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Reducing safety behaviors to prevent anxious symptoms: a pre-registered prevention intervention study

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ABSTRACT

The purpose of this pre-registered study was to test the efficacy of a simple, low-impact safety behavior prevention intervention for anxiety. The intervention was delivered online using a 4-week workbook format. Participants ($n = 130$) were a non-clinical sample of American college students; they were randomly assigned to one of two intervention conditions: safety-behavior reduction or active control condition (academic skills). Results showed that participants in the safety behavior workbook condition did not report fewer safety behaviors or lower levels of anxiety compared to the active control condition post-intervention. Exploratory analyses found that fidelity mattered; participants who completed all the workbook activities reported a significant decrease in the safety-behaviors relative to the control condition. However, those who reduced their use of safety behaviors reported *greater* levels of anxiety compared to participants in the control condition who reduced their safety behaviors. These results suggest that encouraging safety behavior reduction in non-clinical samples may have the unintended consequence of maintaining anxiety.

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Safety behaviors; anxiety; prevention; workbook

"Safety behaviors" are actions and mental processes that people engage in to avoid feared outcomes (Salkovskis, 1991). They manifest in a variety of forms, ranging from reassurance seeking to frequent handwashing. The use of safety behaviors can be adaptive, and even necessary, in the presence of actual threat, such as the need to wear a seatbelt in a moving car. However, in the absence of actual threat, the use of safety behaviors has been associated with negative outcomes, particularly elevated levels of anxiety (Deacon & Maack, 2008, Fawzy, 2016; Goodson et al., 2016; Olatunji et al., 2011; Summers & Cougle, 2018). This work indicates safety behaviors may be involved in the etiology of anxiety as their use appears to precede and predict increases in future anxious symptoms.

There are several explanations for why safety behaviors might lead to negative anxious outcomes. First, safety behaviors have been shown to preserve the sense of threat associated with a stimulus (Blakey & Deacon, 2015; Clark & Beck, 2010; Helbig-Lang & Petermann, 2010; Rachman et al., 2008; Wells et al., 1995). More specifically, many safety behaviors involve avoiding the feared stimulus, leading to a decrease in anxiety that negatively reinforces the avoidant behavior (Abramowitz, 2013). Further, these behaviors

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increase attention toward the stimulus, leading to increased perception of threat cues and threat overestimation (Lavy & van den Hout, 1994). Second, safety behaviors have been shown to reduce perceptions of self-efficacy, which may then decrease the likelihood of approach or engagement (Milosevic & Radomsky, 2013). Third, some safety behaviors have been shown to have a paradoxical effect and increase the likelihood of a feared outcome. This is often the case in social anxiety, as research has consistently shown safety behaviors (and not social anxiety) result in less favorable judgments and ratings of likability (Piccirillo et al., 2016). Finally, some safety behaviors have also been shown to increase anxiety in the moment (Telch & Lancaster, 2012). Specifically, safety behaviors, such as vigilance and monitoring, prime attentional focus towards threat and thereby increase the processing of threat-related cues, resulting in elevated situational anxiety and distress. In a similar vein, the mere presence of safety aids or safety behavior engagement has been shown to increase anxiety and perceptions of threat (Blakey & Deacon, 2015). This likely occurs as danger or threat is inferred because safety behaviors are used or safety aids are present (i.e. "if I check there must be danger.").

Given the potential etiological role of safety behaviors in risk for anxiety, it is important to develop interventions aimed at preventing their overuse. Most studies to date have focused on reducing safety behaviors in a treatment context. These studies have found that reducing safety behaviors enhances treatment outcomes across anxiety disorders (Farrell et al., 2019; McManus et al., 2008; Morgan & Raffle, 1999; Wells et al., 1995). A meta-analysis by Helbig-Lang and Petermann (2010) found that the efficacy of exposure therapy could be increased by reducing safety behaviors. For example, in a study of generalized anxiety disorder, safety behavior use at posttreatment was associated with worse long-term outcomes (hastened symptom resurgence). Similarly, other studies show that safety behavior elimination as the primary intervention is effective in reducing anxiety in transdiagnostic samples (Beesdo-Baum et al., 2012; Riccardi et al., 2017; Schmidt et al., 2012).

Far fewer studies have tested safety behavior reduction in a prevention context. Prevention interventions are important because, unlike treatment interventions that mitigate a current episode of anxiety, they can reduce the prevalence of a disorder (Albee, 1985). To eliminate a disorder, it is necessary to prevent the disorder from occurring in the first place. Moreover, prevention designs allow one to test the causal effect of a risk factor on an outcome as it is directly manipulated in an experimental design. The results of the few prevention studies to date have been promising. For example, Cougle et al. (2020) found that participants with elevated social anxiety randomly assigned to receive text messages to reduce social safety behaviors ($n = 48$) had significantly lower levels of social anxiety at one-month follow-up than those randomly assigned to a control condition ($n = 46$). Similarly, Korte and Schmidt (2020) found that a small group of students randomly assigned to a 2-hour cognitive behavioral intervention that focused on reducing safety behaviors ($n = 25$) reported significant reductions in social anxiety and worry at one-week and one-month compared to students randomly assigned to a 2-hour health education intervention ($n = 25$).

The findings from these studies are promising and suggest that preventing the use of safety behaviors can decrease risk for future anxious symptoms. However, the few studies to date were underpowered, not pre-registered (i.e. they did not document the hypotheses and methods/statistics that would be used to test the hypotheses in advance), and

focused on circumscribed anxious symptom clusters, such as fears of contamination or social anxiety and worry. Additional research is needed to determine if a more individualized approach, targeting a wide range of safety behaviors will reduce general anxious symptoms. Additionally, it is important to replicate the positive effects found in these studies using sufficiently powered sample sizes and pre-registered hypotheses. Pre-registering the studies hypotheses, methods, and statistical approach is important because it reduces researchers' degrees of freedom in searching for statistically significant findings; it inhibits questionable research practices such as p-hacking and HARKing, which in turn reduces false positives in the literature.

The purpose of the current study was to address this gap in the literature. We created an easy-to-use, 4-week, online safety behavior workbook prevention intervention. We chose to use online workbooks for two reasons. First, this approach is cost-effective (especially compared to the costs of a traditional face-to-face therapy). Second, if effective, this intervention would be easy to scale. The workbook was based on educational, cognitive, and behavioral principles found in existing cognitive behavioral interventions for safety behavior reduction (see Goodson & Haeffel, 2022). The intervention workbook focused on teaching participants the safety behavior model with a focus on the different manifestations of these behaviors, how they increase anxiety, and the variety of methods on how to reduce them. We tested two pre-registered hypotheses: 1) participants randomly assigned to the safety behavior reduction workbook condition would report using fewer safety behaviors post-intervention than those assigned to the active control condition; 2) participants randomly assigned to the safety behavior workbook condition would report lower levels of anxious symptoms post-intervention than those assigned to the active control condition.

Method

Open practices

Pre-registration and data can be found here: https://osf.io/xkvhg.

Power analysis

An a priori power analysis (conducted using G*Power 3.1) with two groups showed that a total of 128 participants were needed to detect a medium effect size (f = .25) with a power of .80 and alpha level $p < .05$.The medium effect size was based on prior experiments targeting safety behavior reduction; these studies found medium to large intervention effects (Cougle et al., 2020; Korte & Schmidt, 2020; Riccardi et al., 2017; Schmidt et al., 2012).

Participants

Participants were 131 undergraduates ($M_{age} = 19$; 40 males, 91 females) from a private university in the Midwestern United States. They were recruited to participate in this study using the Psychology Department's online extra credit portal and a campus-wide recruitment email. The recruitment materials advertised a "3-component research study"

in which participants would complete a baseline questionnaire, a 4-week workbook with daily activities (10 minutes each day), and then another questionnaire. The advertisement was intentionally vague as to not create any demand characteristics for the intervention. Seventy percent of participants self-identified as White/European descent ($n = 93$), 7.5% Asian descent ($n = 10$), 12.0% Latin/Hispanic descent ($n = 16$), 3.0% Black/African descent ($n = 4$), 3.0% Southeast Asian descent ($n = 4$), and 4.5% "other" ($n = 6$). All research procedures were fully consistent with APA ethical guidelines, and the study was approved by the University's Human Subjects Committee. Participants were given extra credit or monetary compensation for their participation.

Prevention intervention

We created two workbook conditions: safety behavior reduction and active control (academic skills). Each workbook condition consisted of four, one-week modules. Every morning, participants received an email with a link to a Google Form that contained the daily lesson and activities (~10 minutes total work time each day).

Safety behavior reduction workbook

The safety behavior reduction workbook was based on Goodson & Haeffel's (2022) manualized safety behavior elimination therapy (SBET) for anxiety. The first two weeks of the workbook focus on psychoeducation. Participants learn what safety behaviors are and why they have the potential to increase anxiety. They also learn the different categories of safety behaviors: checking, reassurance-seeking, monitoring, impression-management, and escape/avoid/evade behaviors. Participant complete activities such as reflecting on their own use of these behaviors, which fears elicit them, and how to identify them in hypothetical scenarios. The second two weeks focus on reducing and eliminating safety behaviors. Participants practice identifying and tracking safety behavior usage. They then complete assignments in which they identify times when they most often use safety behaviors and why those situations might be anxiety-provoking. Participants then learn behavioral strategies for reducing the use of safety behaviors such as redirecting focus to less threatening stimuli, setting a limit on the number of times the behavior can be used, and increasingly postponing the use of certain behaviors. Finally, they practice fear-countering exercises based on the safety behavior (e.g. rubbing one's hands in the dirt to combat excessive washing or greeting a stranger to resist pretending to not recognize people in public). This component of the program was individualized so that participants targeted safety behaviors specific to them. Each participant was provided a list of safety behaviors (via email) that he or she rated as using "frequently" on the Safety Behavior Assessment Form (see below) at baseline. They then chose two behaviors from the list to try to reduce and three different behaviors to conduct fear-countering exercises.

Academic skills workbook

The four-week active control workbook, adapted from Haeffel (2010), teaches a variety of academic skills each week. We chose the academic skills workbook as the active control condition because it has shown to do no harm, has high adherence rates, and covers a topic important to participants in the study (college students). During the first week, participants focus on the different learning modes and improving their study

environment, and the second week includes time-management and goal-setting tips. In the third week, participants practice note-taking and textbook reading strategies, and the fourth week guides participants through creating study plans.

Measures

Safety behaviors

The Safety Behavior Assessment Form-41 (Goodson et al., 2016) was used to measure safety behaviors. The SBAF is a self-report measure of safety behaviors designed to measure the frequency of safety behavior usage across a wide range of trauma- and anxiety-related conditions. The SBAF asks respondents to rate the frequency with which they engage in 41 safety behaviors on a 4-point scale (0 = never; 4 = always). Higher scores indicate greater levels of safety behavior usage. The SBAF has demonstrated strong internal consistency (Cronbach's alpha = .94) and test-retest reliability (r=.76). It is also able to discriminate between clinical and non-clinical populations (Goodson et al., 2016).

Anxious symptoms

The Beck Anxiety Inventory (BAI; Beck et al., 1993) a widely used and reliable measure of anxious symptoms. It consists of 21 items assess the emotional, cognitive, and physiological symptoms of anxiety. Higher scores indicate greater levels of anxious symptoms, particularly panic symptoms. The BAI has strong psychometric properties (Becket al., 1988).

Procedure

The study had three primary phases: baseline assessment, intervention, and post-intervention assessment. At baseline, participants were given instructions via Zoom to complete online measures of safety behavior usage and anxious symptoms (via a link to a Qualtrics survey). We then randomly assigned participants to either the safety behavior reduction condition or academic skills condition. Each morning, for the next 28 days, participants received an email with a link to the workbook page to complete that day. Upon completion of the workbooks (four weeks after the initial assessment), participants again completed the baseline measures of safety behaviors and anxious symptoms using the same Zoom and Qualtrics procedure used at baseline.

Results

Descriptive statistics for the primary study variables are listed in Table 1. One participant dropped out of the study after week 2 and thus, did not complete the follow-up assessment. This resulted in a final sample size of $N = 130$ (safety behavior condition, $n = 64$; active control condition, $n = 66$). The safety behavior and control conditions did not differ significantly on any of the baseline variables: age [$F(1,130) = .03$, $p = .86$, $\eta^2 = .00$], SBAF [$F(1,130) = .64$, $p = .42$, $\eta^2 = .01$], and BAI [$F(1,130) = 1.18$, $p = .28$, $\eta^2 = .01$].

In the safety behavior workbook condition, participants logged into to complete the safety behavior workbook an average of 26 days out of 28 (SD = 3.25; range = 20–28), and the active control workbook an average of 26 days out of 28 (SD = 2.35; range = 23–28). In the analyses below, we conducted "intent to treat" analyses.

Table 1. Means and standard deviations for primary study variables as a function of condition.

	Condition	Mean	SD
Age	Active Control	19.38	0.94
	Safety Behavior	19.35	1.23
SBAF Baseline	Active Control	46.08	15.18
	Safety Behavior	44.86	14.35
BAI Baseline	Active Control	9.59	8.67
	Safety Behavior	8.56	7.83
SBAF Time 2	Active Control	44.35	17.54
	Safety Behavior	39.22	16.35
BAI Time 2	Active Control	9.26	9.23
	Safety Behavior	9.64	7.78

SBAF: Safety Behavior Assessment Form; BAI: Beck Anxiety Inventory. There were no statistically significant differences between active control and safety behavior conditions for these variables.

Hypothesis 1: reduction in safety behavior usage

We hypothesized that participants randomly assigned to the safety behavior workbook condition would report using fewer safety behaviors post-intervention than those assigned to the active control condition. To test this hypothesis, we used an Analysis of Covariance (ANCOVA) with workbook condition as the independent variable and SBAF post-intervention score as the dependent variable. SBAF score pre-intervention was entered as a covariate to control for any pre-intervention individual differences in safety behavior usage. Contrary to our hypothesis, there was not a significant main effect of workbook condition on safety behavior usage $F(1,127) = 3.34$, $p = 0.07$, $\eta^2 = .016$ (see Figure 1; safety behavior workbook $M = 39.7$; control workbook $M = 43.9$). Note that results remain the same if safety behavior use at baseline is not included as a covariate ($F[1,127] = 2.97$, $p = 0.09$, $\eta^2 = .023$).

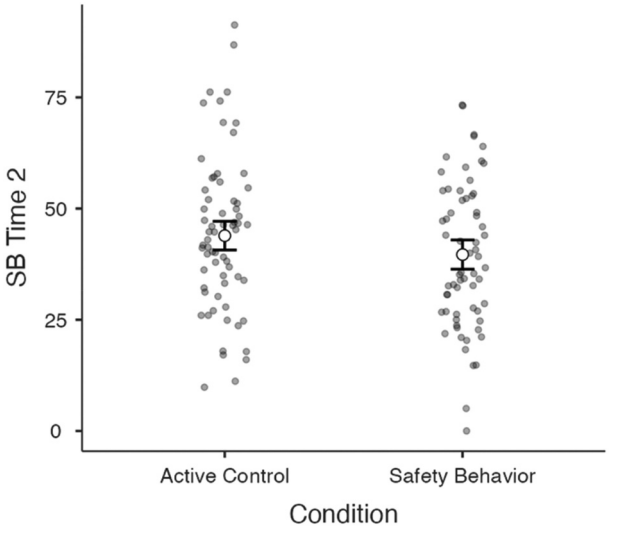

Figure 1. Safety behavior use (SBAF scores) at follow-up as a function of condition, controlling for baseline levels of safety behaviors. Error bars represent 95% confidence intervals.

Hypothesis 2: reduction in anxious symptoms

We hypothesized that participants randomly assigned to the safety behavior workbook condition would report lower levels of anxious symptoms post-intervention than those assigned to the active control condition. To test this hypothesis, we used an ANCOVA with workbook condition as the independent variable and BAI post-intervention score as the dependent variable. BAI score pre-intervention was entered as a covariate to control for any pre-intervention individual differences in anxiety levels. Contrary to our hypothesis, there was not a significant effect of workbook condition on anxious symptoms $F(1,127) = 1.07$, $p = 0.27$, $\eta^2 = .0.005$ (see Figure 2; safety behavior workbook $M = 10.03$; control workbook $M = 8.88$). Note that results remain the same if baseline level of anxious symptoms was not included as a covariate ($F[1,127] = .07$, $p = .80$, $\eta^2 = .001$).

Exploratory analyses

Given the lack of efficacy for the safety behavior workbook intervention, we conducted additional analyses to understand why the intervention did not work. First, we examined if fidelity moderated the effect of the safety behavior intervention. Second, we tested if there were subgroups for whom the intervention was effective. Specifically, we examined the potentially moderating effects of: a) gender, b) baseline levels of safety behaviors, c) baseline levels of anxious symptoms. We also conducted analyses to test the effect of safety behavior reduction on anxious symptoms. Although the workbook intervention was not more effective than active control in reducing safety behaviors, we still expected participants who reduced safety behavior usage to report fewer anxious symptoms.

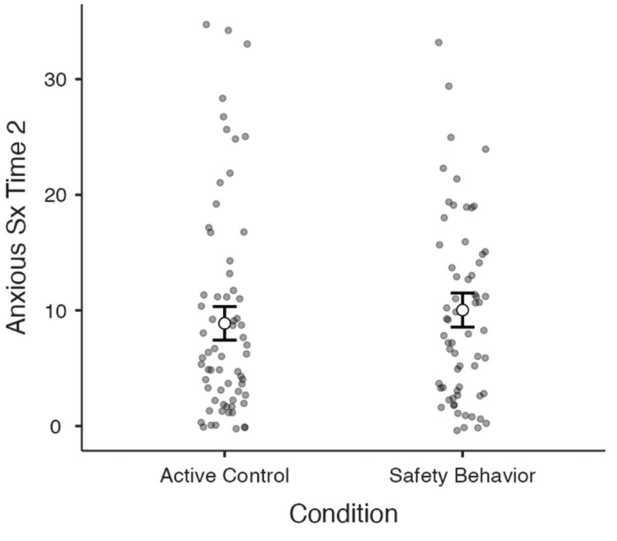

Figure 2. Anxious symptom (BAI scores) at follow-up as a function of condition, controlling for baseline levels of anxious symptoms. Error bars represent 95% confidence intervals.

Fidelity

Participants completed the workbooks on-line, which means it was possible to determine the degree to which they actively participated in all the intervention components. We coded participant fidelity as follows: 0 = did not participate (completed no workbook activities for 4 weeks; $n = 0$), 1 = low fidelity (completed some, but not all, workbook activities, $n = 34$, 53%), 2 = high fidelity (completed all workbook activities, $n = 30$, 47%). We decided to take a "sledgehammer" approach to fidelity analyses in which we compared only participants who completed all activities (high fidelity) to the active control condition on the outcomes of interest. If there were no differences between these extreme groups, then we could safely conclude our intervention had no effect.

We used two Analysis of Covariances (ANCOVAs) with workbook condition as the independent variable and SBAF and BAI post-intervention score as the dependent variables, respectively. SBAFand BAI scores pre-intervention were entered as covariates, respectively. When considering fidelity, the hypotheses was partially supported. As predicted, there was a significant main effect of workbook condition on safety behavior usage $F(1,93) = 4.46$, $p = 0.37$, $\eta^2 = .03$. Those in the safety behavior workbook condition (high fidelity) reported using significantly fewer safety behaviors than those in the active control condition (see Figure 3; high fidelity safety behavior workbook $M = 38.1$, SE = 2.36; control workbook $M = 44.1$, SE = 1.59). Sixty-three percent of high-fidelity participants in the safety behavior workbook condition reported a reduction in safety behaviors compared to 53% of participants in the control condition.

However, there was not a significant main effect of high fidelity workbook condition on anxious symptoms $F(1,93) = 3.34$, $p = 0.62$, $\eta^2 = .001$ (high fidelity safety behavior workbook $M = 9.60$ SE = 1.06; control workbook $M = 8.97$, SE = .71). To further probe this unexpected finding, we divided participants into two groups: those who reported a decrease in safety behavior symptoms and those who did not (coded: 0 = no change or increase in safety behaviors, and 1 = decrease in safety behaviors). Note that there were

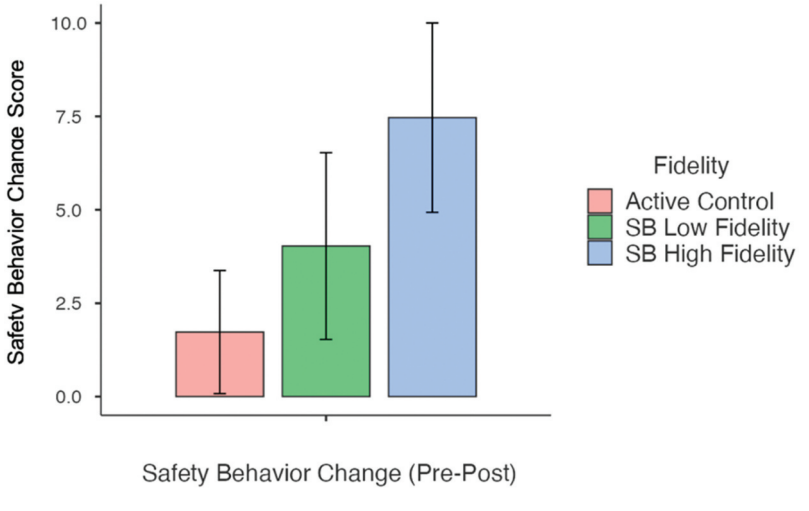

Figure 3. Change in safety behavior use (SBAF scores) at follow-up as a function of fidelity. Higher scores indicate greater reductions in safety behavior use.

no statistically significant differences in the two groups on pre-intervention levels of safety behaviors or anxious symptoms (both *p*-values > .10).

We used ANCOVA to test the effect of SBAF change on post-intervention anxiety symptoms. BAI score pre-intervention was again entered as a covariate to control for any pre-intervention differences in anxiety symptoms. Results showed a significant main effect of SBAF change (F[1, 125] = 5.51, $p = 0.02$, $\eta^2 = 0.02$) and a significant interaction of SBAF change x workbook condition (F[1, 125] = 4.58, $p = 0.034$, $\eta^2 = 0.02$). As shown in Figure 4, participants in the active control condition who reported a reduction in safety behaviors experienced a subsequent reduction in anxious symptoms (as one would expect). However, participants in the safety behavior condition who reported a reduction in safety behaviors reported no decrease in anxious symptoms.

Gender

We used ANCOVA to test if gender moderated the effectiveness of the workbook intervention. There was not a significant main effect of gender on safety behavior use (F[1,127] = .51, $p = .48$, $\eta^2 = .002$) or anxious symptoms (F[1,127] = .23, $p = .65$, $\eta^2 = .001$) or a significant gender x condition interaction on safety behavior use (F[1,127] = .28, $p = .56$, $\eta^2 = .001$) or anxious symptoms (F[1,127] = .47, $p = .49$, $\eta^2 = .002$).

Pre-Intervention levels of safety behaviors

We used a moderated regression to test if pre-intervention SBAF scores moderated the effectiveness of the workbook intervention. There was not a significant main effect of pre-intervention SBAF score on anxiety levels post-intervention ($b = .02$, SE = .05, $t = .37$, $p = .72$, 95% CI: −.08–.12) or a significant pre-intervention SBAF score X condition interaction on safety behavior levels ($b = -.12$, SE = .16, $t = -.76$, $p = .45$, 95% CI: −.43–.19) or anxiety levels ($b = .08$, SE = .07, $t = 1.15$, $p = .25$, 95% CI: −.06–.22) post-intervention.

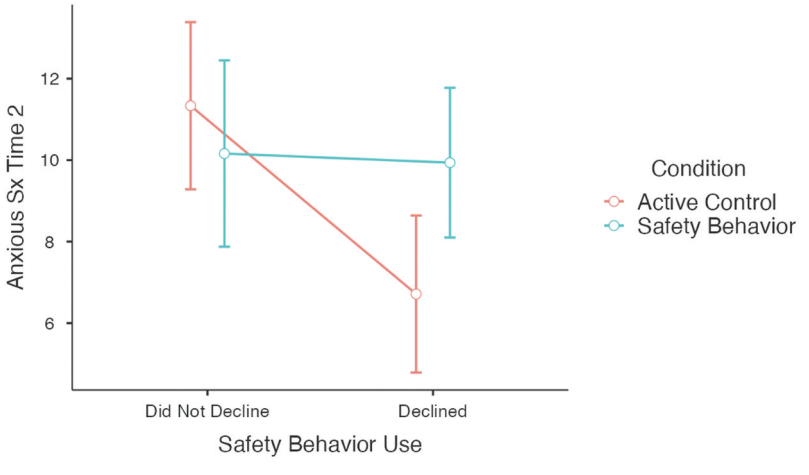

Figure 4. Anxious symptom (BAI scores) at follow-up as a function of condition and change in safety behavior use, controlling for baseline levels of anxious symptoms.

Pre-Intervention levels of anxiety symptoms

We used a moderated regression to test if pre-intervention anxious symptom levels moderated the effectiveness of the workbook intervention. There was not a significant main effect of pre-intervention anxiety scores on safety behaviors post-intervention (b = .25, SE = .20, t = 1.21, p = .23, 95% CI: −.15–.65). There also was not a significant pre-intervention anxiety score X condition interaction on safety behavior levels (b = .20, SE = .28, t = .72, p = .47, 95% CI: −.35–.76) or anxiety levels (b = −.16, SE = .12, t = −1.27, p = .20, 95% CI: −.41–.09) post-intervention.

Discussion

The purpose of this study was to test the efficacy of an online, month-long workbook prevention intervention for reducing safety behaviors and preventing anxious symptoms. We used a pre-post experimental design with an active control condition. Contrary to hypotheses, the results showed that participants in the safety behavior workbook condition did not exhibit fewer safety behaviors and lower levels of anxiety post-intervention than participants in the active control condition. Further, the intervention was not more effective for those with initially high levels of safety behavior usage or high levels of anxiety. This suggests that safety behaviors are difficult to change even for those who may need it most through online interventions.

The most parsimonious explanation for these findings is that a safety behavior workbook intervention is not sufficient to reduce safety behaviors and anxiety. However, there is at least one caveat to consider before concluding that the workbook prevention intervention is useless. Exploratory analyses found that the safety behavior workbook could reduce safety behaviors, but only if participants completed all the activities. This suggests that a safety behavior workbook intervention may be dose dependent and has potential to be effective under the right conditions. For example, it is possible that a longer workbook or one that provides more practice and activities could be efficacious. That said, these conjectures are based on exploratory analyses and require replication.

The exploratory analyses also revealed another unexpected finding—there was no effect of safety behavior reduction on anxious symptoms for those in the safety behavior workbook condition (but there was for the control condition). Participants in the safety behavior workbook condition who decreased their use of safety behaviors reported similar post-intervention anxiety levels to those who reported no change or increased safety behavior use. In contrast, those in the active control condition who decreased their safety behavior use reported significantly less anxiety than those reporting no change or an increase in safety behaviors. These results suggest that encouraging non-clinical samples to focus on, and reduce, safety behavior may actually maintain anxiety in the short term. This result support theorizing by Rachman et al. (2008) who argue for the judicial use of safety behaviors at the start of treatment as they can reduce drop-out and make treatment more tolerable.

The study had both strengths and limitations. Strengths include pre-registration and a well powered sample size. The study also used an active control condition (rather than a waitlist control) in which participants completed a workbook designed to build academic skills. Thus, any results cannot be attributed to the intervention simply "being better than nothing." Rather, any differences must be

due to the content of the workbook (as both groups completed workbooks). A final strength of the study is our focus on prevention rather than treatment. Most research on mental illness is focused on treatment, but if we are to reduce the burden of global mental illness, then we must learn how to stop it before it begins.

This study also had limitations. First, we used a relatively healthy and homogenous college sample. We chose this group for two reasons. First, college students are susceptible to developing anxiety (Paus et al., 2008) and second, our prior work showed that safety behaviors preceded and predicted anxiety in this age range (Goodson et al., 2018). However, it is possible that the results may not generalize to more diverse populations or those with more severe levels of safety behavior use and/or anxious symptoms. A second limitation is that the study was run during the COVID-19 pandemic. COVID-19 has brought about unprecedented changes and concerns, especially on U.S. college campuses, introducing new causes for anxiety. Some safety behaviors that were previously deemed unnecessary and/or harmful are now encouraged. For example, handwashing and research on bodily symptoms previously represented exaggerated or unnecessary safety behaviors, but they are now reasonable and even necessary for avoiding infection. The pandemic may have also introduced new safety behaviors that have impacted overall safety behavior or anxiety levels, such as those related to group socialization or mask-wearing. Finally, we used a single measure of anxiety, the BAI, which tends assess panic-related anxiety symptoms (Cox et al., 1996). It is possible that we would have obtained different results if we used a more general measure of anxious symptoms.

In conclusion, our study did not find support for a four-week online safety behavior workbook intervention for reducing safety behavior usage compared to an active control condition. Exploratory analyses indicate that it may be possible to increase the efficacy of the safety behavior workbook by focusing on fidelity and perhaps, extending the workbook time frame. However, even when participants reduced safety behaviors, they did not experience a subsequent increase in anxious symptoms. It is possible that promoting safety behavior reduction in non-clinical samples may have the unintended consequence of maintaining anxious symptoms.

Disclosure statement

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Ethical approval

University of Notre Dame IRB approved protocol # 20-02-5894

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