

University of Nevada, Reno

**Using Growth Mindset and Modifiable Risk Factors to Prevent Common Mental Disorders  
Among College Students: A Latent Growth Curve Analysis**

A dissertation submitted in partial  
fulfillment of the requirements for  
the degree of Doctor of Philosophy in Psychology

by

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THE GRADUATE SCHOOL

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prepared under our supervision by

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## Abstract

Depression and anxiety disorders (or common mental disorders; CMDs) are increasingly common among college students, with rates comparable to the general population. Brief, scalable, and transdiagnostic prevention efforts targeting CMDs are needed to address this burden. This study evaluated the effect of a single session growth mindset (GM) intervention on CMD symptom severity. The mediating role of changes in modifiable risk factors (e.g., avoidance, physical activity, social engagement) was examined. College students ( $N = 371$ ) were randomly assigned to complete either a GM intervention or a psychoeducation control. Participants completed assessments of CMD severity and engagement in modifiable risk factors at baseline, 3 and 6 months. Latent growth curve modeling was used to compare trajectories of risk factor engagement and CMD symptom severity between groups. Among participants below clinical severity at baseline ( $N = 239$ ), control group participants experienced an increase in anxiety symptoms severity whereas the intervention group experienced no such change. The intervention had no effect on changes in depression symptom severity. To the extent that the intervention increased growth mindset among participants above a clinical threshold at baseline, anxiety and depression symptom severity trajectories decreased more quickly. Among the full sample, to the extent that the intervention prevented an increase in cognitive and behavioral avoidance, symptom severity decreased. The intervention had no effect on any other modifiable risk factor. Findings suggest that a 30-minute, self-directed online intervention can be effective in preventing an increase in anxiety symptom severity among college students. Avoidance may be a key mechanism through which GM interventions influence mental well-being.

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## **Using Growth Mindset and Modifiable Risk Factors to Prevent Common Mental Disorders Among College Students: A Latent Growth Curve Analysis**

Anxiety and depression are known as common mental disorders (CMDs) due to the high frequency with which they occur (Jacka et al., 2013). Epidemiological studies suggest that the lifetime prevalence in the U.S. is 33.7% for any anxiety disorder and 18.3% for major depressive disorder (Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012). College students experience CMDs at similar rates to the general population and experience significant functional impairment and emotional burden as a result (Blanco et al., 2008). Students affected by CMDs experience long-term negative emotional and physical health consequences (Scott et al., 2016) and are at an elevated risk of dropping out of college (Eisenberg, Golberstein, & Hunt, 2009). Recent data suggest the incidence of new-onset major depressive disorder among first-year college students is 6.9% (Ebert et al., 2019), while incidence of new-onset anxiety disorders among emerging adults ages 18-24 is 4% (Essau, Lewinsohn, Lim, Moon-ho, & Rohde, 2018). More alarming, the prevalence of CMDs appears to be increasing in this population (Duffy, Twenge, & Joiner, 2019; Lipson, Lattie, & Eisenberg, 2018). Accordingly, rates of treatment seeking among college students are also increasing (Hunt & Eisenberg, 2010; Lipson et al., 2018), and college counseling centers are becoming overburdened as psychiatric severity increases in this population. Many students with CMDs do not receive treatment (Zivin, Eisenberg, Gollust, & Golberstein, 2009).

As a result, the World Health Organization Mental Health International College Student Project (WHO WMH-ICS) has made assessment of this population and efforts to reduce the burden of mental health disorders a priority (Auerbach et al., 2018). Specifically, the WHO is calling for scalable, cost-effective prevention efforts to address this burden. While existing interventions aimed at the prevention of CMDs among college students have yielded small to

moderate effects, most are time and labor intensive, with a mean intervention duration of 13 hours of in-person instruction. The literature is also characterized by methodological limitations including inadequate follow-up, lack of mediation analyses, and few comparisons to an attention-placebo control condition (Conley, Durlak, & Kirsch, 2015; Conley, Shapiro, Kirsch, & Durlak, 2017). As such, there is an urgent, unmet need for the longitudinal examination of effective components and associated mechanisms of change of brief, disseminable preventative interventions tailored for college students.

### **Growth Mindset Interventions**

Growth mindset (GM) interventions represent a promising area of research for prevention, as they are typically effective in a single session intervention (SSI) format, may target multiple mechanisms related to CMDs, and have identified mechanisms of change. GM interventions arise from Dweck and colleagues' (1995) cognitive model of motivation, in which individuals are hypothesized to have *implicit theories*, or *mindsets*, concerning the perceived malleability of a self-relevant trait. A large body of work examining implicit theories of intelligence suggests that mindsets have important consequences for how individuals choose goals, respond to failure, and perform in academic contexts (Dweck, 1986, 2013; Dweck et al., 1995). Individuals who believe intelligence (or any trait) is fixed are referred to as *entity theorists*, while those who believe a trait is malleable are called *incremental theorists*. These approaches are also referred to as fixed and growth mindsets, respectively. Because entity theorists believe intelligence is fixed and innate, they are more likely to choose tasks that demonstrate to others that they possess a high degree of intelligence. Accordingly, entity theorists are more likely to choose easier tasks to ensure success and persist for a shorter period of time on challenging tasks. In contrast, incremental theorists are more likely to have mastery

goals, resulting in choosing tasks in which they are more likely to learn, and persist for a longer period of time on difficult problems (Dweck & Leggett, 1988).

This work demonstrates that beliefs about the malleability of a trait have important consequences for future behavior, specifically in response to challenge. Moreover, research shows that entity theories are learned (Mueller & Dweck, 1998). Children who receive praise for being intelligent are more likely to exhibit behaviors of entity theorists by choosing easier tasks and spending less time on challenging problems, whereas children praised for trying hard are more likely to resemble incremental theorists by choosing mastery goals and working through difficult problems. The beliefs tend to apply to specific rather than global traits. For example, an individual may have learned that intelligence is fixed but that a personality trait such as hostility is malleable (Yeager & Walton, 2011).

GM interventions are designed to teach individuals that a given trait is subject to change and thus is malleable. These interventions often include a discussion of neuroplasticity in order to demonstrate that the brain can change. By increasing the belief in the malleability of a trait such as intelligence, GM interventions in academic settings increase persistence on challenging problems and show students that finding work challenging is not a sign that they are inherently incapable (Paunesku et al., 2015). Accordingly, GM interventions emphasizing the malleability of intelligence have consistently resulted in significantly improved academic outcomes ( $d = .56$ ; Lazowski & Hulleman, 2016). This model has been successfully applied in college student populations. For example, GM interventions have been found to increase academic enjoyment, engagement, and GPA relative to a control group (Aronson, Fried, & Good, 2002). Just a single session GM intervention addressing adjustment to college resulted in the significant reduction of

achievement gaps among disadvantaged students during their first year of college (Yeager et al., 2016).

### **Growth Mindset and CMDs**

Unsurprisingly, mindsets have been recently evaluated with respect to mental health. In an analysis of the structure of implicit theories across mental health concepts (anxiety, depression, emotions, intelligence, personality, social anxiety, alcohol use), perceptions of malleability were both specific to the problem (e.g., beliefs about depression may differ somewhat from anxiety) and are also related to a general belief of malleability of mental disorders (Schroder et al., 2017).

Beliefs about the malleability of emotion have been also shown to relate to CMD symptom severity, presumably via the effects of engagement and persistence in adequate emotion regulation. Specifically, believing emotions to be malleable is associated with lower depression and anxiety symptom severity, and adaptive use emotion regulation strategies both cross-sectionally and longitudinally (De Castella, Platow, Tamir, & Gross, 2018; Ford, Lwi, Gentzler, Hankin, & Mauss, 2018; Kneeland & Dovidio, 2019; Kneeland, Dovidio, Joormann, & Clark, 2016; Schroder, Dawood, Yalch, Donnellan, & Moser, 2015; Tamir, John, Srivastava, & Gross, 2007). In an observational study of the effect of beliefs about the malleability of emotion on adjustment to college, participants endorsing entity theories of emotion reported more negative emotions, fewer positive emotions, lower well-being, and higher levels of depression over the course of the academic year (Tamir, 2007). Entity theorists also reported less support from college peers than did their counterparts endorsing incremental beliefs. These outcomes were specific to malleability beliefs of emotion. No relationship was found between these

outcomes and malleability of intelligence, further supporting the domain-specific nature of such beliefs (Tamir, 2007).

Mindsets related to navigating life's challenges seem to be particularly important in response to transition and challenge that can be associated with engagement and adaptation (Paunesku et al., 2015; Schleider & Weisz, 2018) or outright avoidance of challenges (Blackwell, Trzesniewski, & Dweck, 2007). These features make mindsets a promising point of intervention in addressing problems in avoidance and coping related to the development and maintenance of CMDs (Hofmann, 2007; Ottenbreit & Dobson, 2008; Trumpf, Margraf, Vriends, Meyer, & Becker, 2010). What's more, the effects of GM interventions are typically found after a single intervention.

Two studies have evaluated long-term effects of single session GM interventions in the reduction of CMDs among youth. Miu and Yeager (2015) aggregated the results of a series of three studies ( $N = 599$ ) examining the effects of a 25-minute GM intervention with adolescents transitioning to high school. The intervention was constructed to engender GM by focusing on the malleable nature of personality and was compared to an active placebo (malleable nature of athletic ability) control group. Both conditions included; (1) reading an article about the potential for change in that trait, (2) reading testimonials from others, and (3) writing a short essay about these concepts. At the 9-month follow-up, participants in the GM intervention were 40% less likely to report clinically significant levels of depression than their counterparts in the active control condition, suggesting that the intervention prevented or slowed the development of depressive symptoms seen in the control group. A moderation analysis suggested that the intervention was most effective for individuals endorsing a fixed mindset at baseline (Miu & Yeager, 2015).

Similar results were found in a study conducted with youth ages 12-15 endorsing high depressive and anxiety symptomology (Schleider & Weisz, 2018). Participants were randomly assigned to complete a 20-30-minute computer-based, self-administered GM intervention intending to increase the belief in the malleability of personality traits. This intervention included a description of neuroplasticity, testimonials from others endorsing a belief in the brain's malleability, vignettes of older youths using coping with using GM, a worksheet applying these principles, and an exercise where participants described this new information to hypothetical younger children. Compared to a supportive-therapy control condition, the intervention group demonstrated reductions in depression symptom severity at 9 months follow-up. Effect sizes for self-reported depressive symptoms ( $d = .32$ ) and parent reported symptoms ( $d = .60$ ) were greater than previously examined SSIs to reduce depression in youth. Reduction in self-reported anxiety symptom severity was not significant, but the effect size favored the GM condition, and reduction in parent-reported anxiety was significant (Schleider & Weisz, 2018).

### **Mechanisms of Change in GM Interventions**

While the examination of GM interventions in the prevention of CMDs is in its infancy, longstanding effects achieved by SSIs more generally are thought to be produced by tapping into *recursive* processes. Specifically, an individual's initial behavior change in response to new information is reinforced because it is effective in achieving desired outcomes and thus is repeated (Yeager & Walton, 2011). Implicit theories about malleability may be among these crucial beliefs that lead to a cycle of engagement (or avoidance) and reinforcement leading to subsequent engagement (or avoidance) and the related contingencies. For instance, GM interventions may promote engagement in modifiable behaviors that lead to positive outcomes (e.g., social engagement) that in turn promote malleability beliefs and future engagement.

Indeed, Schleider and Weisz (2018) found that perceived ability to impact events or environmental conditions mediated the effects of a GM intervention on symptom severity. Similarly, both emotion regulation self-efficacy and cognitive reappraisal have been found to mediate the relationship between implicit theories and well-being outcomes across the college transition (Kneeland & Dovidio, 2019; Tamir et al., 2007). Thus, GM interventions appear to increase the degree to which an individual perceives control over influencing his or her emotions, behavior, and external circumstances. Modifiable behaviors themselves have not yet been examined as mechanisms of changing linking GM interventions to mental health.

### **Adapting GM Interventions to Prevent CMDs among College Students—Identifying Behaviors Subject to Change**

In the academic domain, GM interventions are related to increased task persistence on challenging problems (Diener & Dweck, 1978; Mueller & Dweck, 1998). This concept has yet to be applied to persistence on modifiable behaviors relevant to mental health. Existing GM interventions have made use of examples of individuals responding to challenges and persisting through problems using GM (Miu & Yeager, 2015; Schleider & Weisz, 2018). This content could be modified for college students, as college students have access to resources that allow them to engage in modifiable behaviors (e.g., increasing physical activity by utilizing campus gym, increasing peer affiliation by joining student club) that may pose more challenges for individuals without this infrastructure or adolescents who may have less personal autonomy. Indeed, college campuses represent one of the few circumstances where academic, leisure and health activities are integrated into a single setting, and thus are ideal settings to utilize existing infrastructure to disseminate interventions at a large scale (Hunt & Eisenberg, 2010).

Because no studies to date have evaluated a GM intervention pertaining to mental health in college students, those factors that can be modified that directly relate to mental health should be identified and incorporated into GM interventions. Given the existing research, a short list of modifiable behaviors that have substantial support in the development of CMDs includes physical activity, sleep quality, substance use, social support, coping skills, and avoidance (Cairns, Yap, Pilkington, & Jorm, 2014; Emerson et al., 2018; Zimmermann, Chong, Vechiu, & Papa, 2020a). In addition to being identified as risk factors with causal links to the development and maintenance of CMDs, these can be reasonably modified by individuals without professional support (i.e. substance use could be considered reasonably modifiable without professional intervention but not substance abuse). As such, they are identified candidates for risk factors to include as examples of modifiable behaviors in GM interventions.

### **Present study**

Taken together, GM interventions have demonstrated potential as a preventative intervention for CMDs and appear to be well-suited to adaptation for college students by focusing on risk and protective factors that college students can change. The present study consisted of a randomized trial of the potential efficacy of a universal preventative GM intervention focused on modifiable risk factors and how to alter them in the general population of college students. Participants were randomly assigned to receive a GM intervention adapted for college students with a focus on modifiable behaviors or assigned to an active psychoeducational control. CMD symptom severity and behavioral engagement in activities related to modifiable risk factors targeted were evaluated at 3 and 6 months in order to evaluate the long-term effects of the intervention and the mediating role of engaging in modifiable risk

factors in the development of CMDs. Baseline symptom severity and emotion mindsets were examined as potential moderators.

**Hypothesis 1:** The intervention group will experience a less rapid increase in CMD symptom severity than the control group.

**Hypothesis 2:** Baseline mindset and CMD severity will moderate the effects of the intervention in that individuals with a fixed mindset and higher CMD symptom severity pre-intervention will benefit most from the intervention.

**Hypothesis 3:** The intervention will be associated with increased engagement in modifiable protective factors and lower engagement in modifiable risk factors for CMDs.

**Hypothesis 4:** Changes in engagement with modifiable risk factors for CMDs will mediate the relationship between the intervention condition and CMD symptom severity.

## **Methods**

### **Intervention development**

The intervention was developed to for delivery via web-interface, as computerized interventions for treating mental disorders in university settings have been successful and acceptable to users (Davies, Morriss, & Glazebrook, 2014). GM intervention materials were developed to include an article describing neuroplasticity as it relates to mental health. Specifically, the intervention described the brain, and therefore emotions and mental health, as changing in response to contextual, person-environment factors. This section was followed by information about the role of modifiable behaviors in the development of mental health (e.g., sleep quality, physical activity), and examples of how to change them (e.g., limit screen time before bed, taking the stairs instead of the elevator). The GM component focused on the malleability of emotions, as emotion mindset has been shown to be associated with coping and

symptom severity among college students (Kneeland & Dovidio, 2019; Kneeland, Dovidio, et al., 2016; Kneeland, Nolen-Hoeksema, Dovidio, & Gruber, 2016b; Tamir et al., 2007). Each concept was described in conjunction with interactive multiple choice and short response “check in” questions. The intervention followed procedures used in past studies (Miu & Yeager, 2015; Schleider & Weisz, 2018). Content included testimonials from other college students endorsing a belief in the brain’s malleability, vignettes of other college students using coping with GM, and an exercise in which participants described this new information to a hypothetical high school student. The psychoeducation control consisted of traditional psychoeducation including a description of depression and anxiety (e.g., prevalence, symptoms, how a diagnosis is made by a mental health professional). The control also included testimonials of college students experiencing mental health difficulties. Interactive check in questions and open responses were matched to the frequency and nature of questions in the intervention material.

GM interventions have often yielded effects with a very small dosage. Significant changes in beliefs about emotions, depression, and relevant attitudes have been found following interventions as brief as a one page article (Kneeland, Nolen-Hoeksema, Dovidio, & Gruber, 2016a), or an eight-minute audiovisual presentation (Lebowitz & Ahn, 2018). For the present study, thirty minutes was chosen as this length has been found to be a sufficient “dose” to lead to prevention effects in other studies (Schleider & Weisz, 2018). Qualitative data was collected from undergraduate research assistants ( $N = 3$ ) to assess for content relevance and clarity.

Assessments and intervention were conducted using Qualtrics Survey Software.

### **Participant Recruitment**

**Inclusion/exclusion criteria.** Participants were only included between the ages of 17-24, as CMD risk factors for adults may differ in important ways that would affect the content of the

intervention material (e.g., Emerson et al., 2018). No CMD symptom severity cutoff was chosen. First, this choice allowed for a more ecologically valid representation of service delivery, in which universities may have limited ability to screen students before completing health promotion activities. Second, because the use of GM interventions to change CMD symptom severity is relatively novel, this approach allowed for the comparison of the effects of the intervention on individuals above and below symptom severity threshold cutoffs at baseline.

**Sample size.** Sample requirements for detecting intervention effects with latent growth curve modeling methods depend on the size of the effect, number of repeated measurements and complexity of the model tested. Simulation studies have suggested that 100 may be an adequate sample size for this type of analysis (Curran, 1994). Others have suggested 30-50 per group if variables are normally distributed (Burchinal, Nelson, & Poe, 2006). When the number of instances of measurement (3) and small effect ( $d = .2$ ) is taken into account, a sample size of 346 has been suggested to examine a second-order (two-group) latent growth curve model (Wänström, 2009).

**Participant compensation.** Participants were compensated \$5 for every part of the study completed (up to \$15). Participants who completed all three parts of the study were also eligible to win one of twenty-five \$35 gift cards or receive course credit.

### **Study Design**

Participants completed a battery of questionnaires at baseline and were then randomly assigned to an intervention condition using the randomization feature on Qualtrics Survey Software. Participants then completed a post-intervention assessment immediately after completing the intervention. Follow-up included assessment of CMD symptom severity and risk factors at two subsequent time points (3 months and 6 months). See Figure 1.

### ***Baseline Assessment***

**Demographic questions.** Participants were asked their gender, age, race/ethnicity, and mental health treatment history.

**PHQ-9 ( $\alpha = .88$ ).**<sup>1</sup> Severity of depression was measured via the Patient Health Questionnaire (PHQ-9; Kroenke, Spitzer, & Williams, 2001), a 9-item questionnaire associated containing one item for each symptom of major depressive disorder as specified by the DSM. A PHQ-9 score  $\geq 10$  has a sensitivity of 88% and a specificity of 88% for MDD.

**GAD-7 ( $\alpha = .90$ ).** Anxiety severity was measured using the Generalized Anxiety Disorder 7-item scale (GAD-7; Spitzer, Kroenke, Williams, & Löwe, 2006). The GAD-7 is a common, brief measure of anxiety symptom severity. A GAD-7 score  $\geq 10$  has a sensitivity of 89% and specificity of 82% for an anxiety disorder diagnosis.

**Emotion Mindset ( $\alpha = .80$ ).** Implicit theories of emotion were assessed using the 4-item scale adapted by Tamir and colleagues (2007). Items are rated on a 4-item scale (1 “strongly disagree”, 4 = “strongly agree”). Items assess perceived malleability of emotions (e.g., “The truth is, people have very little control over their emotions”). Items are averaged. High scores reflect incremental or growth mindsets while low scores reflect entity or fixed mindsets.

**Mental Health Mindset ( $\alpha = .90$ ).** Implicit theories of mental health were assessed using the “find-and-replace,” method (Schroder, Dawood, Yalch, Donnellan, & Moser, 2016b) to adapt the 4-item Personality Mindset Scale to reflect beliefs about the malleability of mental health (e.g., “Your mental health is something about you that you cannot change very much.”). Items are rated on a 4-item scale from “strongly disagree,” to “strongly agree.”

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<sup>1</sup> Reflects internal consistency of the measure as assessed in the current study at baseline.

**Beliefs about Risk Factors for CMDs ( $.75 \leq \alpha \leq .86$ ).** Beliefs about risk factors for CMD's were assessed using the Beliefs about Behaviors and Emotional Distress Scale (BBEDS; Zimmermann, Chong, Vechiu, & Papa, 2020b). This measure was developed to assess beliefs about modifiable risk and protective behaviors for CMDs. The scale includes 16 items asking "If you were having difficulty managing emotions, how helpful would it be to..." followed by the modifiable behavior (e.g., spend time with loved ones, try to avoid situations that make me feel anxious or uncomfortable, smoke marijuana) and a 5-item scale ranging from "very unhelpful," to "very helpful." The four subscales include healthy behaviors ( $\alpha = .82$  in this study), social support ( $\alpha = .82$ ), substance use ( $\alpha = .75$ ), and avoidance ( $\alpha = .86$ ).

**Post-treatment Assessment.** This assessment occurred immediately after the participant completed the intervention. This assessment allowed for the evaluation of the acceptability of the intervention as well as potentially negative consequences (e.g., stigma).

**SSMIS-SF.** Public stigma and self-stigma were assessed using the two subscales from the Self-Stigma of Mental Illness Short Form (SSMIS-SF; Corrigan et al., 2012). The 20 items are each rated on a nine-point scale (1= "I strongly disagree" to 9 = "I strongly agree"). Scale scores are determined by summing the 5 items included in each subscale. Awareness of public stigma items began with the item stem "I think the public believes..." and include items such as "most persons with mental illness are to blame for their problems," ( $\alpha = .87$ ), whereas the agreement with stigma items began with the "I think..." and was followed by the same items ( $\alpha = .82$ ).

**CSQ ( $\alpha = .92$ ).** Acceptability of the intervention was assessed using the Client Satisfaction Questionnaire (CSQ; Walker, Obolensky, Dini, & Thompson, 2010). Items are rated

on a 4-point scale from (1= “lowest degree of satisfaction,” to 4= “highest degree of satisfaction”).

**SUS ( $\alpha = .83$ ).** The usability of the intervention was assessed using the System Usability Scale (SUS; Sauro, 2011); a widely used 10-item scale designed to assess program usability. Each item is rated on a 5-point scale ranging from 1 (“strongly disagree”) to 5 (“strongly agree”) with a total score range of 20 to 100. Results of the measure can be compared to empirically derived cutoff scores. A score of 68 or above indicates above average program usability (Sauro, 2011).

**Follow up assessment.** Outcome assessment occurred at two subsequent time points (3 months and 6 months) to assess engagement in risk factors and severity of CMD symptoms. Participants completed all follow-up assessments via online Qualtrics survey software. At each follow-up, participants completed assessments of anxiety and depression symptom severity, knowledge of risk factors and engagement in modifiable risk factors.

***Engagement in Risk Factors.***

**B-COPE.** Coping strategies were assessed using the Brief COPE, a 28-item scale assessing various dimensions of healthy and unhealthy coping (B-COPE; Carver, 1997). This scale yields 14 subfactors. This scale includes a subscale assessing substance use as coping, which used to assess for substance use as a modifiable risk factor in addition to coping ( $\alpha = .94$  in this study). This measure can also be scored using higher order factors of approach and avoidant coping, (Bean, Gibson, Flattery, Duncan, & Hess, 2009). Both demonstrated adequate internal reliability in the present study (approach coping,  $\alpha = .77$ ; avoidant coping,  $\alpha = .73$ ).

**MOS.** Sleep quality was assessed using the Medical Outcomes Study Sleep measure (MOS; Hays & Stewart, 1992). This scale consists of 12 items in which participants report sleep

quality over the past 4-week time period (e.g., how often participants “have trouble falling asleep” and “feel drowsy or sleepy during the day”). Items are assessed on a six-item scale (1 = “all of the time” to 6 = “none of the time”). Internal reliability was not adequate in the current sample, however  $\alpha = .59$ . The removal of item 10, “get the amount of sleep you needed,” however, resulted in adequate reliability  $\alpha = .70$ .

*Social engagement* ( $\alpha = .71$ ). Engagement in social activities was assessed using a measure adapted from a 5-item assessment of the frequency of participation in various social events (e.g., organized events, spending time with friends or family) over the course of the past week (Kim, Wang, & Oh, 2016). The scale consists of a 5-item scale ranging from “very rarely” to “very frequently.”

*Physical activity*. Physical activity was assessed using a two-item questionnaire (Marshall, Smith, Bauman, & Kaur, 2005). Assessment includes self-reported vigorous and moderate activity (e.g., “How many times a week do you usually do 20 minutes of vigorous physical activity that makes you sweat or puff and pant? [for example, jogging, heavy lifting, digging, aerobics, or fast bicycling].”) These items have demonstrated good inter-rater reliability ( $k = .53$ ) according to doctor ratings (Marshall et al., 2005). Cronbach’s alpha was .58 in the current study. As such, the two items (vigorous and moderate physical activity) were examined separately.

*CBAS* ( $\alpha = .94$ ). Avoidance was assessed using the Cognitive-Behavioral Avoidance Scale (CBAS; Ottenbreit & Dobson, 2004). The scale contains 31 items assessing cognitive avoidance, behavioral avoidance, and social and non-social avoidance (e.g., “I do not go out to events when I know there will be a lot of people I do not know”) yielding a total score assessing

avoidance. The scale uses a 5-item scale (1 = “Not at all true for me”, 5 = “Extremely true for me”; Ottenbreit & Dobson, 2004).

## Results

### Participant Characteristics

At baseline, 371 undergraduate students were recruited. Participants had a mean age of 18.29 ( $SD = .93$ ). Participants were primarily (72.0%) female. Of the sample, 58.2% identified as White, 18.1% identified as Asian/Pacific Islander, 14.6% identified as Hispanic/Latino, 4.0% identified as Black or African American, 0.5% identified as Native American or American Indian, and 4.6% identified as other. The sample consisted of 69.5% freshmen students, 19.1% sophomore students, and 9.2% upperclassmen.

**CMD symptom severity.** Of the sample, 34.5% ( $N = 128$ ) reported receiving mental health treatment at any point in the past, with 35.2% ( $N = 45$ ) of this group receiving mental health services at the time of study enrollment. Mean PHQ-9 scores were 8.6 ( $SD = 5.98$ ) and mean GAD-7 scores were 7.84 ( $SD = 5.60$ ). With respect to diagnostic cutoffs, 229 participants (61.7% of the sample) scored below 10 on the PHQ-9, and 239 participants (64.4%) scored below 10 on the GAD-7.

### Emotion Mindset at Baseline

Higher scores on emotion mindset (i.e. a more incremental theory of emotions or believing emotions to be more malleable) were associated with lower depression and anxiety symptom severity. Emotion mindset was not related to awareness of or agreement with public stigma. Baseline emotion mindset was associated with engagement in some but not all modifiable behaviors. Specifically, believing emotions to be more malleable was associated with less avoidance, less substance use, less avoidant coping, better sleep quality and more social

engagement. Emotion mindset was not related to approach coping, or physical activity.

Correlations among baseline variables are presented in Table 1.

### **Randomization**

Independent samples t-tests and a series of chi-square tests were conducted to determine if the control group ( $N = 177$ ) differed from the intervention group ( $N = 194$ ) on any relevant baseline characteristics. Participants did not differ on baseline symptom severity for anxiety  $t(369) = .74, p = .462$ , depression symptom severity  $t(369) = 1.06, p = .288$ , mental health mindset  $t(369) = -1.75, p = .081$ , or emotion mindset  $t(369) = -.06, p = .550$ .

### **Attrition**

The intervention was completed by 371 participants, with 327 participants completing all post-intervention assessments at baseline. For the three-month follow-up (T2), 248 (66.8%) participants initiated (e.g., completed the first questionnaire, the PHQ-9) and 232 (62.5%) completed all assessments. At the six-month follow-up, 278 (75.2%) participants initiated, and 269 (72.5%) completed all assessments. Chi-square analyses suggested that the intervention group did not differ from the control group in rate of attrition at T2 [ $\chi^2(1, N = 371) = .107, p = .301$ ] or T3 [ $\chi^2(1, N = 371) = .01, p = .929$ ]. Independent samples t-tests indicated that individuals who initiated T2 were more likely to report greater anxiety symptom severity at baseline ( $M = 8.25, SD = 5.73$ ) compared to their counterparts who did not complete T2 ( $M = 7.00, SD = 5.22$ ),  $t(369) = -2.03, p = .043$ . No differences were found for depression symptom severity,  $t(369) = -1.27, p = .204$ . The difference in baseline anxiety among T3 completers approached significance, with a mean baseline GAD-7 of 8.15 ( $SD = 5.55$ ) among completers, and 6.92 ( $SD = 5.67$ ) among non-completers  $t(369) = -1.84, p = .067$ . No differences were found for attrition at T3 for baseline depression symptom severity  $t(369) = -1.40, p = .163$ .

## Manipulation Check

A repeated-measures between and within-subjects ANOVA was conducted to determine whether the intervention had an impact on emotion mindset and mental health mindset. A significant main effect  $F(1, 367) = 78.48, p < .001, \eta_p^2 = .176$  was found for emotion mindset, suggesting that across conditions, participants reported an increase in the belief that emotions can be malleable. The interaction of emotion mindset and experimental condition was also significant,  $F(1, 367) = 21.00, p < .001, \eta_p^2 = .054$ , indicating that participants in the intervention condition experienced a greater increase in incremental mindset (i.e. believing emotions to be malleable) than did their counterparts in the control condition. Similar results were found for mental health mindset. A significant main effect was found across conditions,  $F(1, 363) = 5.81, p = .016, \eta_p^2 = .016$ . A significant interaction effect was also found,  $F(1, 363) = 5.43, p = .020, \eta_p^2 = .015$ , suggesting that participants in the intervention condition reported a more incremental mindset than did participants in the control condition.

## *Beliefs about Risk Factors*

Participants in the intervention group reported greater endorsement of avoidance as a risk factor for emotional distress,  $t(369) = -3.21, p = .001$ , as well as greater endorsement of substance use as a risk factor,  $t(369) = -1.99, p = .048$ . No differences were found for beliefs about health behaviors,  $t(369) = -.073, p = .468$ , or social engagement,  $t(369) = -.063, p = .531$ .

## Acceptability

Participants in the intervention group reported CSQ scores of 22.8 ( $SD = 4.51$ ). This result translates to a mean item score of 3.26, with 1 indicating the “lowest degree of satisfaction,” and 4 indicating the “highest degree of satisfaction.” CSQ scores did not differ between groups  $t(360) = .27, p = .791$ . The mean SUS score in the intervention group ( $M = 79.63$ ,

$SD = 14.35$ ) was above the cutoff score of 68, indicating above average program usability, and just below the score of 80.3 which indicates the top 10% of usability scores (Sauro, 2011). No differences were found in usability between groups,  $t(325) = -.12, p = .902$ .

An exploratory analysis was conducted within the intervention group to determine whether there were differences in acceptability among groups including gender, race/ethnicity, or depression or anxiety symptom severity (as indicated by the GAD-7 and PHQ-9). Independent t-tests suggested no gender differences in CSQ scores  $t(187) = -.366, p = .715$  or SUS scores  $t(185) = -1.19, p = .235$ . Participants identifying as Native American or American Indian ( $N = 2$ ) were combined with participants identifying as “other,” ( $N = 17$ ) due to the small group size. A one-way ANOVA indicated no differences among groups for the CSQ,  $F(4, 184) = 2.04, p = .091$  or the SUS,  $F(4, 184) = .420, p = .739$ , although LSD post-hoc tests suggested that participants identifying as Hispanic or Latino did significantly differ from their White counterparts,  $p = .033$  and those identifying as other race/ethnicity ( $p = .047$ ). Mean CSQ scores among Hispanic/Latino participants were 24.00 ( $SD = 3.95$ ) compared with 21.78 ( $SD = 4.69$ ) among White participants and 20.60 ( $SD = 5.06$ ) among those identifying as other race/ethnicity. Pearson correlations suggested that baseline PHQ-9 scores were weakly correlated with satisfaction,  $r(189) = -.149, p = .040$ , but not system usability,  $r(189) = .113, p = .124$ . Baseline GAD-7 scores were weakly associated with better usability ratings  $r(187) = .159, p = .030$ , but not satisfaction  $r(189) = -.024, p = .739$ .

### ***Stigma***

Participants in the intervention group endorsed higher awareness of public stigma ( $M = 27.56, SD = 9.98$ ) than did control group participants ( $M = 24.54, SD = 9.84$ ),  $t(356) = -2.87$ . No

differences were found for agreement with stigmatizing stereotypes,  $t(325) = -0.12, p = .902$ .

Results are presented in Table 2.

### **Prevention of New-Onset CMDs**

Among the 170 individuals responding at six months who scored below 10 on the PHQ-9 at baseline, 21.5% (N = 17) of the control group and 18.7% (N = 17) of the intervention group were above the diagnostic threshold at six months. Chi-square analyses indicated no significant difference between groups,  $\chi^2(1, N = 170) = .213, p = .645$ . Among 175 individuals responding at six months who did not meet the diagnostic threshold on the GAD-7 (< 10) at baseline, 17.7% (N = 14) of the control group and 14.6% (N = 14) of the intervention group met diagnostic criteria at six months, although this difference was not significant,  $\chi^2(1, N = 175) = .318, p = .573$ . These results suggest that the intervention did not have a statistically significant effect on the incidence of anxiety or depression as assessed by cut scores of dimensional symptom severity scales.

### **Hypothesis Testing—Symptom Severity Trajectories**

Data were analyzed using latent growth curve modeling (LGCM) to evaluate the impact of the intervention on CMD symptom severity and to investigate the mediating role of changes in modifiable risk factors relative to a control condition. LGCM has been suggested as an ideal method for the analysis of randomized prevention trials as it compares temporal differences between trajectories of the treatment and control groups (Muthén et al., 2002; Muthén & Curran, 1997). It confers advantages over ANOVA and MANOVA methods, as it can account for missing data and model both between group trajectories and dependence of observations in repeated measures within-subjects study designs (Feingold, 2009). Analyses were conducted using R (R Development Core Team, 2011). The *Lavaan* v. 0.6-4 package was used to conduct

the LGCM testing (Rosseel et al., 2019). An intent-to-treat analysis was conducting using maximum-likelihood estimation in order to include all participants in the analysis (Preacher, Wichman, Briggs, & MacCallum, 2008). Cutoff criteria used to evaluate goodness-of-fit were a Comparative Fit Index (CFI) and Tucker-Lewis Index close to .95, Root Mean Squared Error of Approximation (RMSEA) close to .06, and Standardized Root Mean Square Residual (SRMR) less than .08 (Hu & Bentler, 1999).

Correlations were examined for linearity and bivariate homoscedasticity. No evidence of multivariate collinearity was found, with a maximum  $R^2$  of 0.75. All analyses were conducted separately for participants below and above symptom severity thresholds at baseline. Anxiety and depression symptom trajectories were examined in separate models. Baseline symptom severity level (e.g., PHQ-9 or GAD-7 at baseline) was treated as the reference indicator, with the loading fixed to 1 across time points in order to model the latent intercept. In order to model the growth across time (i.e. slope), loadings of the latent slope variable were fixed at 0, 1, and 2 for baseline, three months and six months. As such, the models all represent linear change over time. The slope is modeled as a latent variable representing changing over time, and the intercept represents the baseline level of each variable modeled. Analyses were conducted using R (R Development Core Team, 2011)

**Hypothesis 1: The intervention group will experience a less rapid increase in CMD symptom severity than the control group.**

#### *Below-threshold Sample*

**Depression.** At baseline, 229 participants scored below 10 on the PHQ-9, consisting of 104 participants in the control group and 125 in the intervention group. Model 1 examined the trajectory of depression symptom severity at baseline, 3, and 6 months. The model was not well

fit to the data as indicated by CFI and TLI indices less than .95 and RMSEA and SRMR greater than .08. Intercept and slope means are presented in Table 4. Parameter estimates suggested that in both groups, the mean slope was significant and positive, indicating that both groups experienced an increase in depression symptom severity during the course of six months.

**Anxiety.** Of the sample, 239 participants scored below 10 on the GAD-7 at baseline, with 107 in the control group and 132 in the intervention group. Model 1 examined the trajectory of anxiety symptom severity at baseline, 3, and 6 months. The mean slope was significant in the control group ( $M = .55, p = .036$ ) suggesting that participants below the GAD-7 threshold at baseline experienced a statistically significant increase in anxiety symptom severity over 6 months. The mean slope in the intervention group was not significant ( $M = .08, p = .665$ ), suggesting that participants in the intervention group did not experience an increase in their anxiety symptom severity. A small effect was found for the difference between slopes,  $d = .24$ . Parameter estimates and models representing the control and intervention groups are presented in Figure 2.

### ***Above-threshold Sample***

**Depression.** Model 1 was examined among the 73 individuals in the control group and 69 individuals in the intervention group who scored 10 or above on the PHQ-9 at baseline. The mean slope was negative in the control group ( $M = -1.20, p < .001$ ) and the intervention group ( $M = -1.72, p < .001$ ), suggesting that individuals in both groups experienced a decline in depression symptom severity. The slope variance also differed between the intervention and control groups, with statistically significant intraindividual variability in the intervention group ( $\sigma^2 = 6.62, p = .043$ ) but not the control group ( $\sigma^2 = 2.59, p = .429$ ). This finding suggests that there was more variation in depression symptom severity change in the intervention group than

in the control group, and that this variation was not accounted for in the model examined.

Parameter estimates of Model 1 in the above-threshold group are presented in Table 4.

**Anxiety.** Among individuals above the threshold of 10 on the GAD-7 at baseline, 62 were in the intervention group and 70 were randomized to the control group. In both groups, the slope differed significantly from zero and was negative ( $M = -1.56, p < .001$  in the control group,  $M = -1.39, p = .002$  in the intervention group). These results suggest that across groups, anxiety symptom severity decreased over time for participants above the GAD-7 threshold at baseline. The slope variance differed between the intervention and control groups, with significant intraindividual variability in the intervention group ( $\sigma^2 = 9.75, p < .001$ ) but not the control group ( $\sigma^2 = 5.99, p = .171$ ).

**Hypothesis 2a: Baseline CMD severity will moderate the effects of the intervention in that individuals with higher CMD symptom severity pre-intervention will benefit most from the intervention.**

Symptom trajectories were examined with the interaction between baseline symptom severity and condition as a predictor. Simple slopes analyses were conducted to probe the significant three way interactions between baseline symptom severity, condition, and time (Preacher, Curran, & Bauer, 2006). Model fit indices and parameter estimates are presented in Tables 3 and 4, respectively.

### ***Below-threshold Sample***

**Depression.** The model was not able to converge normally, and as such no reliable estimate was obtained for the effect of the interaction between the baseline depression symptom severity and depression symptom change. However, the covariance between intercept and slope

was not significant in either the control or intervention groups, suggesting no relationship between baseline symptom severity and slope.

**Anxiety.** The parameter estimate for the interaction between baseline anxiety symptom severity and condition on slope was significant,  $b = .433$ ,  $p < .001$ . The covariance between intercept and slope was significant in the control group ( $\sigma_{i,s} = -3.13$ ,  $p = .020$ ), but not the intervention group ( $\sigma_{i,s} = -0.34$ ,  $p = .815$ ) suggesting that greater symptom severity at baseline was associated with decrease in symptoms over time in the control group. Simple slopes were examined to probe the interaction. Results are presented in Figure 3. The slope for participants at low levels of baseline anxiety symptom severity in the intervention group was not significantly different from zero ( $M = -.16$ ,  $p = .819$ ). The slope significantly differed from zero for the control group at all baseline levels of severity, and the intervention group at higher levels of severity. These results suggest that baseline symptom severity moderated the effects of the intervention on preventing an increase in anxiety symptom severity, with participants at lower levels of anxiety at baseline benefitting most from the intervention.

### **Above-threshold Sample**

In both the anxiety and depression symptom severity models, the model including the interaction term did not converge normally, and thus no parameter was estimated. The covariances between intercept and slope were not statistically significant in either the control or intervention groups, suggesting no relationship between baseline symptom severity and slope.

**Hypothesis 2b: Baseline mindset will moderate the effects of the intervention in that individuals with a fixed mindset pre-intervention will benefit most from the intervention.**

First, a model including the interaction term as a predictor was examined. Model 2 then examined parameter estimates in each group by including baseline emotion mindset as a

predictor of the mean slope in each condition. Model fit indices and parameter estimates are presented in Tables 3 and 4, respectively.

### ***Below-threshold Sample***

**Depression.** The effect of the interaction between baseline mindset and condition on depression symptom severity slope was not statistically significant ( $b = -.07, p = .817$ ). Baseline emotion mindset was not a significant predictor of depression symptom severity trajectory in either condition.

**Anxiety.** The interaction between baseline emotion mindset and condition did not have a statistically significant effect on anxiety symptom severity slope,  $b = -.273, p = .359$ . When parameter estimates in each group were examined, the mean slope was statistically significantly different from zero in the control but not the intervention group, suggesting that the prevention effect remained when baseline emotion mindset was added into the model. In the control group, no relationship was found between baseline emotion mindset and slope,  $b = -.06, p = .770$ . In the intervention group, however, the relationship between baseline emotion mindset and slope was approaching significance, with a more incremental theory of emotions at baseline associated with a more negative slope,  $b = -.10, p = .052$ . Because the relationship was approaching statistical significance, simple slopes were used to probe the interaction between baseline emotion mindset, condition and time. Results are presented in Figure 4. Results were consistent with hypotheses in that among participants with a fixed mindset at baseline, the slope was significantly different from zero in the control group  $b = .52, p = .046$ . The slope in the intervention group did not differ significantly from zero,  $b = .50, p = .080$ . Among participants with a growth mindset at baseline, slopes in both groups were non-significant, although the slope in the intervention group

was negative  $b = -.10, p = .711$ , while the slope in the control group was positive  $b = .46, p = .252$ .

### *Above-threshold Sample*

**Depression.** The interaction between baseline emotion mindset and condition was approaching statistical significance for the effect on depression symptom severity  $b = -.90, p = .065$ . The effect of the interaction on the intercept was also approaching significance ( $b = 1.38, p = .065$ ) suggesting differences at baseline between groups. Baseline emotion mindset was not associated with depression symptom severity change in the control group,  $b = -0.31, p = .310$ . In the intervention group, baseline emotion mindset was significantly associated with slope  $b = -1.37, p < .001$ , suggesting that incremental theory at baseline was associated with a more negative change in depression symptom severity, but only in the intervention group. See Appendix for simple slopes analysis.

**Anxiety.** The interaction between baseline emotion mindset and condition had no significant effect on anxiety symptom severity change  $b = -.159, p = .789$ . In both groups, baseline emotion mindset was significantly associated with a more negative anxiety symptom severity slope,  $b = -.73, p = .022$  in the control group, and in the intervention group  $b = -.92, p = .028$ .

### **Hypothesis 3: The intervention will be associated with increased engagement in modifiable protective factors and lower engagement in modifiable risk factors for CMDs.**

The full sample was used to examine the effect of the condition on change in engagement in modifiable behaviors. The trajectory of each modifiable behavior at baseline, three months and six months was examined. In examining the trajectories of cognitive and behavioral avoidance as the dependent variable, the model was well fit to the data,  $\chi^2_{(2)} = .61, CFI = 1.00$ ,

TLI = 1.01, RMSEA = .000, and SRMR = .007. In the control group, cognitive and behavioral avoidance increased over time, with a mean slope of 1.84 ( $p = .019$ ). In contrast, the slope in the intervention group did not differ significantly from zero ( $M = .86, p = .198$ ). The slopes of all other modifiable behaviors (social engagement, substance use, approach coping, avoidant coping, physical activity, and sleep quality) did not differ significantly from zero ( $p < .05$ ) in either condition. See Appendix for model fit indices and parameter estimates for the non-significant models.

**Hypothesis 4: Changes in engagement with modifiable risk factors for CMDs will mediate the relationship between intervention condition and CMD symptom severity.**

No differences between groups were found for modifiable risk behaviors other than cognitive and behavioral avoidance. As such, only this variable was examined in subsequent models. Because cognitive and behavioral avoidance and depression and anxiety symptom severity likely covary over time (i.e. avoidance is both a cause and effect of CMD symptom severity), a multivariate latent growth curve was used to examine this temporal relationship. In this model, the mean intercept and mean slope of both symptom severity and cognitive behavioral avoidance were estimated. In model 3, the avoidance and symptom severity were allowed to covary. This model allows for the mean intercepts and rate of change for the two variables to depend on one another (Curran & Hussong, 2003).

Depression and anxiety symptom trajectories were significantly associated with avoidance trajectories in both the control and intervention groups. Change in avoidance was positive and significant in the control group ( $p < .05$ ). In the intervention group, rate of change in avoidance did not differ significantly from zero. This finding suggests that control group participants increased avoidance over the course of the six months, whereas their counter parts in

the intervention group did not. The mean depression symptom severity slope was not significantly different from zero in either the control or intervention group. The mean slope of anxiety symptom severity was negative in the intervention group, ( $M = -.41, p = .045$ ), and did not differ from zero in the control group ( $M = -.26, p = .211$ ). Parameter estimates are presented in Table 5. Results suggested that symptom severity changed along with avoidance, and that the intervention group was associated with a slower rate of avoidance change than the control groups. Furthermore, the intervention group was associated with a negative mean slope for anxiety symptom trajectories when avoidance was added into the model. This model is displayed in Figure 5.

## **Post-hoc Analyses**

### ***Baseline Mindset and Avoidance***

Baseline emotion mindset was examined as a moderator of cognitive and behavioral avoidance trajectories as they covaried with symptom trajectories. First, the interaction term was added into the model. There was a significant interaction between condition and baseline emotion mindset on avoidance trajectories in the model including avoidance symptom trajectories,  $b = -1.17, p = .031$ . The interaction was not significant in the model including depression symptom trajectories  $b = -.37, p = .673$ , although emotion mindset was a significant predictor of avoidance trajectories in the control group. Model 4 included baseline emotion mindset as a predictor of both symptom and cognitive and behavioral avoidance symptom trajectories. The model was a good fit to the data as suggested by fit indices for both depression trajectories  $\chi^2(22) = 33.04, CFI = .970, TLI = .943, RMSEA = .073$ , and SRMR = .051 and anxiety symptom trajectories  $\chi^2(22) = 28.27, CFI = .997, TLI = .993, RMSEA = .039$ , and SRMR = .034. In models examining both anxiety and depression trajectories, incremental emotion mindset in the control

group was associated with decreases in avoidance. Such a relationship was not found in the intervention groups. While the interaction was not significant for the model including depression, this finding is suggestive of the effect of the intervention on preventing the increase in cognitive and behavioral avoidance particularly among those individuals with a fixed mindset at baseline.

### ***Post-intervention Mindset***

Model 5 examined whether the extent that the intervention was associated with an incremental mindset post-manipulation, symptom trajectories would be more negative. Baseline emotion mindset was controlled for in order to avoid artificially inflated causal path estimates (Cole & Maxwell, 2003). Across groups, condition was significantly associated with post-manipulation emotion mindset. Parameter estimates are presented in Table 6. Among participants below threshold at baseline, change in emotion mindset post-intervention was not related to symptom trajectories. In the above-threshold sample, however, post-manipulation mindset was significantly associated with slope,  $b = -.86$ ,  $p = .004$  for depression, and  $b = -.66$ ,  $p = .008$  for anxiety. Among the above-threshold samples, there was a significant indirect effect (IE) from condition to slope through post-manipulation emotion mindset on both depression (IE<sub>EM</sub> =  $-.51$ ,  $p = .015$ ) and anxiety (IE<sub>EM</sub> =  $-.19$ ,  $p = .026$ ) symptom trajectories. Of note, the model included a covariance between baseline emotion mindset, baseline avoidance, and baseline symptom severity, thereby providing support for the causal interpretation of this pathway (Cole & Maxwell, 2003). By controlling for the relationship between emotion mindset, avoidance and symptom severity at baseline, the estimated pathway from post-manipulation mindset to symptom trajectories reflects the change in emotion mindset and in turn, symptom severity, as a function of the intervention, rather than a pre-existing relationship between these variables.

### ***Moderators of Post-intervention Emotion Mindset***

Because post-manipulation emotion mindset was a significant mediator in the above-threshold sample, a moderation analysis was conducted to determine factors associated with a more incremental mindset following the intervention. Among the full sample, time spent on the intervention did not moderate the effect of the intervention on post-intervention emotion mindset when controlling for baseline emotion mindset,  $F(1, 364) = .305, p = .581$ . The intervention condition was associated with emotion mindset post-intervention at all levels of time duration when controlling for baseline emotion mindset  $b = 1.57, 95\% \text{ CI } [1.01, 2.14], p < .001$ . Baseline symptom severity moderated the effect of the intervention on post-intervention emotion mindset. The interaction effect was significant for baseline anxiety symptom severity  $F(1, 364) = 4.97, p = .026$ . The interaction effect for baseline symptom severity and condition was also significant  $F(1, 364) = 9.16, p = .026$ . Higher anxiety symptom severity at baseline was associated with a greater emotion mindset post-intervention when controlling for baseline emotion mindset.

### ***Effect of the Intervention on Awareness of Public Stigma***

The unanticipated effect of the intervention on awareness of public stigma was further examined. A Pearson correlation suggested no relationship between post-manipulation emotion mindset and stigma,  $r(358) = -.061, p = .249$ . A moderation analysis was conducted to examine the moderating effect of time spent on the intervention. The interaction was significant,  $F(1, 354) = 7.72, p = .005$ . Among participants spending less than 30 minutes on the intervention and assessments in total, there was a significant effect of the condition on awareness of public stigma  $b = 7.35, 95\% \text{ CI } [3.71, 10.98], p < .001$ . Among participants spending 30 minutes or longer, there was no relationship between the condition and awareness of public stigma  $b = 1.15, 95\% \text{ CI } [-1.31, 3.61], p = .359$ .

## Discussion

The present study aimed to examine the effects of a 30-minute, online and self-administered SSI to prevent the increase of CMD symptom severity among college students. The intervention combined growth mindset, or teaching students that emotions and mental health can change, with psychoeducation describing modifiable risk factors. A sample ( $N = 371$ ) of college students were randomized either to the intervention condition or to the psychoeducational control. A universal prevention approach was taken to mimic real-world conditions under which universities might disseminate this intervention. As such, data were analyzed for participants below and above CMD symptom cutoffs at baseline.

### Preventing Increases in Symptom Severity

Post-manipulation analyses suggested that the GM intervention had a medium effect on the intended construct of emotion mindset. Latent growth curve modeling was used to examine the effect of the intervention on anxiety and depression symptom severity trajectories. Results indicated that the intervention prevented an increase in anxiety symptom severity. Participants in the control group below threshold ( $GAD-7 < 10$ ) at baseline experienced a statistically significant increase in anxiety symptom severity over the course of six months, whereas their counterparts in the intervention group experienced no such increase ( $d = .24$ ). The intervention had no direct effect on preventing the increase of depression symptom severity among participants below threshold ( $PHQ-9 < 10$ ) at baseline. In both the intervention and control groups, participants experienced an increase in depression symptom severity, suggesting that the intervention was not effective in preventing an increase in depression symptom severity. This finding was surprising, as a growth mindset SSI conducted with youth found changes in youth-reported depression but not anxiety at a nine month follow-up (Schleider & Weisz, 2018).

One difference between the present study and existing studies using GM to prevent CMDs is a focus on the malleability of emotions rather than personality (Miu & Yeager, 2015; Schleider & Weisz, 2018). Emotion malleability was targeted in the present study due to a consistent link found between emotion mindsets and coping (Kneeland & Dovidio, 2019; Kneeland et al., 2016; Ford et al., 2018), and a longitudinal association with depression (Ford et al., 2018; Kneeland & Dovidio, 2019; Tamir et al., 2007). However, it is possible that emotion malleability may be more closely related to anxiety than depression. For instance, a significant relationship has been found between emotion mindsets and Anxiety Sensitivity (AS), whereas AS was not related to personality mindsets. Similarly, emotion malleability beliefs but not personality malleability beliefs were shown to be associated with worry (Schroder et al., 2016b). AS, a trait variable reflecting the a fear of bodily sensations, may be particularly important, as it is a risk factor for the development of anxiety disorders (Schmidt, Zvolensky, & Maner, 2006). Future research should examine this construct as a potential pathway through which emotion mindset may impact the development of anxiety disorders. Furthermore, future research should examine the distinction between interventions targeting beliefs about the malleability of personality.

### **Moderators of Prevention Effects**

Baseline symptom severity moderated the effect of the intervention on anxiety but not depression symptom severity. It was hypothesized that greater baseline symptom severity at baseline would be associated with a larger effect, as this effect would be consistent with prevention research typically finding larger effects for indicated prevention than for universal prevention (Muñoz, Cuijpers, Smit, Barrera, & Leykin, 2010). The finding that depression symptom severity at baseline did not moderate the effect of the intervention was consistent with

past research finding an effect for both below and above threshold cutoff samples (Miu & Yeager, 2015). For anxiety symptom trajectories, it was participants with lower baseline symptom severity that experienced less of an increase in symptom severity compared to the control group. It is possible that adherence may be related to this outcome, as a meta-analysis of adherence in internet delivered interventions found that lower GAD symptom severity was associated with greater intervention adherence (Christensen, Griffiths, & Farrer, 2009).

In the below-threshold sample, emotion mindset moderated the effect of the intervention on anxiety but not depression symptom severity. The effect was approaching statistical significance, with participants with a more fixed mindset at baseline increasing in anxiety symptom severity at a slower rate than their counterparts in the control group. This finding was consistent with Miu and Yeager (2015), whose findings showed that baseline fixed mindset was associated with greater symptom severity only in the control group. Similar to the direct effect on symptom trajectory, however, this was only the case for anxiety symptom severity. Furthermore, emotion mindset moderated the effect of the intervention on anxiety symptom trajectories when avoidance symptom severity trajectories were included in the model. Specifically, fixed mindset was associated with a higher slope in the control group, but not in the intervention group. Taken together, results supported hypotheses for anxiety symptom trajectories but not depression.

### **Reducing Symptom Severity in Above-Threshold Groups**

For participants above symptom severity thresholds at baseline ( $GAD-7, PHQ-9 \geq 10$ ), the intervention had no direct effect on symptom trajectories. Symptom severity decreased for all individuals above baseline regardless of group. The intervention did, however, have an indirect effect on symptom trajectories through post-manipulation emotion mindset. While post-manipulation mindset was not related to slope in the below-threshold groups, it was statistically

significantly associated with a more negative slope both for depression and anxiety in the above-threshold groups. To the extent that the intervention was associated with a growth mindset of emotions post-intervention, depression and anxiety symptom severity decreased more quickly in the above-threshold groups. While the intervention was clearly more effective for anxiety than for depression, this finding represents a transdiagnostic element to emotion mindsets. That post-manipulation mindset was a mediator only in the above-threshold groups may be related to the fact that baseline symptom severity moderated the effect of the intervention on post-manipulation mindset. Participants at higher levels of baseline anxiety and depression symptom severity experienced a greater increase in emotion mindset post-intervention.

### **Modifiable Risk and Protective Behaviors**

The effect of the intervention on modifiable risk and protective behaviors was examined. The only modifiable behavior that changed over time was cognitive and behavioral avoidance. While the intervention did not result in changes in these modifiable behaviors, the control group participants also did not change their behavior over time, despite evidence that emerging adulthood constitutes a time at which risk behaviors such as alcohol and drug use begin (Arnett, 2000). The study was limited by only a six-month follow-up. It is possible that six months may be too short of a latency period to see changes in these modifiable behaviors.

Cognitive and behavioral avoidance did increase in the control group. In contrast, no change was found for the intervention group, suggesting that the intervention prevented increases in avoidance over the course of six months. This finding is important, as behavioral avoidance of safe situations is both associated with risk for anxiety and depression and also functions to maintain symptoms (Hofmann, 2007; Ottenbreit & Dobson, 2004, 2008; Vriends, Becker, Meyer, & Margraf, 2011). Furthermore, when avoidance trajectories were added into the model

and allowed to covary with depression and anxiety symptom trajectories, a positive relationship and statistically significant relationship was found between these two slopes. The slope of avoidance was significant and positive in the control groups, suggesting that to the extent that the control group members experienced an increase in avoidance over time, anxiety and depression symptom severity increased over time as well.

Avoidance is a key consequence of mindsets found in the academic domain. Students with fixed mindsets are more likely to withdraw and respond negatively when academic challenges are presented (Blackwell, Trzesniewski & Dweck, 2007) and are more likely to hold performance-avoidance goals (DeBacker et al., 2018). As such, the findings of the present study are consistent with the theoretical underpinnings of growth mindset interventions. Individuals with fixed mindsets interpret failure as a sign of an unchanging and personal weakness. With respect to emotions, negative emotions for those with a fixed mindset may view these experiences as signs of personal failing and seek to avoid circumstances under which they might arise. Accordingly, cross-sectional studies have found a link between emotion mindsets and emotion regulation strategies involving avoidance of difficult or painful emotions (Kappes & Schikowski, 2013; Sung, Park, Choi, & Park, 2017). The present study extends this finding by showing cognitive and behavioral avoidance to be a key mechanism that may explain the relationship between emotion mindsets and symptom severity over time. Furthermore, while past studies have primarily examined the avoidance of painful thoughts and emotions, the use of the Cognitive and Behavioral Avoidance Scale extends this finding to behavioral avoidance as well.

### **Intervention Acceptability**

Participants found the intervention to be acceptable and the program software to be usable. While the intervention had no effect on self-stigma, participants in the intervention group

did report significantly higher perceptions that mental health concerns were stigmatized by *others*, which poses a concern in the use of this intervention at a large scale. This finding is in contrast to a previous studies finding either a negative effect (Lebowitz, Ahn, & Nolen-Hoeksema, 2013) or no effect of a mindset intervention on public stigma among depressed individuals (Zimmermann, Hmaidan, Preiser, & Papa, 2020). Furthermore, past research has suggested that to the extent that an intervention increased a growth mindset, stigma actually decreased for depressed individuals (Zimmermann, Hmaidan, Preiser, & Papa, 2020). A key difference between the present study and past research may be that participants completed the experiment in the lab, and thus may have been more likely to engage with the material. This interpretation is supported by the fact that the effect was no longer present when participants spending less than 30 minutes on the intervention and assessments were removed from the analysis. Among the remaining 245 participants, no significant differences were found. Furthermore, post-hoc analyses suggested no relationship between emotion mindset and public stigma, suggesting that the increase in stigma was not related to the intended target of emotion mindset.

The stigma assessment used is based on Corrigan's four-stage model of stigma (Corrigan & Watson, 2002), using the first two stages of awareness of stigma and agreement with stigmatizing stereotypes. In this model, the awareness of public stigma only serves to lead to lower self-esteem if it is accompanied by personal endorsement of these stereotypes. Corrigan refers to this process as a "paradox," describing how individuals who are part of this group are more likely to be engaged in advocacy and efforts to empower individuals with mental disorders. Individuals who agree with these stereotypes, however, are likely to suffer the psychological consequences of stigma. Accordingly, agreement with stigmatizing stereotypes but not

awareness of public stereotypes is associated with depression symptom severity (Corrigan et al., 2012).

Because awareness of public stigma was not assessed prior to the intervention, it is also possible existing stigma causally relates to the length of time spent on the intervention (i.e. greater awareness of stigma could be associated with a shorter length of time spent on the intervention). Another possibility is that the control condition decreased stigma. This finding would be in line with past attempts in Western culture to decrease stigma by emphasizing biological etiology of mental disorders (Deacon, 2013). The fact that awareness of stigma but not agreement with these stereotypes differed between the two groups, however, speaks to the way that participants perceived others to view the intervention. It may be that by describing mental disorders as equivalent to a medical condition, perceptions of how others would view mental disorders changed. Taken together, these findings raise caution for the potential for this type of intervention to be misinterpreted, particularly for those individuals who spent less time interacting with the material. Because it cannot be determined if the intervention increased public stigma or the psychoeducational control decreased it, the effect of the intervention on public stigma warrants future research.

### **Limitations**

The present study had several important limitations. Most notably, the self-selecting nature of the study may limit the generalizability of the findings. For instance, it is notable that a large proportion of the sample was experiencing clinically significant levels of depression or anxiety and reported current or past mental health service utilization. Data suggest however, that anxiety and depression symptom severity have been increasing, and this sample may actually be somewhat representative of the current college student population. A sample of college students

reported a GAD-7 mean of 7.69 ( $SD = 5.79$ ) and PHQ-9 mean 9.18 ( $SD = 6.39$ ) in the 2017-2018 academic year (Duffy et al., 2019), which is quite comparable to the symptom severity of the present study (GAD-7,  $M = 7.84$ ,  $SD = 5.60$ ; PHQ-9,  $M = 8.6$ ,  $SD = 5.98$ ). In a 12-month time period, 17.9% of University of Nevada, Reno students reported being diagnosed or treated by a professional for depression, 20.2% for anxiety, 10.8% for panic attacks, 2.5% for Obsessive Compulsive Disorder, 1.1% for Phobia and 5.6% for insomnia (ACHA, 2018). Participant demographics also suggested the study sample was similar to the general student population. Women were overrepresented in the present study (72.0%), but this finding is consistent with the University of Nevada, Reno student body (68.6%).

The intervention dose of 30 minutes was chosen based on past studies examining growth mindset as a preventive intervention (Miu & Yeager, 2015; Schleider & Weisz, 2018). This choice represents a limitation of the study, as the “optimal,” dose of growth mindset unclear. It is possible that a longer intervention may have changed the results of the study.

Particularly with respect to behavioral engagement in risk factors, the self-reported nature of the present study represents a limitation. Global reports of mood states and behavior may be subject to systematic bias (Shiffman, Stone, & Hufford, 2008). As such, future research may benefit from assessing modifiable behaviors using ecological momentary assessment.

The study did experience significant attrition, losing 33.3% of the initial 371 participants. While participants lost to follow-up did not differ based on randomization or baseline depression severity, baseline anxiety was related to completing the three- and six-months follow-ups. The use of maximum likelihood estimation allowed an intent-to-treat analysis to account for participants lost to follow-up. All participants randomized to a condition were included in analyses.

While longitudinal mediation research addresses many of the limitations of cross-sectional mediation (Maxwell & Cole, 2007), some limitations should be noted in the present study. Longitudinal mediation research designs should take into account the time required for one variable to affect another (Cole & Maxwell, 2003). For instance, one study examining predictors of freshmen college students specifically, found that substance and alcohol use was not a predictor of new-onset depression (Ebert et al., 2019), whereas the evidence base supporting drug use as a risk factor includes much longer follow-up periods (e.g., 14-16 years; Bovasso, 2001). If a relationship does exist between emotion mindsets and modifiable behaviors related to mental health, the time required to detect a relationship between these variables is unknown. Additionally, because avoidance and symptom severity were assessed at the same time points, a causal relationship cannot be conclusively determined (von Soest & Hagtvet, 2011).

### **Implications and Future Research**

It is notable that the intervention had an effect on anxiety symptom severity and avoidance behavior despite the fact that it was completed remotely. Past research has found that open access to web-based intervention is associated with high intervention dropout (over half; Spek et al., 2007). Thus, the present intervention was particularly low intensity in nature and still yielded a benefit for those individuals at lower levels of baseline anxiety symptom severity. While the effect size was small ( $d = .24$ ) given that this is a low-cost, self-directed, and is acceptable to consumers, it is potentially worth delivering at a large scale (Martin, Murray, Darnell, & Dorsey, 2018). Unintended negative consequences should be examined. Before delivering this intervention at a large scale, the effect of the intervention on awareness of public stigma should be further examined.

This intervention has potential for the universal prevention of anxiety symptoms, filling a much-needed gap in available services. Furthermore, it is possible that this intervention may be relevant to other populations. A systematic review, for example, found no studies even examining universal prevention of anxiety disorders in primary care (García-Campayo et al., 2015). As such, the potential for this intervention to be delivered in other contexts should be considered.

A significant strength of the study was the examination of factors mediating changes in symptom severity as a result of the intervention, as this approach is uncommon in prevention studies (Conley et al., 2017). Results suggested that cognitive and behavioral avoidance explained the relationship between both the intervention and symptom trajectories and baseline emotion mindset and symptom trajectories. Because the intervention did not have an effect on other modifiable risk factors, modifying the intervention to focus more directly on avoidance as the key modifiable behavior could yield a stronger effect.

Recent data have also suggested that there is significant overlap between mindsets and other related constructs such as hopelessness (Mullarkey & Schleider, 2020). It is possible that a change in hopelessness may better explain the effects of mindset interventions. Future research should involve the comparison of these related constructs along with emotion mindset and personality mindsets to determine their relative utility in explaining the effects of the intervention.

### **Conclusions**

The present study examined the effects of a self-administered, 30-minute online intervention using growth mindset and modifiable risk factor information to prevent CMDs among college students. The intervention effectively prevented the increase of anxiety symptom

severity among college students below anxiety symptom severity threshold at baseline over a six-month timespan. The intervention had no direct effect on depression symptom severity. To the extent that the intervention was associated with beliefs that emotions are malleable, the trajectory of depression symptom severity was more negative among individuals above baseline symptom threshold, as well as among individuals above the baseline anxiety symptom severity threshold. Changes in cognitive and behavioral avoidance explained the effects of the intervention on anxiety symptom severity in that as avoidance increased, symptom severity decreased. The intervention had the effect of slowing the increase of avoidance, thereby resulting in less of an increase in symptom severity. While participants found the intervention acceptable, the intervention condition was associated with greater public stigma for those individuals spending less than 30 minutes on the study. As such, the intervention has potential to be delivered at a large scale, pending the investigation of this unintended negative consequence.

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**Table 1***Correlations Among Baseline Variables*

	1	2	3	4	5	6	7	8	9	10	11	12
1 EM	—											
2 GAD-7	-.23**	—										
3 PHQ-9	-.27**	.76**	—									
4 SSMIS <sub>Aware</sub>	-.06	.17**	.14**	—								
5 SSIMS <sub>Agree</sub>	.00	-.12*	-.13*	.27**	—							
6 SE	.10 <sup>†</sup>	-.27**	-.30**	-.05	-.00	—						
7 CBAS	-.29**	.59**	.63**	.15**	-.06	-.39**	—					
8 BCOPE <sub>Substance</sub>	-.15**	.22**	.34**	.05	-.07	-.06	.30**	—				
9 BCOPE <sub>Approach</sub>	.08	0.04	-.04	.00	-.12*	.27**	-.12*	-.03	—			
10 BCOPE <sub>Avoid</sub>	-.25**	.60**	.67**	.14**	-.12*	-.20**	.60**	.48**	.20**	—		
11 PA <sub>Moderate</sub>	-.04	.05	-.02	-.02	-.02	-.06	.04	.04	-.07	-.02	—	
12 PA <sub>Vigorous</sub>	-.14	.05	.10	.18*	-.10	-.08	.15*	.01	.04	.11	.25**	—
13 MOS	.17**	-.54**	-.62**	-.02	.16**	.14*	-.34**	-.27**	-.03	-.49**	.02	-.10

Note: <sup>†</sup>  $p = .06$ , \*  $p < .05$ , \*\*  $p < .01$ , Emotion Mindset (high scores are more incremental), GAD-7: Generalized Anxiety Disorder-7, PHQ-9: Patient Health Questionnaire-9, SSMIS: Self-Stigma of Mental Illness Short Form, SE: Social Engagement, CBAS: Cognitive and Behavioral Avoidance Scale, BCOPE: Brief Cope, PA: Moderate Physical Activity, MOS: Medical Outcomes Study Sleep Subscale

**Table 2***Post-Manipulation Differences between Control and Intervention Groups*

	Control (N = 177)		Intervention (N = 194)		<i>t</i>	<i>df</i>	<i>p</i>
	M	SD	M	SD			
Beliefs about risk							
Avoidance	8.95	3.46	10.19	3.91	-3.21	369	.001
Social	12.35	2.26	12.49	2.19	-0.63	369	.531
Health behaviors	21.51	2.82	21.73	2.95	-0.73	369	.468
Substances	17.93	2.55	18.45	2.50	-1.99	369	.048
Mindset (Post)							
Mental Health	4.02	0.90	4.32	0.76	-3.35	363	.001
Emotions	3.66	0.95	4.10	0.73	-4.95	367	<.001
Acceptability							
CSQ	22.4	4.09	22.28	4.51	0.27	360	.791
SUS	77.82	13.99	79.63	14.35	-1.21	357	.227
SSMIS <sub>Aware</sub>	24.54	9.84	27.56	9.98	-2.87	356	.004
SSMIS <sub>Agree</sub>	14.19	6.22	14.28	7.34	-0.12	325	.902

*Note:* CSQ: Client Satisfaction Questionnaire, SUS: System Usability Scale, SSMIS: Self-Stigma of Mental Illness Short-Form

**Table 3***Model Fit Indices*

<b>Model</b>	Depression							Anxiety					
	<i>df</i>	$\chi^2$	AIC	CFI	TLI	RMSEA	SRMR	$\chi^2$	AIC	CFI	TLI	RMSEA	SRMR
Below													
Model 1	2	21.09	2969.15	.742	.226	.289	.095	24.44	3013.38	.875	.624	.306	.085
Model 2	6	20.65	2972.51	.724	.448	.146	.081	22.38	3013.72	.822	.644	.171	.094
Model 5	9	33.11	3418.68	.851	.768	.108	.074	33.97	3480.28	.949	.921	.108	.080
Above													
Model 1	2	5.269	2085.08	.931	.782	.152	.054	4.451	1905.94	.944	.832	.136	.058
Model 2	6	18.88	2077.62	.826	.652	.174	.104	7.543	1899.75	.969	.939	.062	.065
Model 5	9	27.66	2387.05	.850	.767	.121	.093	24.51	2196.72	.829	.734	.114	.080
Full													
Model 3	14	37.67	12814.88	.998	.995	.096	.049	26.16	12716.16	.986	.969	.068	.033
Model 4	22	33.04	13785.48	.970	.943	.073	.051	28.27	13688.89	.997	.993	.039	.034

*Note:* Below: Refers to below-threshold sample at baseline, Above: Refers to above-threshold sample at baseline, Full: Refers to full sample ( $N = 371$ ), Model 1: Symptom trajectory with no moderator, Model 2: Baseline emotion mindset added as a predictor of the growth of symptom severity, Model 3: includes growth curve trajectory of CBAS with covarying dependent variables, Model 4: includes growth curve trajectory of CBAS with covarying dependent variables with emotion mindset added as a moderator, Model 5: Mediation model including emotion mindset and CMD symptom severity through CBAS

**Table 4***Parameter Estimates for Latent Growth Curve Model of Symptom Trajectories*

Parameter	Below Threshold				Above Threshold			
	Model 1		Model 2		Model 1		Model 2	
	Control	GM	Control	GM	Control	GM	Control	GM
<b>Depression (PHQ-9)</b>								
Covariance	0.19	2.41	0.20	2.36	.141	1.29	-.54	.011
Intercept Mean	4.83**	4.81**	4.83**	4.81**	14.90**	15.19**	14.90**	15.19**
Slope Mean	0.84**	0.85**	0.84**	0.85**	-1.20**	-1.72*	-1.21**	-1.22**
Intercept Variance	2.58	1.08	2.57	1.05	12.38 <sup>a</sup>	4.86	12.36 <sup>†</sup>	5.12
Slope Variance	0.90	1.78	0.88	1.91	2.59	6.62*	2.53	6.56*
EM → Slope			-0.04	-0.21			-.41	-1.37**
<b>Anxiety (GAD-7)</b>								
Covariance	-3.13*	-0.34	-3.13	-0.52	6.54	-4.08	6.45	-4.73 <sup>†</sup>
Intercept Mean	4.29**	4.38**	4.29**	4.38**	13.55**	14.66**	13.55**	14.66**
Slope Mean	0.55*	0.08	0.55*	0.12	-1.56**	-1.39**	-1.56**	-1.39**
Intercept Variance	9.44**	6.62*	9.44**	6.53	-3.44	9.22*	-3.89	9.40*
Slope Variance	4.47**	3.49*	4.46**	3.16 <sup>†</sup>	-5.99	9.75**	-7.08	9.61**
EM → Slope			-0.06	-0.10 <sup>†</sup>			-.73*	-.92*

Note: <sup>†</sup> $p < .08$ , \* $p < .05$ , \*\* $p < .01$  Model 1: Symptom trajectory with no moderator, Model 2: Baseline emotion mindset added as a predictor of the growth of symptom severity

**Table 5***Parameter Estimates for Latent Growth Curve Model of Avoidance and Symptom Trajectories*

	Depression (PHQ-9)		Anxiety (GAD-7)	
	Control	Intervention	Control	Intervention
<b>Model 3</b>				
Covariance (Intercepts)	70.32**	85.83**	59.41**	77.84**
Covariance (Slopes)	7.40**	8.64**	6.35**	7.21**
Symptom Slope Mean	0.01	0.07	-0.26	-.41*
CBAS Slope Mean	1.68*	0.86	1.70*	0.85
Symptom Slope Variance	0.41	4.53*	2.67**	0.41*
CBAS Slope Variance	24.28	14.60	18.39	0.85
<b>Model 4</b>				
Covariance (Intercepts)	71.07**	84.25**	61.07**	76.71**
Covariance (Slopes)	7.92**	7.45**	6.71**	6.52**
Symptom Slope Mean	0.01	0.08	-0.26	-0.38†
CBAS Slope Mean	1.55*	0.85	1.57*	0.87
EM → Symptom Slope	0.08	-0.36	-0.06	-0.24
EM → CBAS Slope	-1.79*	-0.57	-1.83*	-0.59
Symptom Slope Variance	-0.26	4.64*	-2.50	3.07
CBAS Slope Variance	25.92	11.37	22.50	18.55

Note: † < .08, \* < .05, \*\* < .01

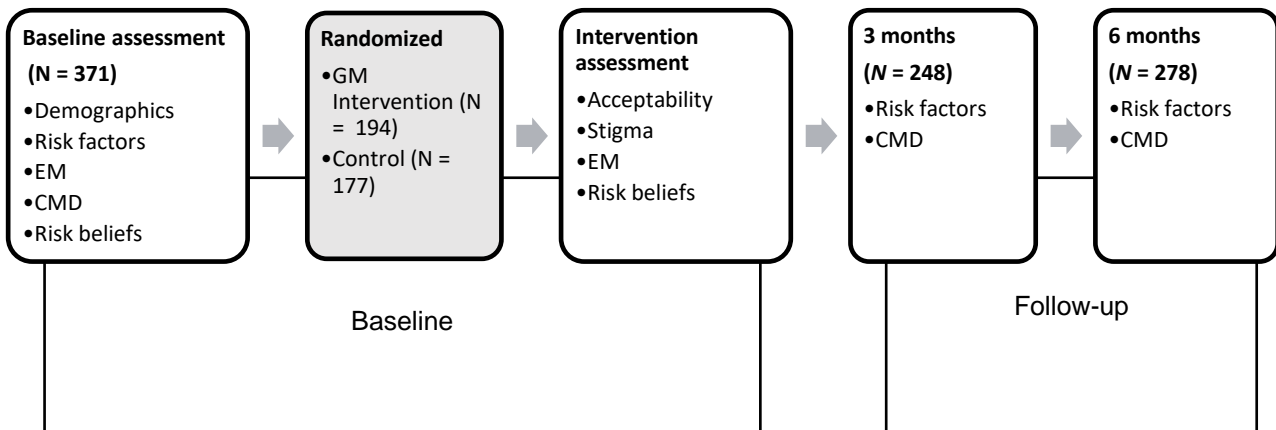
EM: Emotion Mindset. CBAS: Cognitive and Behavioral Avoidance Scale. Model 3: CBAS and Symptom Severity allowed to covary, Model 4: Emotion mindset included as a moderator. Models 3 and 4 were examined with the full sample ( $N = 371$ ).

**Table 6**

*Parameter Estimates for Latent Growth Curve Model of Emotion Mindset and Symptom Trajectories*

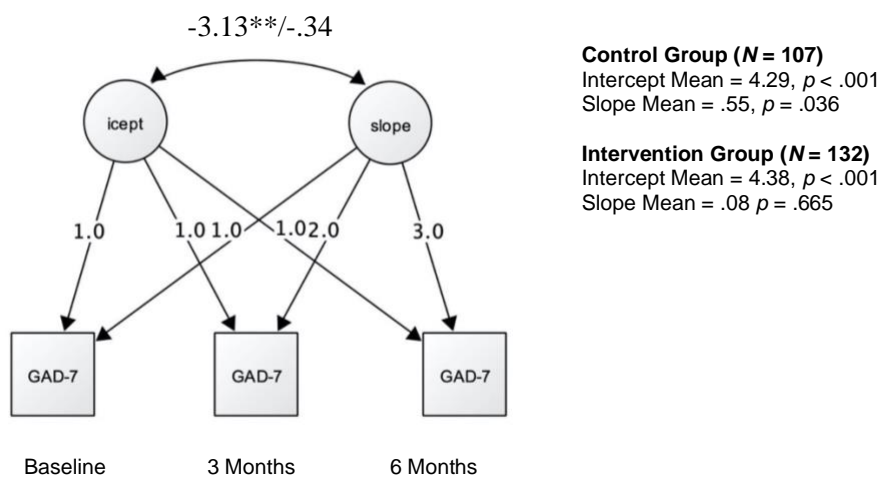
Model 6—Emotion Mindset	Below Threshold		Above Threshold	
	Depression	Anxiety	Depression	Anxiety
Intercept Mean	4.81**	4.33**	14.92**	14.11**
Slope Mean	0.79**	0.45	-1.40**	-1.78**
EM Post → Slope	0.16	-0.15	-0.87**	-0.66**
Condition → Slope	0.14	-0.25	0.54	0.71
Condition → EM Post	0.13*	0.14*	0.30**	0.29**
EM Pre → EM Post	0.56**	0.50**	0.58**	0.63**

*Note:* EM: Emotion Mindset

**Figure 1***Study Design*

**Figure 2**

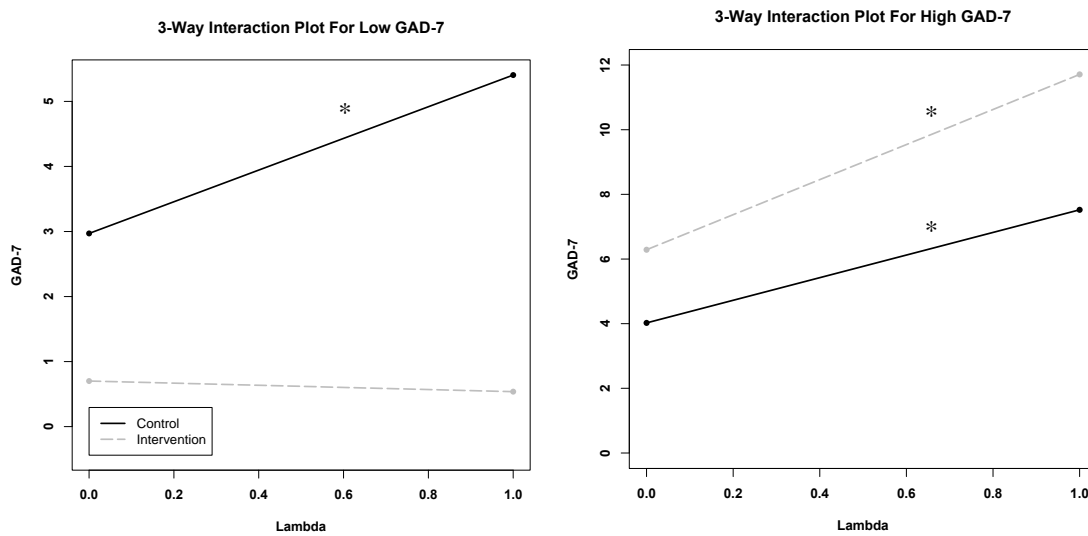
*Anxiety Symptom Severity Trajectories in Control and Intervention Groups (Baseline GAD-7 < 10; N = 239)*



*Note:* Model 1. GAD-7 (Generalized Anxiety Disorder-7). \* $p < .05$ , \*\* $p < .01$ . Coefficients are unstandardized and represent coefficients for Control/Intervention groups.

**Figure 3**

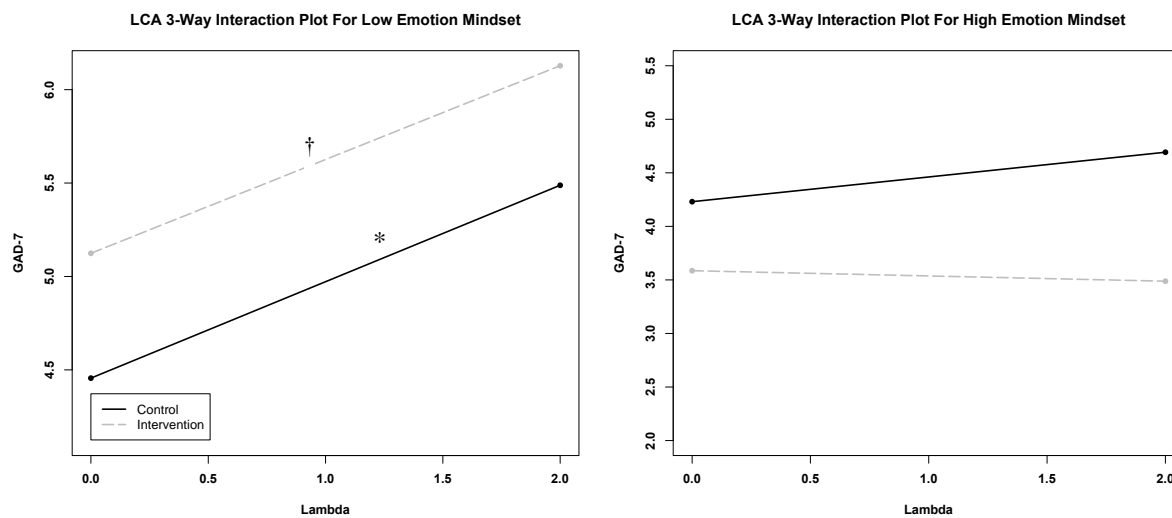
*Simple Slopes Analysis of Baseline Anxiety Symptom Severity, Condition, and Time (Baseline GAD-7 < 10; N = 239)*



*Note: \*Slope is significantly different from zero. Lambda represents time.*

## Figure 4

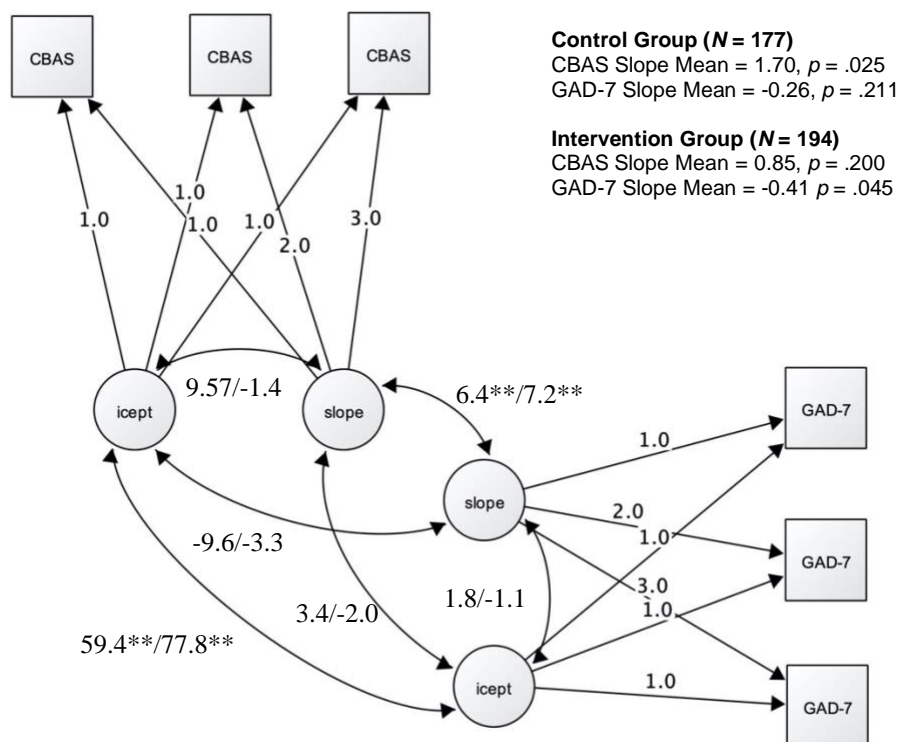
Simple Slopes Analysis of Baseline Emotion Mindset, Condition, and Time (Baseline GAD-7 < 10;  $N = 239$ )



Note: † Slope differs from zero,  $p = .080$ , \*Slope differs from zero,  $p < .05$

**Figure 5**

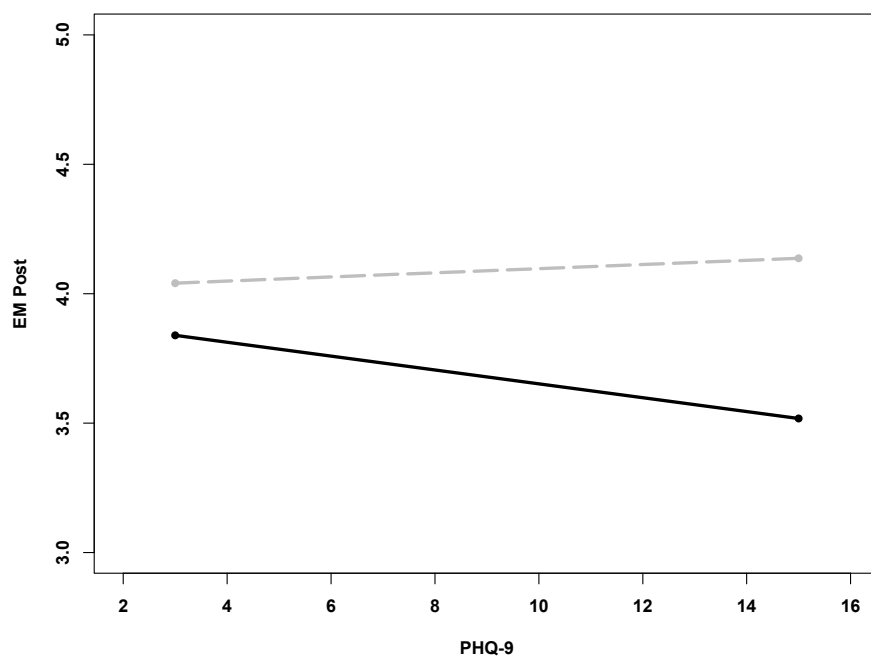
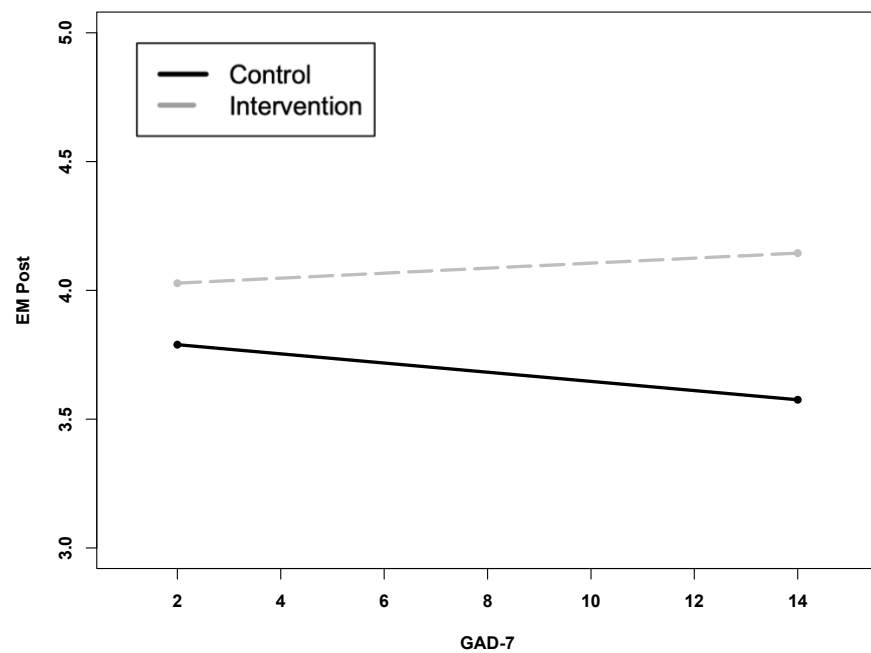
*Multivariate Mediation Model Linking Avoidance Trajectories to Anxiety Symptom Severity Trajectories*



*Note.* Model 3. CBAS: Cognitive and Behavioral Avoidance Scale, GAD: Generalized Anxiety Disorder-7. Coefficients are unstandardized and represent coefficients for Control/Intervention groups.

**Figure 6**

*Interaction of Baseline Symptom Severity and Condition on Post-Manipulation Emotion Mindset*



*Note:* Analyses controlled for baseline emotion mindset.

## Appendix

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## Effect of Intervention on Modifiable Risk Factors

Latent growth curves were examined for the trajectories of all modifiable risk and protective behaviors (Table 7). Cognitive and behavioral avoidance was the only behavior that changed over time (Table 8). This change was only found in the control group.

**Table 7**

*Model Fit Indices for Models including Modifiable Behavior Trajectories*

Model	$\chi^2$	df	AIC	CFI	TLI	RMSEA	SRMR
Approach Coping	48.46	2	5115.84	.294	1.120	.354	.153
Substance	94.54	2	2227.33	.510	.470	.429	.214
Social Engagement	1.42	2	2109.27	1.000	1.001	.000	.016
Physical Activity (Moderate)	0.28	2	2936.68	1.000	1.470	.000	.010
Physical Activity (Vigorous)	3.28	2	2131.53	.948	.843	.059	.032
Sleep	3.74	2	1725.16	.994	.983	.069	.066
Avoidance	.270	2	7543.86	1.000	1.014	.000	.005

**Table 8**

*Parameter Estimates for Modifiable Behavior Trajectories*

Model	Control		Intervention	
	Intercept	Slope	Intercept	Slope
Approach Coping	16.48**	0.11	16.69**	0.11
Substance Use	1.37**	0.03	1.37**	0.02
Social Engagement	3.46**	0.02	3.53**	-0.14
Physical Activity (Moderate)	1.38**	0.12	-0.08**	-0.08
Physical Activity (Vigorous)	1.22**	0.00	1.17**	-0.06
Sleep quality	3.46**	0.01	3.62**	0.00
Avoidance	63.58**	1.61*	64.63**	0.73

Note: \* $p < .05$ , \*\* $p < .01$

## Emotion Mindset and Beliefs about Modifiable Behaviors

Pearson Correlations were conducted to examine the relationship between emotion mindset and beliefs about risk and protective behaviors. Emotion mindset at baseline was associated with greater endorsement of health behavior and substance use as protective and risk behaviors, but not avoidance and social support. Post-manipulation emotion mindset was associated with greater belief that modifiable behaviors were associated with all four subscales.

**Table 9**

*Correlations Between Emotion Mindset and Beliefs about Risk*

	1	2	3	4	5
1 EM Pre	—				
2 EM Post	.61**	—			
3 BBEDS Avoidance	.06	.15**	—		
4 BBEDS Social	.09	.15**	-.03	—	
5 BBEDS Health behaviors	.16**	.23**	-.04	.55**	—
6 BBEDS Substances	.13*	.14**	.09	.05	.15**

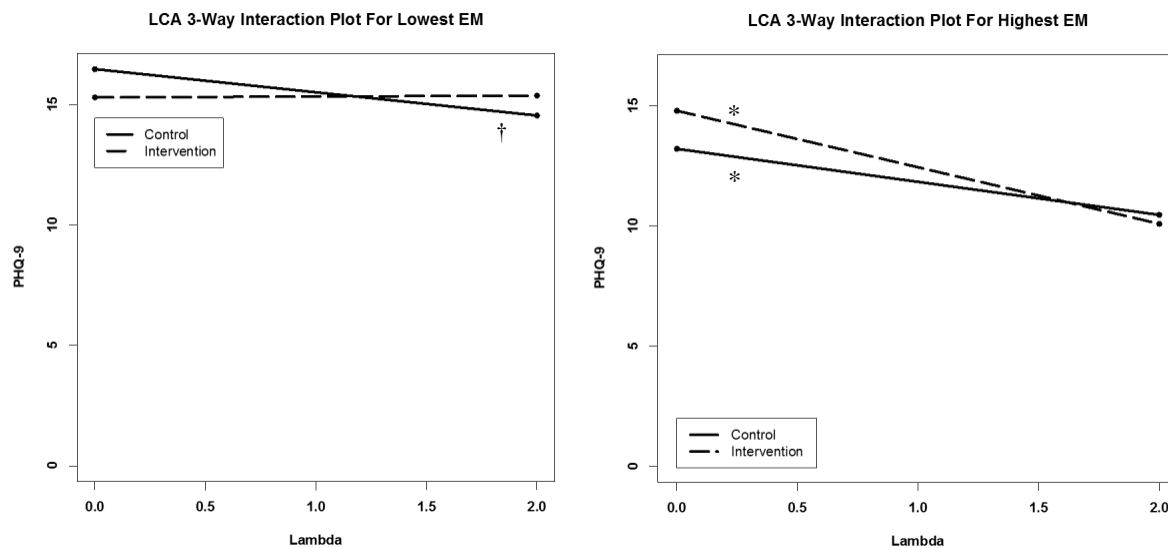
*Note:* \* $p < .05$ , \*\* $p < .01$ , EM: Emotion Mindset, BBEDS: Beliefs about Behaviors and Emotional Distress Scale

## **Interaction between Baseline Mindset, Condition and Time and Depression Symptom Severity in Above-Threshold Group**

A simple slopes analysis was conducted to probe the interaction between baseline emotion mindset and condition (Figure 7). The interaction term was approaching significance for the effect on depression symptom severity slope,  $b = -.90$ ,  $p = .065$  and intercept,  $b = 1.38$   $p = .065$ . Participants with a more incremental mindset at baseline experienced a decrease in depression symptom severity in both the intervention and control groups. For participants with a more fixed mindset at baseline, the slope did not differ from zero in the intervention group. For participants in the control group, the slope was negative ( $b = -.96$ ) and approaching significance ( $p = .056$ ) suggesting participants with a fixed mindset at baseline experienced more of a decrease in depression symptom severity than participants in the intervention group. The interpretation of this finding is limited by an interaction effect approaching significance for the intercept, with individuals with fixed mindset in the control group beginning at a higher level of severity than the intervention group, and those with an incremental mindset in the control group beginning at a lower level of severity than in the intervention group.

**Figure 7**

*Simple Slopes Analysis for Baseline Emotion Mindset, Condition, and Time (Baseline PHQ-9  $\geq 10$ ,  $N = 142$ )*



*Note:* † Slope differs from zero,  $p < .08$ , \*Slope differs from zero,  $p < .05$

### Comparing Emotion Mindset and Mental Health Mindset

A confirmatory factor analysis was conducted in order to examine the factor structure of emotion mindset and mental health mindset based on the structure identified by Schroder and colleagues (2016). A model was examined with both emotion mindset and mental health mindset loading onto one factor. As expected, the model was a poor fit for the data,  $\chi^2_{(20)} = .393.11$ , AIC = 7463.17, CFI = .633, TLI = .487, RMSEA = .224, SRMR = .161. A model with emotion mindset and mental health mindset as separate factors was a good fit,  $\chi^2_{(19)} = .78.84$ , AIC = 7063.78, CFI = .941, TLI = .913, RMSEA = .092, SRMR = .039.

Models were also examined with mental health mindset. Mental health mindset functioned similarly to emotion mindset. To determine which construct was a better predictor of depression and anxiety symptom severity, a forward linear regression was conducted to examine the relative contribution of emotion mindset and mental health mindset to depression at follow-up. Mental health mindset was a significant predictor of depression symptom severity at six months  $\beta = -.22$ ,  $p < .001$ . Next, baseline depression symptom severity was added into the model. When baseline severity was controlled for, mental health mindset was no longer significant,  $\beta = -.05$ ,  $p = .29$ . In the third step, when emotion mindset was added into the model, emotion mindset but not mental health mindset predicted depression at follow-up  $\beta = -.15$ ,  $p = .003$  and  $\beta = -.39$ ,  $p = .701$ , respectively. The same pattern was found for anxiety symptom severity. When entered as the sole predictor, mental health predicted anxiety symptom severity at six months,  $\beta = -.20$ ,  $p = .001$ . However, when anxiety symptom severity and emotion mindset were added into the model, mental health mindset was no longer significant,  $\beta = -.02$ ,  $p = .662$ . Emotion mindset was a significant predictor  $\beta = -.149$ ,  $p = .701$ . It is possible that a more overlap between mental health mindset and symptom severity may explain these findings.

## **Mental Health and Risk and Protective Behaviors in the University of Nevada, Reno Student Body**

The American College Health Association reports that University of Nevada, Reno students report significant distress and impairment related to depression and anxiety. Specifically, 27.8% of students report anxiety and 21.7% report depression has significantly affected their academic performance (e.g., “received a lower grade on an exam, or an important project; received a lower grade in the course; received an incomplete or dropped the course; or experienced a significant disruption in thesis, dissertation, research, or practicum work,” ACHA, 2018, p. 5). In a twelve-month timeframe, 46.5% of University of Nevada, Reno students “Felt so depressed that it was difficult to function,” and 66.4% “felt overwhelming anxiety,” (ACHA, 2018). The majority (88%) of students reported having “felt exhausted (not from physical activity).” Two-thirds of students also reported having felt very lonely. Close to 60% reported finding more than three life stressors (e.g., intimate relationships, health problems, sleep finances) to be “traumatic or very difficult to handle.” Almost half (45.5% report “more than average stress,” in the last twelve months. With respect to mental health service utilization, 20.2% reported having been diagnosed or treated by a professional for anxiety, and 17.9% reported diagnosis or treatment for depression.

Within the last 30 days, 7.3% of students report cigarette use, 10.5% report e-cigarette use, 60.0% report alcohol use, and 25.5% report marijuana use. Within a two-week time-frame, 19.6% of college men and 17.7% of college women report binge drinking (consuming 5 or more drinks in a sitting) 1-2 times. A substantial number (12.0%) also report using prescription drugs that were not prescribed to them within the last 12 months. Approximately half of students report

problems with sleepiness during daytime activities. With respect to protective behaviors, 50% of students meet recommendations for moderate-intensity and vigorous-intensity exercise.