) and CF conditions ($M = 5.10, SD = 1.19$) reported higher levels of meaning/value of the study than those in the SR condition ($M = 4.24, SD = 1.52$) (*ps* < .01).

We also used LIWC2007 to examine word counts for positive emotions, negative emotions, and cognitive process in the three conditions (Table 2). Participants in the ESR and SR conditions used more positive and negative emotion words (all *ps* < .001) and more cognitive process words ($p < .05$) than the CF condition. Although ESR and SR conditions did not differ in these word categories overall, emotion word counts varied by week. At week 1, ESR writing (stress and coping writing instruction prompt) elicited more negative emotion words than SR writing (emotional disclosure instruction prompt). At week 2, ESR writing (emotional disclosure instruction prompt) elicited fewer negative emotion words than SR writing (stress and coping writing instruction prompt).

3.3. Longitudinal modeling of effects of writing at the follow-ups

Means and standard deviations for health outcomes by conditions at the four time points are presented in Table 3. For hypothesis 1, we examined the effects of writing conditions on the outcomes at all the follow-up assessments using longitudinal (residual change) models. Separate regression models were conducted for outcomes (depressive symptoms

and anxiety symptoms) at all follow-up time points (1, 3, 6-month). Model 1 tested the effects of the ESR and SR in comparison to the CF condition (reference group), and Model 2 tested the effects of SR and CF conditions in comparison to ESR (reference group). The unstandardized regression coefficients (b) and corresponding significance tests representing the effect of the conditions were computed.

In Model 1, outcomes at the 1-month, 3-month, and 6-month follow-ups were regressed on the corresponding baseline scores and the two dummy code variables representing ESR and SR conditions. Compared to the CF, the ESR reported significantly lower levels of depressive symptoms at all three follow-ups (bs ranged from -1.60 to -2.22 , all $ps < .05$) and lower levels of anxiety symptoms at all three follow-ups (bs ranged from -0.11 to -0.17 , $ps < .05$). No differences in depressive and anxiety symptoms were found at any of follow-ups between the CF and SR conditions ($ps > .05$) (Table 4). In Model 2, with ESR as the reference group, the analysis specifically explored the differences in outcomes between the SR and the ESR conditions. Outcomes at the 1-month, 3-month, and 6-month follow-ups were regressed on the corresponding baseline scores and the two dummy code variables representing SR and CF conditions. The results indicated that no significant differences in outcomes at all follow-ups were found between the ESR and the SR conditions ($ps > .05$) (Table 4).

For hypothesis 2, we repeated the regression models above with perceived stress and intrusive thoughts as outcomes. The ESR had lower levels of perceived stress at all three follow-ups (bs from -1.06 to -0.91 , all $ps < .05$) and lower levels of intrusive thoughts at 1-month follow-up ($b = -2.05$, $p < .05$), compared with the CF condition. The SR condition had lower levels of perceived stress at 1-month follow-up ($b = -1.24$, $p < .01$) and lower levels of intrusive thoughts at 1-month and 6-month follow-ups (bs from -2.02 to -1.93 , all $ps < .05$) compared with the CF condition. No significant differences in outcomes were found between the ESR and the SR conditions (Table 4).

3.4. Mediation analysis

For hypothesis 3, with the significant main effects of ESR on depressive and anxiety symptoms, we conducted further analysis to examine if the effects of ESR on depressive/anxiety symptoms at the 6-month follow-up were explained by perceived stress or intrusive thoughts at earlier follow-ups (1-month or 3-month). Multiple mediation models (Model 4 of the SPSS PROCESS macro) (Preacher & Hayes, 2008) were tested with the predictor = ESR condition (ESR vs. CF); the mediators = intrusive thoughts/perceived stress at 1-month/3-month follow-up; the outcome variables = depressive/anxiety symptoms at 6-month follow-up. Four separate mediation models were tested for the two outcomes (depressive/anxiety symptoms at 6-month follow-up) and for the mediators at 1-/3-month follow-ups. In the mediation analyses, the specific indirect effects from the dummy code ESR (versus CF) to anxiety/depressive symptoms at 6-month follow-up were estimated, including the indirect paths via intrusive thoughts and perceived stress at 1-month/3-month follow-up. The baseline levels of depressive/anxiety symptoms, intrusive thoughts, perceived stress, and the dummy code SR condition (versus CF) were also included in the analysis as covariates.

The multiple mediation model results indicated that the indirect effects from ESR to depressive symptoms at 6-month follow-up via perceived stress at 1-month follow-up ($b = -0.774$, $se = 0.400$, $95\%CI = -1.1617, -0.034$) and at 3-month follow-up ($b = -0.913$, $se = 0.462$, $95\%CI = -1.930, -0.133$) were significant (Fig. 2). However, after considering the mediators, the direct effects from ESR to depressive symptoms were no longer significant (from $c = -1.875$, $se = 0.810$, $p < .05$ to $c' = -0.840$, $se = 0.706$, $p > .05$), suggesting that perceived stress at the 1-month and 3-month follow-ups significantly mediated the effects of ESR on depressive symptoms at the 6-month follow-up. On the other hand, the indirect effects from ESR to depressive symptoms at 6-month follow-up via intrusive thoughts at 1-month follow-up ($b = -0.261$, $se = 0.235$, $95\%CI = -0.859, 0.033$)/3-month follow-up ($b = -0.087$, $se = 0.126$, $95\%CI = -0.398, 0.095$) were not significant (Fig. 2). The patterns of mediation findings were the same, regardless of the timepoint of the mediators (1-month or 3-month).

Similarly, the multiple mediation model results indicated that the indirect effects from ESR to reduced anxiety symptoms at 6-month follow-up via perceived stress at 1-month follow-up ($b = -0.034$, $se = 0.021$, $95\%CI = -0.129, -0.011$) and at 3-month follow-up ($b = -0.042$, $se = 0.021$, $95\%CI = -0.088, -0.005$) were significant. After considering the mediators, the direct effects from ESR to reduced anxiety symptoms were no longer significant (from $c = -0.108$, $se = 0.052$, $p < .05$ to $c' = -0.047$, $se = 0.049$, $p > .05$), suggesting that perceived stress at the 1-month and 3-month follow-ups mediated the effects of ESR on anxiety symptoms at the 6-month follow-up. Conversely, the indirect effects from ESR to anxiety symptoms at 6-month follow-up via intrusive thoughts at 1-month follow-up ($b = -0.027$, $se = 0.020$, $95\%CI = -0.074, 0.001$)/3-month follow-up ($b = -0.022$, $se = 0.018$, $95\%CI = -0.065, 0.007$) were not significant. The patterns of mediation findings were similar for the mediators at the 1-month and 3-month and Fig. 2 shows the 3-month mediation results.

4. Discussion

This RCT examined the effects of two culturally adapted expressive writing interventions on depressive and anxiety symptoms among Chinese American breast cancer survivors at 1-month, 3-month, and 6-month follow-ups. Compared to the CF condition, only participants in the ESR condition (cognitive reappraisal prior to emotional disclosure) demonstrated benefits for both depressive and anxiety symptoms. Participants in the SR condition (emotional disclosure prior to cognitive reappraisal) were not significantly different from the CF condition for depressive and anxiety symptoms over time, suggesting important ordering effects. Mediation analyses indicated that the ESR condition's mental health benefits at 6-month follow-up were explained by reductions in perceived stress at 1-month and 3-month follow-ups. Intrusive thoughts did not mediate the positive effects of the ESR condition, though intrusive thoughts decreased following the writing intervention as well. Those in the ESR condition reported higher levels of participant engagement than those in the SR and CF conditions. The results suggested that the culturally adapted intervention promoting cognitive reappraisal prior to emotional disclosure improved mental health.

Only those in the ESR condition experienced longitudinal benefits for depressive and anxiety symptoms, which suggests that the ordering of the cognitive reappraisal and emotional disclosure writing sessions had an important effect. There are several plausible explanations.

First, the cultural congruence of the ESR condition may contribute to ESR benefitting depressive and anxiety symptoms through reduced perceived stress, as the mediation results showed. The most distinguishing feature of the ESR from the SR condition was a continued reduction in perceived stress at 6-month follow-up. The sustained reduction in perceived stress is perhaps a result of being primed with a cognitively reappraised perspective about oneself or one's situation at session one. This mindset of reevaluating coping resources at the very beginning of the intervention in ESR may help to manage stressful situations and facilitate reappraisal of stressors (Lazarus & Folkman, 1984) (e.g., feeling in control of things in life, feeling more confident about dealing with problems, feeling that things are going well, feeling that one can overcome difficulties). The explicit permission to write about negative valence content in a culturally congruent manner (i.e., not directly requesting emotion expression) accompanied by cognitive reappraisal resulted in the highest expression of negative emotions and reduced depressive symptoms. This corroborates prior research that writing instructions giving explicit permission of negative valence content accompanied by cognitive acceptance benefits depression (Baum & Rude, 2013), and that cognitive reappraisal moves different outcomes than emotional expression (Moore, Zoellner, & Mollenholt, 2008). Together, the findings support the SMEW model (Lu & Stanton, 2010) which posits that cognitive reappraisal reduces the impact of stress and produces benefits associated with expressive writing. The ordering effects suggest the necessity of advancing a culturally specific sub-version of the SMEW model: SMEW-C, which posits that engaging cognitive reappraisal prior to emotional disclosure enhances health benefits among those practicing Asian cultural values. The SMEW-C model may guide future adaptation of other psychological interventions/therapies involving cognitive reappraisal and emotional disclosure.

Second, the ESR was more engaging than the SR. The results suggest that the ESR fostered higher engagement with higher self-ratings on essay emotionality and level of personal meaning versus the SR. The intervention adaptation process of the ESR condition involved Chinese American BCS' feedback on writing prompts, and the BCS suggested that writing about stress is more acceptable and comfortable than writing about emotions. Perhaps it is more common for East Asians to reflect about stressful events than to express emotions outwardly (De Vaus et al., 2018), and Chinese breast cancer survivors accustomed to suppressing emotions are more comfortable when the first writing intervention prompt centers on reflections about stress and coping rather than their deepest feelings. Not beginning with direct prompting of emotional disclosure appears more congruent with cultural norms and may explain the better mental health outcomes. This study demonstrates how the ESR condition may benefit Chinese American breast cancer survivors by prioritizing the ordering of what is culturally normative.

Third, the ESR might have caused emotional changes that are essential to creating benefits. Interestingly, the ESR condition week 1 prompt (stress disclosure) elicited more negative

emotion words in writing compared to in the SR condition week 1 prompt (emotional disclosure) whereas the reverse was found during week 2 where the SR condition (stress disclosure) elicited fewer negative emotion words than the ESR condition (emotional disclosure). These results suggest that the stress disclosure prompt resulted in more negative emotion expression than the emotional disclosure prompt did, regardless of whether it came first or second. Structuring writing interventions with culturally tailored prompts to indirectly elicit negative emotions followed by a steady decline may be beneficial, in that this reduction suggests autonomic habituation to processing stressful experiences (Low, Stanton, & Danoff-Burg, 2006). Engaging emotions in writing appears important for Chinese American breast cancer survivors, and prioritizing culturally congruent components to elicit more emotions may create more meaning that facilitates better mental health. Greater self-reported emotionality in writing can be associated with less perceived stress (Danoff-Burg, Mosher, Seawell, & Agee, 2010), and this may be one reason why ESR demonstrated a continued reduction of perceived stress at all follow-up assessments versus SR reducing perceived stress only at the 1-month follow-up.

According to the social cognitive processing model (Lepore, 2001), intrusive thoughts may contribute to depressive and anxiety symptoms. However, our study did not find intrusive thoughts as the specific mechanism explaining the beneficial effects of the ESR condition on depressive and anxiety symptoms. Although the ESR and SR conditions varied in their timing of greater reduction in intrusive thoughts compared with the CF condition (1-month follow-up in the ESR condition and at 1- and 6-month follow-ups in the SR condition), both conditions imparted medium sized reductions in intrusive thoughts which suggests that ESR and SR have common components relieving suppression of the cancer experience and cognitive adaptation as in previous expressive writing studies (Klein & Boals, 2001; Park & Blumberg, 2002; Pennebaker, 1997a; Smyth, True, & Souto, 2001). Importantly though, beyond effects on intrusive thoughts, the most distinguishing feature of the ESR from the SR condition was a continued reduction in perceived stress at the 6-month follow-up. It may be that intrusive thoughts reductions alone were insufficient for benefitting depressive and anxiety symptoms for Chinese American breast cancer survivors.

Several limitations should be considered in interpreting the results of this study. Compared to other samples of women with breast cancer (Galdón et al., 2008), baseline anxiety for the overall sample was lower; a prior study suggests that benefits of the ESR condition could have been stronger in samples with clinical levels of anxiety (Pavlacic, Buchanan, & Maxwell, 2019). Another consideration is that this study was not powered to detect small effect sizes, and the SR condition might show benefits for depressive and anxiety symptoms compared to the CF condition in a larger sample. The SR condition also reduced intrusive thoughts at the 6-month follow-up, and it is plausible that the condition may have other physical health benefits or secondary beneficial mental health outcomes at the 6-month or even longer follow-ups that was not captured in this analysis. It is also possible that more differences in emotions or cognitive processing, between the ESR and SR conditions, might have been detected with human raters in comparison to LIWC (Ziemer & Korkmaz, 2017). Participants in this study were self-selected and the results may not apply to Chinese American or other Asian American breast cancer survivors who do not favor writing as a mode of expression. Future studies with larger randomly selected samples may help better

understand whether the results from this study extend to other Chinese American or other Asian American cancer survivors.

To our knowledge, this RCT is the first to demonstrate that a novel cultural adaptation strategy, re-ordering intervention components based on cultural theory and stakeholder-informed input, can result in a better fitting intervention. The ordering effects support the SMEW-C model, which may help to guide the adaptation of other psychological interventions/therapies involving cognitive reappraisal and emotional disclosure.

Understudied populations, such as Asian Americans facing health related disparities (Kim, Lu, & Stanton, 2021), may benefit from detailed efforts to increase the cultural fit of interventions. This RCT also contributes to our understanding of how expressive writing interventions are helpful for depressive and anxiety symptoms in Chinese American BCS. For populations where verbalization of one's thoughts and feelings are not the normative way of processing a stressful situation, culturally adapted writing interventions that are enhanced to be most acceptable provide long term benefits for mental health.

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Data availability

Data will be made available on request.

References

- American Cancer, Society. (2022). *Cancer Facts & Figures 2022*. Atlanta. American Cancer Society.
- Andresen EM, Malmgren JA, Carter WB, & Patrick DL (1994). Screening for depression in well older adults: Evaluation of a short form of the CES-D. *American Journal of Preventive Medicine*, 10(2), 77–84. [PubMed: 8037935]
- Baum ES, & Rude SS (2013). Acceptance-enhanced expressive writing prevents symptoms in participants with low initial depression. *Cognitive Therapy and Research*, 37(1), 35–42.
- Bernal GE, & Domenech Rodríguez MM (2012). *Cultural adaptations: Tools for evidence-based practice with diverse populations*. American Psychological Association.
- Chen SC, Lai YH, Liao CT, & Lin CC (2005). Psychometric testing of the Impact of Event Scale-Chinese version (IES-C) in oral cancer patients in Taiwan. *Supportive Care in Cancer*, 13(7), 485–492. [PubMed: 15717159]
- Cohen S, Kamarck T, & Mermelstein R (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24(4), 385–396. [PubMed: 6668417]
- Danoff-Burg S, Mosher CE, Seawell AH, & Agee JD (2010). Does narrative writing instruction enhance the benefits of expressive writing? *Anxiety, Stress & Coping*, 23(3), 341–352. [PubMed: 19705310]

- De Vaus J, Hornsey MJ, Kuppens P, & Bastian B (2018). Exploring the east-west divide in prevalence of affective disorder: A case for cultural differences in coping with negative emotion. *Personality and Social Psychology Review*, 22(3), 285–304. [PubMed: 29034806]
- Derogatis LR, & Melisaratos N (1983). The Brief symptom inventory: An introductory report. *Psychological Medicine*, 13(3), 595–605. [PubMed: 6622612]
- Frattaroli J (2006). Experimental disclosure and its moderators: A meta-analysis. *Psychological Bulletin*, 132(6), 823–865. [PubMed: 17073523]
- Frisina PG, Borod JC, & Lepore SJ (2004). A meta-analysis of the effects of written emotional disclosure on the health outcomes of clinical populations. *The Journal of Nervous and Mental Disease*, 192(9), 629–634. [PubMed: 15348980]
- Galdón MJ, Durá E, Andreu Y, Ferrando M, Murgui S, Pérez S, et al. (2008). Psychometric properties of the Brief Symptom Inventory-18 in a Spanish breast cancer sample. *Journal of Psychosomatic Research*, 65(6), 533–539. [PubMed: 19027441]
- Gomez SL, Noone AM, Lichtensztajn DY, Scoppa S, Gibson JT, Liu L, et al. (2013). Cancer incidence trends among Asian American populations in the United States, 1990–2008. *Journal of the National Cancer Institute*, 105(15), 1096–1110. [PubMed: 23878350]
- Hall GCN, Kim-Mozeleski JE, Zane NW, Sato H, Huang ER, Tuan M, et al. (2019). Cultural adaptations of psychotherapy: Therapists' applications of conceptual models with Asians and Asian Americans. *Asian American journal of psychology*, 10(1), 68. [PubMed: 30854159]
- Hoang TM, Shin LJ, Xu S, & Lu Q (2020). Coping with breast cancer among immigrant Chinese Americans. *Asian American Journal of Psychology*, 11(2), 108–116.
- Horowitz M, Wilner N, & Alvarez W (1979). Impact of event scale: A measure of subjective stress. *Psychosomatic Medicine*, 41(3), 209–218. [PubMed: 472086]
- Huang CL, Chung CK, Hui N, Lin YC, Seih YT, Chen WC, & Pennebaker JW (2012). The development of the Chinese linguistic inquiry and word count dictionary. *Chinese Journal of Psychology*, 54, 185–201.
- Kim BSK, Atkinson DR, & Umemoto D (2001). Asian cultural values and the counseling process. *The Counseling Psychologist*, 29(4), 570–603.
- Kim JHJ, Lu Q, & Stanton AL (2021). Overcoming constraints of the model minority stereotype to advance Asian American health. *American Psychologist*, 76(4), 611–626. [PubMed: 34410738]
- Klein K, & Boals A (2001). Expressive writing can increase working memory capacity. *Journal of Experimental Psychology: General*, 130(3), 520–533. [PubMed: 11561925]
- Lau A, Barnett M, Stadnick N, Saifan D, Regan J, Wiltsey Stirman S, Roesch S, Brookman-Frazee L. Therapist report of adaptations to delivery of evidence-based practices within a system-driven reform of publicly funded children's mental health services. *J Consult Clin Psychol*. 2017 Jul;85(7):664–675. doi: 10.1037/ccp0000215. Epub 2017 May 4. [PubMed: 28471210]
- Lazarus RS, & Folkman S (1984). *Stress, appraisal, and coping*. Springer Publishing Company.
- Lepore SJ (2001). A social-cognitive processing model of emotional adjustment to cancer. In Baum A, & Andersen BL (Eds.), *Psychosocial interventions for cancer* (pp. 99–116). American Psychological Association.
- Leung DYP, Lam TH, & Chan SSC (2010). Three versions of perceived stress scale: Validation in a sample of Chinese cardiac patients who smoke. *BMC Public Health*, 10, 513, 2010. [PubMed: 20735860]
- Low CA, Stanton AL, & Danoff-Burg S (2006). Expressive disclosure and benefit finding among breast cancer patients: Mechanisms for positive health effects. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association*, 25(2), 181–189. [PubMed: 16569109]
- Lu Y, Alvarez AN, & Miller MJ (2019). Measurement invariance of the Brief Symptom Inventory-18 (BSI-18) across Asian American ethnic, nativity, and gender groups. *Asian American Journal of Psychology*, 10(1), 1–10.
- Lu Q, Gallagher MW, Loh A, & Young L (2018). Expressive writing intervention improves quality of life among Chinese American breast cancer survivors: A randomized controlled trial. *Annals of Behavioral Medicine*, 52(11), 952–962. [PubMed: 30346497]

- Lu Q, Man J, You J, & LeRoy AS (2015). The link between ambivalence over emotional expression and depressive symptoms among Chinese breast cancer survivors. *Journal of Psychosomatic Research*, 79(2), 153–158. [PubMed: 25697586]
- Lu Q, & Stanton AL (2010). How benefits of expressive writing vary as a function of writing instructions, ethnicity and ambivalence over emotional expression. *Psychology and Health*, 25(6), 669–684. [PubMed: 20204944]
- Lu Q, Wong CCY, Gallagher MW, Tou RYW, Young L, & Loh A (2017). Expressive writing among Chinese American breast cancer survivors: A randomized controlled trial. *Health Psychology*, 36(4), 370–379. [PubMed: 27929333]
- Lu Q, Zheng D, Young L, Kagawa-Singer M, & Loh A (2012). A pilot study of expressive writing intervention among Chinese-speaking breast cancer survivors. *Health Psychology*, 31(5), 548–551. [PubMed: 22229930]
- Merz EL, Fox RS, & Malcarne VL (2014). Expressive writing interventions in cancer patients: A systematic review. *Health Psychology Review*, 8(3), 339–361. [PubMed: 25053218]
- Moore SA, Zoellner LA, & Mollenholt N (2008). Are expressive suppression and cognitive reappraisal associated with stress-related symptoms? *Behaviour Research and Therapy*, 46(9), 993–1000. [PubMed: 18687419]
- Onken LS, Carroll KM, Shoham V, Cuthbert BN, & Riddle M (2014). Reenvisioning clinical science. *Clinical Psychological Science*, 2(1), 22–34. [PubMed: 25821658]
- Park CL, & Blumberg CJ (2002). Disclosing trauma through writing: Testing the meaning-making hypothesis. *Cognitive Therapy and Research*, 26(5), 597–616.
- Pavlicac JM, Buchanan EM, Maxwell NP, Hopke TG, & Schulenberg SE (2019). A meta-analysis of expressive writing on posttraumatic stress, posttraumatic growth, and quality of life. *Review of General Psychology: Journal of Division 1, of the American Psychological Association*, 23(2), 230–250.
- Pennebaker JW (1997a). Writing about emotional experiences as a therapeutic process. *Psychological Science*, 8, 162–166.
- Pennebaker JW, & Beall SK (1986). Confronting a traumatic event: Toward an understanding of inhibition and disease. *Journal of Abnormal Psychology*, 95(3), 274–281. [PubMed: 3745650]
- Pennebaker JW, & Chung CK (2011). Expressive writing: Connections to physical and mental health. In Friedman HS (Ed.), *The oxford handbook of health psychology*. Oxford University Press.
- Pennebaker JW, Evans J, & Evans JF (2014). *Expressive writing: Words that heal*. Arbor: Idyll.
- Pennebaker JW, Mayne TJ, & Francis ME (1997b). Linguistic predictors of adaptive bereavement. *Journal of Personality and Social Psychology*, 72(4), 863–871. [PubMed: 9108699]
- Pew Research Center. The rise of Asian Americans. <http://www.pewsocialtrends.org/asianamericans>.
- Pilevarzadeh M, Amirshahi M, Afsargharehbagh R, Rafiemanesh H, Hashemi SM, & Balouchi A (2019). Global prevalence of depression among breast cancer patients: A systematic review and meta-analysis. *Breast Cancer Research and Treatment*, 176(3), 519–533. [PubMed: 31087199]
- Preacher KJ, & Hayes AF (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40, 879–891. [PubMed: 18697684]
- Slatcher RB, & Pennebaker JW (2006). How do I love thee? Let me count the words: The social effects of expressive writing. *Psychological Science*, 17(8), 660–664. [PubMed: 16913946]
- Smyth J, True N, & Souto J (2001). Effects of writing about traumatic experiences: The necessity for narrative structuring. *Journal of Social and Clinical Psychology*, 20 (2), 161–172.
- Stanton AL, Danoff-Burg S, Sworowski LA, Collins CA, Branstetter AD, Rodriguez-Hanley A, et al. (2002). Randomized, controlled trial of written emotional expression and benefit finding in breast cancer patients. *Journal of Clinical Oncology*, 20(20), 4160–4168. [PubMed: 12377959]
- Stirman S, Baumann AA, & Miller CJ (2019). The FRAME: An expanded framework for reporting adaptations and modifications to evidence-based interventions. *Implementation Science*, 14(1), 1–10. [PubMed: 30611302]
- Tsai W, & Lu Q (2017). Acculturation matters in the relation between ambivalence over emotional expressions and well-being among Chinese American breast cancer survivors. *Quality of Life Research*, 26(10), 2755–2762. [PubMed: 28597110]

- Tsai W, & Lu Q (2018). Culture, emotion suppression and disclosure, and health. *Social and Personality Psychology Compass*, 12(3), Article e12373.
- Tsai W, Wu IHC, & Lu Q (2019). Acculturation and quality of life among Chinese American breast cancer survivors: The mediating role of self-stigma, ambivalence over emotion expression, and intrusive thoughts. *Psycho-Oncology*, 28(5), 1063–1070. [PubMed: 30838727]
- Wen KY, Fang CY, & Ma GX (2014). Breast cancer experience and survivorship among asian Americans: A systematic review. *Journal of Cancer Survivorship: Research and Practice*, 8(1), 94–107. [PubMed: 24214498]
- Ziemer KS, & Korkmaz G (2017). Using text to predict psychological and physical health: A comparison of human raters and computerized text analysis. *Computers in Human Behavior*, 76, 122–127.

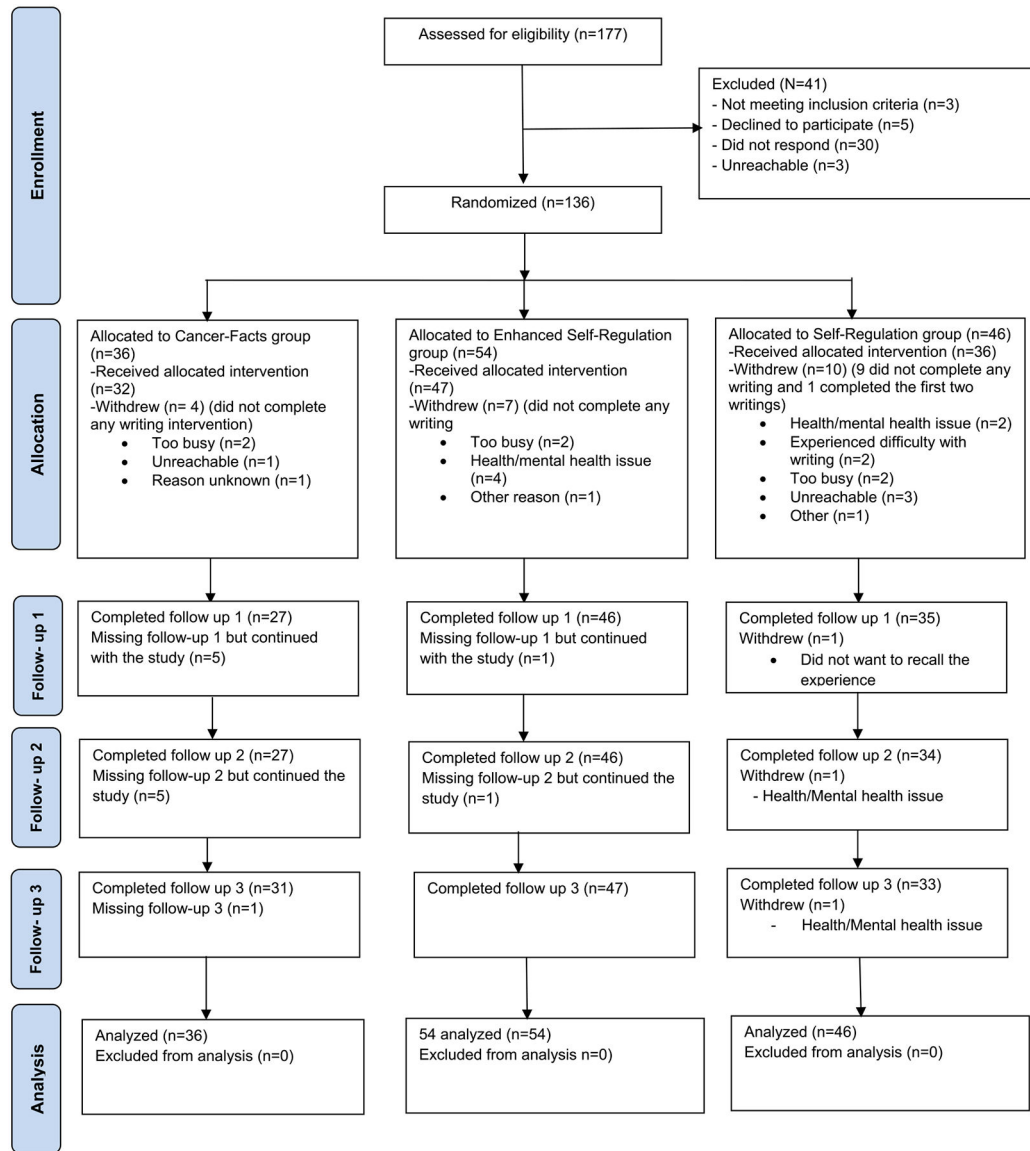
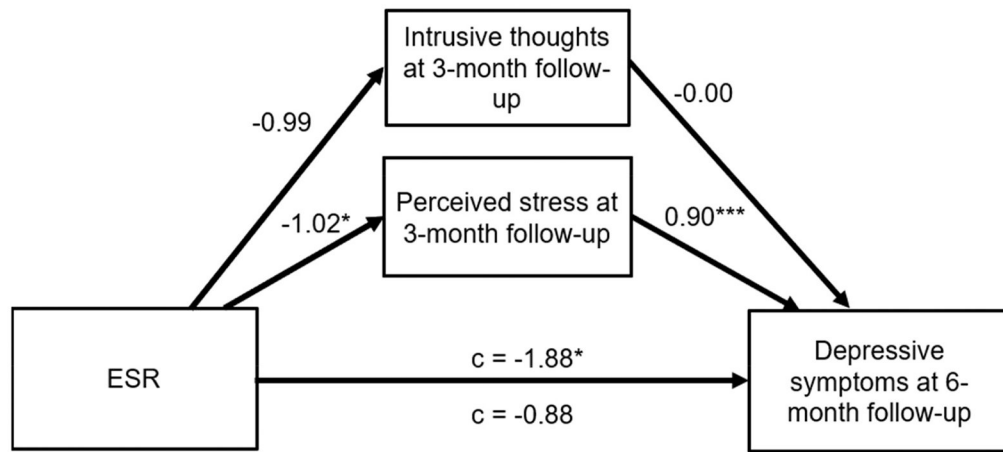
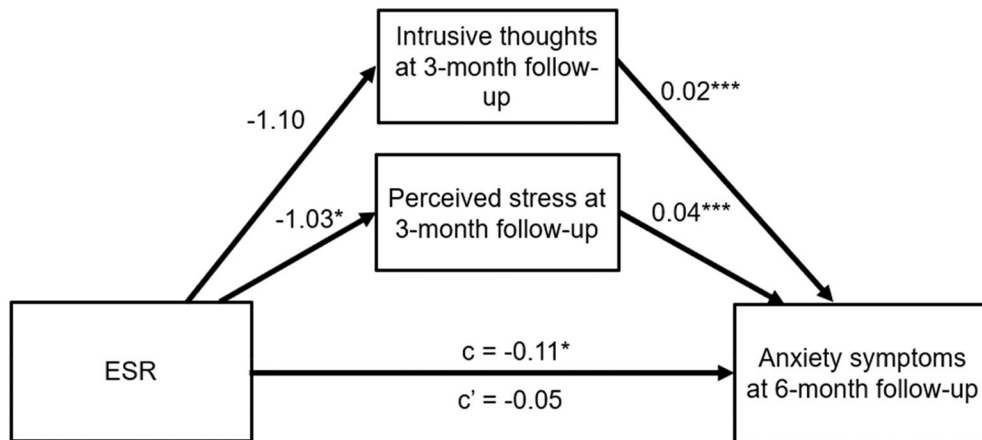


Fig. 1.
The CONSORT flow diagram.



Covariates: Baseline depressive symptoms, baseline intrusive thoughts, baseline perceived stress, SR dummy code
The path coefficients are unstandardized estimates.



Covariates: Baseline anxiety symptoms, baseline intrusive thoughts, baseline perceived stress, SR dummy code
The path coefficients are unstandardized estimates.

Fig. 2. Multiple mediation models explaining the intervention effect of the enhanced self-regulation (ESR) group on depression symptoms (upper panel) and anxiety symptoms (lower panel) at 6-month follow-up through intrusive thoughts and perceived stress at 3-month follow-up. The mediation results at the 1-month were similar and only the 3-months results were shown for simplicity.

Table 1

Participants' demographics and clinical characteristics (N = 136).

Variables	Overall (N = 136)
	N (%) / Mean (SD)
Age	57.8 (9.2)
Missing	4 (2.9)
Marital status	
Married	88 (64.7%)
Not married	46 (33.8)%
Missing	2 (1.5%)
Highest education	
Some college	83 (61.0%)
No college	52 (38.2%)
Missing	1 (0.7%)
Household income	
\$15,000	46 (33.8%)
\$15,000 - \$45,000	43 (31.6%)
\$45,000 - \$75,000	13 (9.6%)
> \$75,000	22 (16.2%)
Missing	12 (8.8%)
Employment status	
Working full-time	34 (25.0%)
Working part-time	21 (15.4%)
Retired	20 (14.7%)
Housewife	29 (21.3%)
Unemployed	24 (17.6%)
other	6 (4.4%)
Missing	2 (1.5%)
Stage	
0	15 (11.0%)
1	43 (31.6%)
2	46 (33.8%)
3	23 (16.7%)
4	4 (2.9%)
Missing	5 (3.7%)
Treatments	
Surgery	127 (93.4%)
Radiation	84 (62.2%)
Chemotherapy	81 (60.0%)
Years in the US	18.51 (10.27)
Acculturation levels	
Liking to speak native language	127 (93.4%)

	Overall (N = 136)
Variables	N (%) / Mean (SD)
Speaking English at home	24 (17.6%)
Having many (Anglo) American acquaintances	43 (31.6%)

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Table 2

Group comparison of word usage in written essays by week.

Word category	Cancer-facts condition (N = 36)	Self-regulation condition (N = 46)	Enhanced self-regulation condition (N = 54)	F	<i>d</i>
Week 1					
Positive emotion	1.38 (0.99) ^b	2.86 (1.37) ^a	3.11 (1.54) ^a	16.81 ^{***}	1.19
Negative emotion	1.17 (0.86) ^c	2.31 (1.11) ^b	3.54 (1.68) ^a	31.12 ^{***}	1.39
Cognitive Process	19.03 (5.24)	20.40 (2.77)	21.00 (4.91)	1.88	0.38
Week 2					
Positive emotion	1.57 (1.31) ^b	3.30 (1.31) ^a	3.73 (1.69) ^a	21.43 ^{***}	1.33
Negative emotion	1.48 (0.89) ^c	3.75 (1.69) ^b	3.04 (1.29) ^a	25.32 ^{***}	1.39
Cognitive Process	18.87 (4.70) ^b	22.17 (3.51) ^a	21.80 (4.64) ^a	5.93 ^{***}	0.71
Week 3					
Positive emotion	4.43 (2.30)	4.72 (2.62)	4.54 (2.92)	0.10	0.07
Negative emotion	2.15 (1.21)	1.91 (1.33)	2.25 (1.25)	0.75	-0.04
Cognitive Process	22.43 (5.39)	20.03 (4.87)	21.16 (4.94)	1.84	-0.35
Overall					
Positive emotion	1.63 (0.94) ^b	3.67 (1.02) ^a	4.00 (1.46) ^a	40.50 ^{***}	1.85
Negative emotion	1.48 (0.73) ^b	2.65 (1.01) ^a	3.03 (0.99) ^a	27.09 ^{***}	1.48
Cognitive Process	19.22 (4.42) ^b	21.50 (2.35) ^a	21.35 (4.16) ^a	3.91 [*]	0.58

Note: Different superscripts mean statistically different.

p < .001.

Table 3

Descriptive statistics of participants' health outcomes by writing groups at different follow-ups.

	Cancer-facts condition (N = 36)	Self-regulation condition (N = 46)	Enhanced self-regulation condition (N = 54)
	Mean (SD)	Mean (SD)	Mean (SD)
Outcomes			
Depression Baseline	10.81 (6.78)	11.06 (7.86)	9.30 (7.73)
Depression 1-month FU	10.67 (6.42)	9.23 (5.12)	8.17 (5.90)
Depression 3-month FU	10.85 (6.13)	9.56 (6.26)	7.68 (6.16)
Depression 6-month FU	10.87 (6.51)	9.78 (5.58)	8.15 (5.56)
Anxiety Baseline	4.66 (4.76)	5.14 (7.13)	4.84 (6.39)
Anxiety 1-month FU	6.08 (4.38)	4.76 (4.64)	4.52 (4.11)
Anxiety 3-month FU	6.70 (4.61)	5.63 (5.10)	4.56 (4.59)
Anxiety 6-month FU	5.73 (4.08)	4.83 (3.79)	4.25 (4.08)
Mediators			
Perceived stress baseline	6.56 (3.68)	6.80 (3.99)	6.06 (3.63)
Perceived stress 1-month FU	6.86 (2.80)	5.74 (2.60)	5.70 (2.86)
Perceived stress 3-month FU	6.38 (2.77)	5.82 (3.04)	5.07 (2.87)
Perceived stress 6-month FU	6.24 (3.23)	5.83 (2.75)	4.90 (2.88)
Intrusive thoughts baseline	11.19 (7.68)	10.39 (8.12)	10.02 (7.90)
Intrusive thoughts 1-month FU	11.22 (7.97)	8.64 (6.22)	8.37 (6.37)
Intrusive thoughts 3-month FU	10.19 (6.99)	8.09 (6.82)	8.22 (7.16)
Intrusive thoughts 6-month FU	9.60 (7.27)	7.12 (6.61)	7.29 (6.48)

Note. FU denotes follow-up assessments.

Table 4

Residual change models at the follow-ups.

Outcomes	Model 1		Model 2	
	Predictors	<i>b</i> (95%CI)	Predictors [†]	<i>b</i> (95%CI)
Depression 1-month FU	ESR (versus CF)	-1.60* (-3.17, -0.04)	SR (versus ESR)	1.1 (-1.46, 1.47)
	SR (versus CF)	-1.60 (-3.21, 0.02)		
Depression 3-month FU	ESR (versus CF)	-2.22* (-3.92, -0.52)	SR (versus ESR)	0.77 (-0.82, 2.36)
	SR (versus CF)	-1.45 (-3.20, 0.31)		
Depression 6-month FU	ESR (versus CF)	-1.84* (-3.47, -0.21)	SR (versus ESR)	0.60 (-0.92, 2.12)
	SR (versus CF)	-1.24 (-2.92, 0.44)		
Anxiety (log) 1-month FU	ESR (versus CF)	-0.11* (-0.22, 0.00)	SR (versus ESR)	1.1 (-0.10, 0.11)
	SR (versus CF)	-0.10 (-0.22, 0.11)		
Anxiety (log) 3-month FU	ESR (versus CF)	-0.17** (-0.29, -0.05)	SR (versus ESR)	0.09 (-0.02, 0.20)
	SR (versus CF)	-0.08 (-0.21, 0.04)		
Anxiety (log) 6-month FU	ESR (versus CF)	-0.12* (-0.23, -0.01)	SR (versus ESR)	0.05 (-0.05, 0.15)
	SR (versus CF)	-0.07 (-0.18, 0.04)		
Mediators				
Perceived stress 1-month FU	ESR (versus CF)	-0.91* (-1.79, -0.04)	SR (versus ESR)	-0.33 (-0.15, 0.49)
	SR (versus CF)	-1.24** (-2.15, 0.33)		
Perceived stress 3-month FU	ESR (versus CF)	-1.06* (-1.98, -0.14)	SR (versus ESR)	0.37 (-0.50, 1.23)
	SR (versus CF)	-0.70 (-1.65, 0.26)		
Perceived stress 6-month FU	ESR (versus CF)	-1.06* (-1.91, -0.20)	SR (versus ESR)	0.51 (-0.30, 1.31)
	SR (versus CF)	-0.55 (-1.44, 0.34)		
Intrusive thoughts 1-month FU	ESR (versus CF)	-2.05* (-3.80, -0.29)	SR (versus ESR)	0.02 (-1.61, 1.66)
	SR (versus CF)	-2.02* (-3.84, -0.21)		
Intrusive thoughts 3-month FU	ESR (versus CF)	-1.13 (-2.88, 0.62)	SR (versus ESR)	-0.40 (-2.03, 1.23)
	SR (versus CF)	-1.53 (-3.34, 0.28)		
Intrusive thoughts 6-month FU	ESR (versus CF)	-1.52 (-3.28, 0.24)	SR (versus ESR)	-0.41 (-2.05, 1.23)
	SR (versus CF)	-1.93* (-3.75, -0.12)		

Note. FU denotes follow-up assessments. SR: self-regulation condition, ESR: enhanced self-regulation condition, CF: cancer-facts condition. Model 1: CF as the reference group, Model 2: ESR as the reference group.

b represents unstandardized regression coefficients.

[†]The predictor CF (versus ESR) was also included in Model 2; the *b* estimates of CF (versus ESR) were not presented, as the magnitude of those estimates were identical to those in Model 1 with ESR (versus CF) as the predictor. All follow-up outcome measures in the regression models were also statistically controlled for by their corresponding baseline measures.