Do Mindfulness based Interventions decrease Anxiety Sensitivity by promoting an adaptive Coping Style?

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Abstract

Anxiety sensitivity (AS) has gained substantial support to be a vulnerability factor exacerbating virtually all anxiety disorders. Little research exists on interventions that can successfully treat AS, and underlying mechanisms that could explain potential treatment effects remain unexplored. Mindfulness interventions (MBI) gathered support to effectively treat anxiety. Being an easily applied, evidence-based intervention, they may also be utilized to target AS transdiagnostically, which is especially useful where access to a psychological professional is limited. Further, research has shown that how one copes with anxiety provoking events influences AS and, in extension, anxiety. Investigating coping styles' effect on AS could provide insight in how such intervention works. By fostering acceptance of aversive emotional reactions and adaption of a non-judgmental attitude of curiosity, we propose that MBI 1) decrease AS and 2) enhance Coping Self-efficacy (CSE). CSE is 3) proposed to mediate an inverse relationship between MBI and AS. Participants with high trait anxiety ($N = 105$) were invited to follow 12 sessions of either a guided MBI, or listening to audiobooks. Results indicate an overall positive effect of the intervention on AS and CSE. However, mindfulness was not more effective than our control condition. Additionally, CSE did not mediate the relationship between MBI and AS. This could be due to the limited time we conducted the interventions, or because accepting negative experience did not motivate participants to engage into solution-based behavior. Thus, research is needed to establish determents of when and how MBI can be conducted most effectively.

Keywords: anxiety, anxiety sensitivity, mindfulness interventions, coping style, coping self-efficacy

Introduction

The Anxiety and Depression Association of America determined anxiety disorders as the most prevalent of all mental health disorders, with 1 in 13 humans suffering from at least one kind of clinically relevant anxiety disorder during their lives. Yet, in the US only 36.9% receive adequate treatment, beside the generally good treatability of anxiety disorders (ADAA, 2021). This supposedly stems, among other factors, from a lack of treatment accessibility, and consequently "increasing [its] availability has been identified as a priority…" (Shafran et al., 2009, p. 903). If professional help is unavailable, applicable interventions will be needed that can treat anxiety symptoms broadly without the necessity of establishing a specific diagnosis immediately, for instance by tackling vulnerability factors that transdiagnostically influence anxiety (i.e., Fitzgerald et al., 2021). Mindfulness based interventions (MBIs) are shown to be a brief and easily available intervention effectively decreasing multiple anxiety symptoms (e.g., Ostafin et al., 2014). Thus, mindfulness could provide an easily accessible tool to close this treatment gap, or may be used supplementally until further therapy is available (Hofmann et al., 2010). We propose that anxiety sensitivity (AS) could be a vulnerability factor worth targeting, as it exacerbates many anxiety disorders and their comorbidities, e.g., GAD, PTSD, social anxiety disorder, panic disorder, eating disorders, depression, or substance abuse (Fitzgerald et al., 2021; Reiss et al., 1986). It maladaptively affects both, clinical and sub-clinical populations, fostering clinical distress, as well as negative health behaviors (e.g., Fitzgerald et al., 2021). Consequently, we center our research on the question of whether and how MBI can reduce AS.

Anxiety Sensitivity

Anxiety sensitivity (AS) is the tendency to interpret anxiety-related stimuli (i.e., physical, cognitive and social concerns) as threatening, whereby individuals become afraid of

the fear elicited by catastrophic expectancies (Reiss et al., 1986; Taylor et al., 2020). Fearing negative emotions produces additional anxiety, which exacerbates anxious affect towards an aversive event. As a consequence, one may expect catastrophic consequences and feel too overwhelmed to cope properly with such a situation, which promotes the belief not to be capable of dealing with aversive or threatening situations. In turn, anxiety increases further (Mahoney et al., 2012). Therefore, AS functions as a vulnerability factor, aggravating symptom severity and influencing treatment success across virtually all anxiety disorders (Angehrn et al., 2020). Historically, high levels of AS were viewed as a predictor for panic related symptoms. Yet, an increasing body of research recognizes AS as an important predecessor of a broad range of anxious pathology, including GAD, PTSD and social anxiety, as well as comorbid disorders, including depression and substance abuse (Fitzgerald et al., 2021; Reiss et al., 1986). Within a recent prospective study, higher levels of AS were found to maintain anxiety related distress by interacting with stressful life events. Thereby, AS predicted overall greater fear responses than the average population, when stress increases (Paluszek et al., 2021). AS is a relatively stable trait-like disposition (Taylor, 2020). Yet, research showed that AS may be manipulated with interventions, hence being a priority target for transdiagnostic treatment (e.g., Taylor, 2020). Accordingly, AS functions by conditioning formerly neutral stimuli, related to a specific anxiety cue, as a threat stimulus (Reiss et al., 1986). Specifically, people with lower AS fear anxiety itself less and can tolerate and cope with stronger exposure to anxious stimuli.

In contrast, anxiety sensitive individuals not only fear a specific anxiety provoking cue (e.g., a negative facial expression in the context of social anxiety), but in addition learn to fear cues that are associated with the perception of anxiety (e.g., nervousness in social interactions). Such enhanced anxious affect leads to less tolerance of exposure to anxiety-provoking stimuli (Reiss et al., 1986). In this way, AS promotes generalization of anxiety, because the associative network of anxiety provoking cues grows broader (Taylor et al.,

2020). For instance, a socially anxious person who feels nervous in the face of a difficult social interaction, could learn to fear nervousness as well, e.g., if they believe they will be negatively judged when others notice how nervous they are (Reiss et al., 1986). Because they could expect catastrophic negative consequences to occur when they are anxious, this may lead to them feeling overwhelmed and not capable of coping with the anxiety elicited in threatening situations. Consequently, social interactions in general become associated with anxiety and are more likely to be avoided. Thus, a vicious cycle between anxiety and the threatening expectation to experience this anxiety is created, which hinders an individual to elaborate on an aversive situation without additional anxious affect. Instead, the ongoing input of anxious distress may foster avoidance, which hinders the fear associated with anxiety stimuli to be reappraised or "updated" as non-threatening, even when it is an unrealistic or harmful belief (Fitzgerald et al., 2021; Reiss et al., 1986).

Mindfulness Based Interventions as an intervention for Anxiety Sensitivity

In mindfulness practice, one is asked to maintain attention on a defined focus (e.g., the felt sensations of one's breathing). When distracting thoughts or sensations arise, one should notice them, but then let them go and return to the original focus. Additionally, the content of one's thought should not be elaborated, but instead tried to be accepted as a natural part of experience, which does not need to be influenced in any way (Bishop et al., 2004). This creates a mindful state of mind, characterized by consciously experiencing one's environment, thoughts and feelings as they arise, without being distracted by them or elaborating on their content (Bishop et al., 2004). Consequently, mindfulness fosters capacity to a) enhance self-regulation of attention to the present and b) to enhance curiosity, openness and acceptance towards a present experience (Bishop et al., 2004). Regulating attention to the present involves conscious anchoring of sustained vigilance on a current experience. Thus, less attentional resources are available to focus on secondary elaboration about the content of such

experience. Accordingly, one aims to avoid thinking about consequences, associations or implications of experience (Bishop et al., 2004). Further, adopting an open attitude of curiosity towards a thought stream and its content, while not trying to influence this experience in any way, fosters acceptance of experience in each given moment and reduces its negative emotional affect (Bishop et al., 2004).

As a result, both components of mindfulness - awareness of the present and acceptance – may contribute independently to fewer negative reactions towards threatening stimuli. Accordingly, Mindfulness is inversely related to chronic anxiety (Ostafin et al., 2014). Similarly, mindfulness has been shown to be inversely related to AS (Mahoney et al., 2015), suggesting that MBI are capable of treating AS associated anxiety disorders. AS could be reduced, because acceptance and neutral elaboration of negative experience counteracts the urge to change it with potentially counterproductive means, such as rumination or avoidance. That is, catastrophic expectancies in response to anxiety cues will not be anticipated, when one does not elaborate about the implications of an aversive experience. Additionally, when one accepts the fear about anxiety, anxiety could rather be perceived as a natural part of experience. This reduces the fear of it, and the negative association between anxiety and the fear to be anxious extinguishes (Bishop et al., 2004; Mahoney et al., 2015).

Coping Style as a mediator between an inverse relationship of MBI and AS

Coping style could mediate this relationship between MBI and AS. Coping style is defined as a set trait of behaviors aimed to reduce discomfort in stressful situations. Humans dimensionally prefer either a solution- or an emotion - based approach (Beutler et al., 2003). Solution-based coping emphasizes the engagement in activities directly aimed at acquiring new behaviors and perceptions that resolve an issue. Contrary, emotion-based coping emphasizes self-reflection and hope that distress alleviates if one understands the reason for these negative emotions. Healthy coping strategies are thoughts or behavior that reduce

negative emotions in the long run. For example, during an episode of chronic pain, self-reflection that one cannot resolve the pain, but distract oneself from it, could be an example of healthy emotion-based coping. Contrary, in social anxiety, participating in different social activities to train social skills, could represent healthy solution-based coping (Beutler et al., 2003). Thereby, coping is most effective when a preferred coping style fits with the situation at hand. That is, solution – based coping is more effective in highly controllable situations, e.g., during studying for an exam. Contrary, emotion – based coping is more effective in less controllable situations, e.g., when dealing with a chronic disease (Beutler et al., 2003; Thwaites et al., 2005).

Especially emotion-based coping can be maladaptive when it "exaggerates" or becomes too "rigid", thereby also potentially influencing AS. That is, for example, coping with an aversive event via extensive rumination or avoidance leads to growing anxious affect towards it. In turn, the fear of negative consequences of anxiety could increase as well, because growing anxious affect may be misinterpreted as a sign for imminent catastrophic consequences (Beutler et al., 2018; Zhang et al., 2021).

Contrary, because solution-based coping promotes engagement instead of e.g., avoidance, participants could learn that they can cope with an aversive event, which reduces the fear of it. Subsequently, solution-based coping promotes coping self-efficacy (CSE), i.e., the belief one is able to prevent aversive events. CSE is an integral part of solution-based coping and functions as a prerequisite for change, which is necessary to foster engagement into solution-oriented behavior (Chesney et al., 2006). CSE may represent a useful indirect measurement to quantify the change from using emotion-based coping towards more solution-based coping (Chesney et al., 2006). This is necessary, because direct measures of CS suffer from limitations, including unreliable recall of targeted events or undetectable changes in CS within the same situation (Folkman et al., 2004). Contrary, measuring CSE does not require to recall specific situations and it is a rather stable state across situations (Chesney et al., 2006).

MBI could be a tool to enhance CSE, because neutral elaboration and acceptance of negative experience could lead to participants not trying to eliminate it, but instead lead to it functioning as a motivator for change, i.e., one could be motivated to engage into solutions that are likely to alleviate an issue. Accordingly, mindfulness was shown to increase the use of solution-based coping in situations where change is perceived as feasible (Finkelstein-Fox et al., 2019), while Sauvain-Sabé et al. (2022) found that high trait mindfulness is related to higher utilization of solution-based coping and proactivity.

Research on how CSE is associated with AS specifically, is limited. Hua and Howell (2022) have shown that low CSE was associated with avoidance of negative health information, while active reflection of coping abilities increased the readiness to receive such information. Accordingly, it could be argued that with increasing CSE individuals become readier to also reappraise the fear elicited by expecting negative information, hence this way decreasing AS.

Luberto et al (2014) found that trait mindfulness is associated with greater CSE, while CSE partially mediated an inverse relationship between trait mindfulness and emotion regulation difficulties, e.g., avoidance and rumination. Extending these findings, we suggest that by increasing CSE, MBI could similarly decrease AS: Thereby, participants who experience increased CSE as a result of mindfulness practice, may learn to believe they can deal with aversive events and subsequently may display less catastrophic expectations and reflexive avoidance towards them. Instead, the expectation to gain positive results when one tries, could subsequently motivate engagement. For instance, a social anxiety patient, who accepts the fear to be anxious sometimes, would use fewer maladaptive coping, e.g., avoidance. Instead, they could believe that they can manage their social anxiety and are able to make friends. This could motivate them to engage into more social activities, for example joining a sports club. Meeting new people there could then provide the positive feedback necessary to override the fear to experience social anxiety in other social situations. Thereby,

CSE would decrease AS specifically, because ingraining the belief one is capable to deal with aversive events on the whole could alleviate the fear about an anxiety in general, and not solely anxiety symptoms related to a specific event. As a result, mindfulness could, by promoting solution-based coping, build protective cognitive resources that buffer against the catastrophic appraisal of anxiety provoking cues.

This study adds to former research that AS could be worthy treatment target for transdiagnostic anxiety symptoms. We are investigating specific mechanisms that contribute to the development of interventions that can directly influence AS. We designed a brief mindfulness intervention with the aim to reduce AS and propose specific mechanisms on how such an intervention may function. The second part of this study suggests CSE to be a mediator between MBI and AS. Thereby, we suggest that MBI could modify maladaptive coping styles by increasing CSE, which could decrease AS.

Hypotheses

1. A mindfulness intervention reduces AS, compared to an audiobook control condition.
2. A mindfulness intervention increases CSE, compared to an audiobook control condition.
3. An increase of CSE mediates the effect of a mindfulness intervention on a reduction of AS.

Method

Participants

We screened 526 people for heightened anxiety symptoms. Via the Paid Participants Sona pool (PPP), we recruited a sample of 180, mostly female participants with heightened anxiety. Participants were fluent in English. A random number generator (randomizer.org) was used to generate a random condition sequence from 1-3. Participants were allocated to

either a mindfulness intervention ($n = 53$), an imaginal exposure condition (this condition is not used in this thesis) or a "Harry Potter" audio book condition, as a control group ($n = 52$). Participants were blinded towards the overall aim of the study, however an intervention rationale for their respective condition was included as part of the survey.

Six participants had to be excluded, because they did not meet the requirement of finishing at least five sessions to complete the intervention. Because the data gathering extend the timepoint at which we had to start with writing our theses, we used a preliminary sample of 105 (88.5 % female) participants in this thesis. We conducted a post hoc power analysis using G*Power (Faul et al., 2007) to test the achieved power of our sample. Using a repeated measures ANOVA, a total sample of 105 participants indicates a power of .83 to detect a medium effect size (*Cohen's f* = 0.25) at $\alpha = 0.05$.

Material

Participants were eligible for participation if they were screened for heightened anxiety levels as indicated by a ≥ 8 cutoff score in the Generalized Anxiety Disorder questionnaire (GAD-7; Spitzer et al., 2006). This cutoff score represents comparably higher general anxiety levels than present in the average population. The GAD-7 was shown to be especially sensitive to indicate anxiety symptom severity, which results in it being a reliable screening tool (Spitzer et al., 2006). It is a 7-items scale, assessing anxiety with with excellent internal consistency (Cronbach's $\alpha = .92$). On a scale from 0 "not at all" to 3 "nearly every day" participants indicate how bothered they have been feeling by anxiety related symptoms over the last 14 days, e.g., "[…] how often have you been bothered by […] feeling nervous, anxious, or on edge".

AS was indicated by the "Anxiety Sensitivity Index; ASI-3" (Taylor et al., 2007). The ASI-3 is a widely used measure of 18 items measuring AS (Wheaton et al., 2012). The three dimensions of AS have excellent internal consistency (total $\alpha = .93$), measuring physical-

(α = .88; e.g., "it scares me when my heart beats rapidly"), social- (α = .92; "I worry that other people will notice my anxiety") and cognitive (α = .84; "when I cannot keep my mind on a task, I worry that I might be going crazy") concerns. On a scale from 0 "very little" to 4 "very much", participants indicate anxious sensations on these domains, whereby the sum of all concerns from each scale determines the degree of AS (Wheaton et al., 2012).

Change in coping styles were measured via the "Coping Self-efficacy Scale (CSES)", by accessing an increase of self-efficacy as an indirect measurement for the use of solution-focused coping (Chesney et al., 2006). The CSES is a 13-item checklist, measuring three domains with excellent internal consistency (total α = .87): Use of problem-solving strategies (α = .91; e.g., "think about one part of a problem at the time"), stop of negative thoughts/behavior (α = .91; e.g., "take your mind off unpleasant thoughts") and support from family/friends (α = .80; e.g., "get friends to help you with the thinks you need"). Thereby, the scale "use of problem-solving strategies" was positively correlated with utilization of-problem solving strategies. The scales "stop of negative thoughts/behavior" was negatively associated with cognitive escape-avoidance behavior, and "support from family/friends" was positively correlated with actively seeking out social support and negatively with distancing. Taken together, all three scales were found to partially explain unique variance of CSE, whereby each scale uniquely assesses independent aspects of solution-based coping (Chesney et al., 2006). Via a Likert scale from 0 "cannot do at all" over 5 "moderately certain can do" to 10 "certain can do", participants indicate their internal belief on how likely they are to perform certain coping behavior.

Procedure

Participants, screened for heightened anxiety, before recruitment took place. Eligible participants were asked to provide informed consent and invited to participate in the intervention. After the allocation, we administered twelve ten-minute interventions in

accordance to the participant's respective conditions, which took place over twelve consecutive days. We assessed anxiety symptoms pre- and post- intervention. Another assessment took place as a follow-up, four weeks later, which also included the debriefing. The study was conducted online via qualtrics, whereby participants were free of choice when and how they undergo a session, but had to do so within an interval of 24 hours per session and on consecutive days. A payment of max. 30€ was given in accordance to the number of interventions participants completed.

The experiment itself consisted of a twenty-minute intervention within the first session of assessment, followed by twelve ten-minute interventions on the next twelve consecutive days, and an additional ten-minute intervention within second session of assessment. Before the intervention we asked participants to indicate how anxious, worried and tense they were over the last day on a slider ranging from 1 ("not at all") to 100 ("extremely"). Following, participants in the mindfulness condition are asked to follow a 10-minute guided audio incurring a guided mindfulness practice. This involves instructions to place attention on ones breathing, bodily sensations, immediate surroundings, thinking and to perceive these with open curiosity, for instance by assessing their quality (i.e., whether they are perceived as hot or cold, pleasant or unpleasant, good or bad, etc.). Participants are continuously reminded to let go of implications or consequences that are not immediately related to these stimuli and refocus attention to the present, thereby widening their perception to all that the present incurs. Beginning from day six, participants are additionally asked to recall a memory that is anxiety provoking, and to indicate how aversive this memory currently is on a slider ranging from 1 ("not at all") to 100 ("extremely"). At every other day, they can choose to use the same memory or recall a new one. The guided intervention then changes, in that participants are encouraged to openly observe the aversive memory, but then turn back to their original focus. The audiobook intervention involves listening to a ten-minute audio extract from the"

Harry Potter" books, not incurring any additional guided instructions. The interventions also do not involve recalling a memory from day six on, as in the experimental condition.

Analysis

H1 and H2 were tested via repeated measures ANOVA, with time (pre- and post-assessment) as the within-subjects factor and condition (Mindfulness versus audiobook) as the between-subject factor, evaluating the change in ASI-3 and CSES scores as the outcome variables. H3 was investigated with PROCESS macro (Hayes., 2013). The conditions are the independent variable, ASI-3 change scores (i.e., post-scores minus baseline scores) are the dependent variable, and CSES change scores (i.e., post-scores minus baseline scores) the mediator.

<div align="center">

Results

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Sample demographics can be seen in the appendix (Tables 1–4). Descriptive statistics and reliabilities of the outcome questionnaires are depicted in Table 1. The reliabilities of the ASI-3 and CSES proved to be good to excellent at both, pre- and post- assessment. An exception was the social support scale of the CSES, which was acceptable.

Table 1

Number of participants, minima, maxima, means with standard deviations, skewness and kurtosis with standard errors and reliability with Cronbach's alpha for outcome questionnaires at baseline and post intervention.

	N	Minimum	Maximum	Mean (Std. Deviation)	Skewness (Std. Error)	Kurtosis (Std. Error)	Reliability (α)
ASI-3 Session 1	105	.33	3.56	1.803 (.637)	-.025 (.236)	-.156 (.467)	.846 (Physical: .821), (Cognitive: .848), (Social: .765)
ASI-3 Session 2	105	.00	3.22	1.588 (.636)	-.017 (.236)	-.149 (.467)	.859 (Physical: .851) (Cognitive: .860) (Social: .774)
CSES Session 1	105	1.15	7.54	4.476 (1.420)	-.211 (.236)	-.327 (.467)	.854 (Sol._Coping: .831) (Stop_Thoughts: .900) (Seek_Support: .719)
CSES Session 2	105	.92	8.08	5.166 (1.344)	-.451 (.236)	.268 (.467)	.848 (Sol._Coping: .868) (Stop_Thoughts: .909) (Seek_Support: .764)
Valid N (listwise)	105						

Note. ASI-3, Anxiety Sensitivity Index; CSES, Coping Self-Efficacy Scale

To test our first hypothesis, i.e., MBI reduce AS in comparison to an audiobook control group, we conducted a two-way repeated measures ANOVA. Means and standard errors for ASI-3 pre- and post-scores of ASI-3 per conditions are depicted in Figure 1. The main effect of time proved to be significant with a small effect size (F (1, 103) = 25.61, $p < .001$, $\eta^2 = .199$). However, the analysis revealed that for AS, with the within-subject factor being time (i.e., pre- vs. post-scores), and the between-subjects factor being the condition

(i.e., mindfulness vs. audiobooks), the interaction effect time*condition is non-significant (F (1, 103) = 1.25, p = .266). Thus, contrary to our hypothesis, the reduction of ASI-3 scores is not significantly different between the two conditions. Specifically, MBI do not reduce AS more strongly than audiobooks. Assumptions are met (see Tables 7–9 in the appendix).

Figure 1

ASI-3 scores pre- and post-intervention per condition. Error bars indicate one standard error.
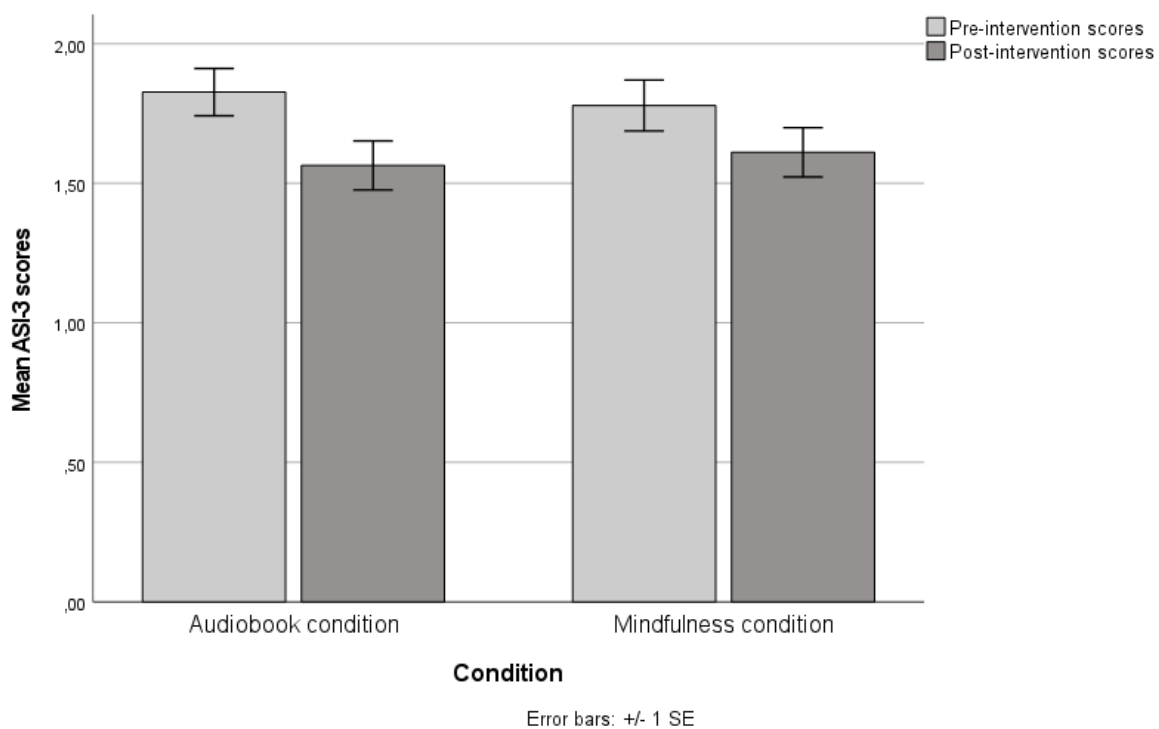
To test our second hypothesis, i.e., MBI increase CSE in comparison to an audiobook control group, we conducted a two-way repeated measures ANOVA. Means and standard error for CSES pre- and post-scores per conditions are depicted in Figure 2. The main effect of time proved to be significant with small effect size (F (1, 103) = 22.61, p = < .001, η^2 = .180). However, the analysis revealed that for CSE, with the within-subject factor being time (i.e., pre- vs. post- scores), and the between-subjects factor being the condition (i.e.,

mindfulness vs. audiobooks), the interaction effect time*condition is non-significant

(F (1, 103) = 1.30, p = .258). Thus, contrary to our hypothesis, the increase of CSES scores is

not significantly different between the two conditions. Specifically, MBI do not increase CSE

more strongly than audiobooks. Assumptions are met (see Tables 10–12 in the appendix)

Figure 2

CSES scores pre-and post- intervention per condition. Error bars indicate one standard
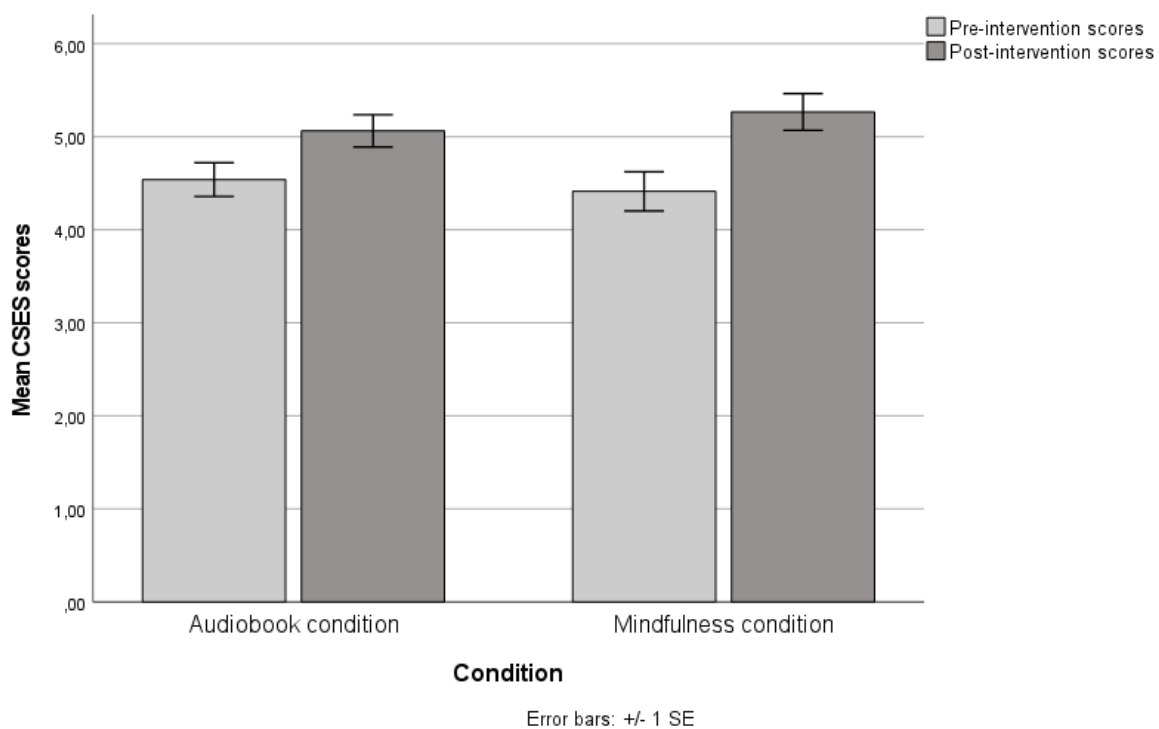
error.

To test whether MBI reduce AS through a change in CS we conducted a PROCESS

macro analysis. The complete original output is listed in the appendix (Tables 13–16), while

total, direct and indirect effects on ASI-3 scores are depicted in Table 2. The mediation

hypothesis for AS through CSE was tested by regressing ASI-3 change scores on the

conditions, and CSES change scores entered as the mediator. Contrary to our suggestion, MBI

was not related to CSE, thus mindfulness did not predict an increase of CSE, as indicated by a

zero-order correlation. Similarly, the effect of MBI on AS was not significant, that is our mindfulness intervention did not predict a decrease of AS. Controlling for MBI, the full model indicates that adding CSE did not create additional variance in severity of AS, whereby the indirect effect (a*b) yields a bias-corrected bootstrapping confidence interval that includes zero. Thus, contrary to our third hypothesis, CSE does not seem to mediate the relationship between MBI and AS.

Table 2

Results of the PROCESS makro analysis; testing effects of MBI on AS with CSE as the mediator.

Outcome variable	Total effect (standard error)	Direct effect (standard error)	Indirect effect (95% CI)
ASI-3	.095 (.085) *	.098 (.086) *	-.003 (-.045, .019)

Note. ASI-3, Anxiety Sensitivity Index; CI, for bias corrected and bootstrapped 95% confidence interval; *$p > .05$.

A Monte Carlo post-hoc power analysis for indirect effects (Schoemann et al., 2017) yielded a very small power to detect indirect effects on ASI-3 scores (power = 0.03). Assumptions pertaining the mediation analysis are met, although a slight violation of normality can be seen (see Figure 3–6 in the appendix).

Discussion

We investigated whether a mindfulness intervention can reduce AS and enhance CSE in comparison to an audiobook control condition and whether the reduction of AS through a mindfulness intervention is mediated by an increase of CSE. The results indicate that over time AS was significantly reduced and CSE increased. However, neither is the difference between the conditions (MBI versus the control group) in interaction with time significant,

nor does CSE significantly mediate an inverse relationship between MBI and AS. Given that participants display a decrease in AS over the course of our intervention, it seems that a decrease in AS via brief and broadly accessible interventions, such as MBI or relaxation practice, is generally possible. In line with Fitzgerald et al., 2021, our study suggests that patients with anxiety symptoms, who are not specifically diagnosed yet, nor have immediate access to therapy, could profit from brief interventions like MBI or relaxation practices to reduce AS. However, contrary to Hofman's et al. (2010) suggestion, MBI do not seem to be better amenable to reduce AS than alternative brief interventions. Future research is needed to assess under what circumstances which intervention is most effective.

Contrary to our first hypothesis, MBI do not reduce AS more than our "Harry Potter" audiobook control group. This is surprising, as in theory acceptance and attention regulation stand in direct opposition to the catastrophic expectancies common in AS (Mahoney et al., 2015). One explanation could be that the relaxation component of audiobooks reduces AS to a similar degree than MBI. A pilot study investigating the effect of audiobooks on state anxiety in children expecting pediatric treatment found that audiobooks indeed decrease state anxiety in expectation of an anxiety provoking event, as they distract from aversive thoughts (Stein-Duker et al., 2021). A qualitative study interviewing regular consumers of audiobooks as a distraction from daily living found interviewees to use audiobooks routinely to aid well-being, specifically to de-stress, unwind, to substitute for social interaction and as a sleeping aid (Tattersall-Wallin, 2021). Therefore, it is possible that the routine consumption of audiobooks in our intervention functioned as an aid to distract from challenging thoughts, including the expectancy to experience anxiety, which increased relaxation and decreased AS. Thus, while listening to audiobooks is calming, MBI predominantly address acceptance and attention regulation (Beutler et al., 2014). This could indicate that the effects of Mindfulness and relaxation tasks are distinct and reduce AS independently from each other.

Alternatively, a study conducting a mindfulness intervention with a total duration of 8 hours on nursing students, which are known to be a population with high state anxiety, did find a slight, but not significant, decrease of anxiety. In contrast the control group, who did not receive treatment, showed increasing anxiety (Stinson et al., 2020). Similar to us, this study utilized a student sample with high trait anxiety, as well as a guided mindfulness intervention of approximately the same length as we did, subsequently arriving at likewise results. In contrast, a recent RCT found a mindfulness intervention to indeed reduce anxiety (Ritvo et al., 2021). Thereby, the researchers used a student sample that is not pre-screened for anxiety. Additionally, this study did not use a placebo (i.e., like the audiobook condition in our study) condition, but rather a wait-list control. Also, with a duration of 8 weeks, this intervention was longer and incorporated more additional elements than us, such as peer-to-peer discussions and psychoeducation. This implies that in comparison to no treatment, mindfulness interventions might be of advantage to reduce AS, but in order for a differentiated effect of mindfulness interventions (versus placebo conditions) to occur, the intervention may need to be longer and more intensive than ours has been. Thereby, not using additional psychotherapeutic elements, such as social interactions in discussion groups or face to face contact with a professional, may explain why our results were not significant, but could be necessary to achieve significant treatment outcomes.

The results regarding our second hypothesis followed a similar pattern: CSE was enhanced at post-assessment, which implies a change of coping styles to more problem-focused coping (Chesney et al., 2006). Yet, an interaction of time with MBI versus listening to audiobooks is not significant. Given that past-research found that people often use audiobooks to enhance relaxation (Tattersall-Wallin, 2021), relaxation could have been elicited here as well, and is thereby as effective in enhancing CSE, as the Mindfulness components. That is, the belief to be able to control the implications of an aversive event could be equally enhanced by a relaxed emotional state as it is by acceptance and attention

regulation. Indeed, relaxation has been found to enhance CSE, including the willingness to engage into problem-focused coping, at the present moment (Montero-Marin et al., 2019). Thus, in order for a more pronounced enhancement of CSE to occur, brief mindfulness interventions might not be more amenable than alternative treatments.

Accordingly, given that two substantially different outcomes (AS and CSE) show the same patterns of results, the indifference of MBI and audiobooks may stem from relaxation being a substantial underlying mechanism of mindfulness interventions. This contradicts the view that MBI are distinctive to relaxation tasks (e.g., Bishop et al., 2004), as MBI aim to proactively notice the content of one's stream of thoughts instead of inducing a deep state of relaxation (Beutler et al., 2004). However, it could be argued that although not the primary goal of MBI, relaxation could still be a by-product. That is, the primary mechanism that reduces AS and enhances CSE could be relaxation, when it is elicited by relieved tension as a result of attention regulation and acceptance. In this case the effect of MBI would be less distinguishable to other relaxation tasks. Indeed, in one of the first clinical trials assessing mindfulness effects on anxiety, Kabat-Zinn et al. (1985) suggests that mindfulness not only induces cognitive-behavioral changes, but also a deep state of physiological relaxation that is deeper than can be achieved with other relaxation methods. This is in line with Lancester et al. (2016), who found no significant difference between short mindfulness practice in comparison to sham meditation based on relaxation and progressive muscle relaxation on anxiety. However, they did find that mindfulness increases decentering more strongly than the control tasks, which translates into a reduction of momentary emotional reactivity. We argued that reducing emotional reactivity promotes the feeling to be capable to deal with an aversive event, enhancing CSE. However, because enhanced centering was only present shortly after a mindfulness practice took place (Lancester et al., 2016), our mindfulness intervention might not be long or throughout enough to ingrain the belief to be self-efficacious in the face of an aversive event stronger and in the long run. This adds to the former argumentation that

mindfulness needs to be practiced continuously and with high intensity to produce a pronounced effect in comparison to other relaxation tasks.

The results are in conflict with our third hypothesis as well, showing that CSE did not significantly mediate an inverse relationship between MBI and AS. Specifically, neither did our mindfulness intervention increase CSE more than audiobooks, nor did CSE reduce AS. This contradicts past research, for example Luberto et al. (2014) who found CSE to mediate an inverse relationship between trait mindfulness and emotion regulation dysfunction. In light of the very limited research connecting CSE with AS, we argued that the effect of CSE on emotion regulation difficulties might extend to AS specifically. However, considering our results, this was not the case and CSE, in fact, did not significantly influence AS. A methodological difference between this and the current study was that we used the GAD-7 (Spitzer et al., 2006) to recruit a sample with elevated general anxiety, while Luberto et al. (2014), recruited an un-screened, average sample. However, generalized anxiety represents higher affectivity promoted by continuous worrying, rather than a specific fear to a specific aversive event (Heimberg et al., 2014). It may be possible that generalized anxiety, and with it the participants' fear to experience such, resembled a state which was less affected through CSE than the general emotion regulation skills, targeted in the sample from Luberto et al. (2014).

Specifically, CSE was shown to be integral to solution-based coping, but not in emotion-based coping (Chesney et al., 2006). However, Finkelstein-Fox et al. (2019) discuss that higher solution-based behavior is associated with aversive situations which source is perceived to be well controllable, e.g., fearing to fail an exam, which is perceived to be preventable with studying, elicits motivation to study. Contrary, situations that are less controllable, e.g., suffering from a chronic condition, are related with more emotion-based coping. An explanation for our negative results might be that participants did not perceive the source of their generally elevated anxiety levels as controllable with acute solutions, and thus

did not think how they could engage in such. Instead, participants focused more on emotion regulation by reducing affectivity through mindfulness. However, not thinking about acute solutions could subsequently result in participants not reflecting on their ability to solve specific aversive events, whereby also the fear to experience anxiety would not be challenged through CSE. Hence, CSE could have played a less prevalent role in cognition during our intervention than we expected. In turn, this could extend to MBI being only relevant to reduce AS through CSE in those kinds of aversive events that can be avoided immediately with momentary action. Thus, further research on positive effects of mindfulness on coping and AS may need to differ between highly controllable issues and those that are not.

The literature concerning the relationship between Mindfulness and anxiety is vast. Yet, very few studies investigated the potential effects of Mindfulness on transdiagnostic precursors of anxiety, including AS. Further, the research on individual differences in coping styles that may influence success or failure of interventions targeting AS is limited. Although our hypotheses turned out to be insignificant, the experimental design of our study provides insights into mechanisms that influence the relationships between Mindfulness and AS. Yet, there are limitations. Firstly, given that all used conditions were experimental interventions, the factor time cannot be excluded as an explanation for both, reduced AS and enhanced CSE. It is possible that the time passed from the initial screening constitutes to the alleviation of negative experience, for example when participants have been in an explicitly stressful episode at the beginning of the study, which resolved over the course of the intervention independently of it. Secondly, given the experimental design of our study, some ecological validity had to be sacrificed. Thereby, our study was advertised as a relaxation study. However, MBI involves proactive engagement with personal goals and fears, while listening to audiobooks can be done rather passively. In a real setting, MBI may be used as a tool to deal with emotional reactivity when a person intends change. Yet, our participants expected a relaxation task, but not necessarily a proactive intervention, which might have influenced

engagement into the MBI task. Lastly, we did not use a clinical sample with an official diagnosis of an anxiety disorder. A clinical population (versus a non-clinical sample) could be differently affected by both psychological interventions and pathological symptoms alike. A meta-analysis established that mindfulness interventions are effective in both clinical and non-clinical samples with moderate to high effect sizes on anxiety (Khoury et al., 2013). However, it remains unclear whether this effect extends to AS specifically, thus it is necessary that future research replicates these results in more diverse samples.

Our study contradicts theoretical aspects of former research on how individual coping styles could influence treatment outcomes of MBI's on AS (e.g., Luberto et al., 2014). This suggests the presence of underlying mechanisms that influence such relationship, which are not yet considered in the current literature. A worthy idea might be to investigate how individuals perceive the controllability of different situations, and how these differences influence mindfulness and AS. Additionally, our failure to prove a significant difference between mindfulness and relaxation contradicts research that differentiates between these two (e.g., Beutler et al., 2004; Hofman et al., 2010). Further, results on the effectiveness of mindfulness versus relaxation in the treatment of the transdiagnostic risk factor AS, are mixed (e.g., Ritvo et al., 2021; Stinson et al., 2020). Hereby, our study adds evidence that mindfulness is not more effective in treating AS than relaxation in a brief self-help setting of approximately two weeks of interventions, which do not involve psychological professionals. Thus, for clinical practice, researchers should pay more attention on underlying mechanisms that explain when and how clinical MBI's may be more or less effective than relaxation tasks, for example by investigating how much guidance from a professional is necessary for a more distinctive effect of MBI's to occur.

Conclusion

Our study adds to the limited research that describes the relationships between MBI and the transdiagnostic AS, and how it is influenced by individually differing coping styles. Broadly accessible brief interventions such as MBI or relaxation tasks show potential to reduce AS in a non-clinical sample. However, we could not prove that MBI are more effective than comparable treatment forms. Also, CSE does not seem to mediate the relationship between MBI and AS, at least not during or shortly after the intervention took place. Future research directions could profit from investigating how long and throughout MBI should be to provide optimal effects, whereby a clear distinction between Mindfulness and relaxation components should be made. Lastly, highly controllable and uncontrollable aversive expectancies and situations might need to be be targeted with different interventions and research is necessary to determine factors in what context which brief intervention is appropriate.

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Appendix

Tables 3–6

Sample frequencies.

Condition

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Audio	52	49,5	49,5	49,5
	MBI	53	50,5	50,5	100,0
	Total	105	100,0	100,0	

What is your age?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18	3	2,9	2,9	2,9
	19	9	8,6	8,6	11,4
	20	14	13,3	13,3	24,8
	21	18	17,1	17,1	41,9
	22	19	18,1	18,1	60,0
	23	12	11,4	11,4	71,4
	24	8	7,6	7,6	79,0
	25	9	8,6	8,6	87,6
	26	4	3,8	3,8	91,4
	27	4	3,8	3,8	95,2
	28	2	1,9	1,9	97,1
	29	1	1,0	1,0	98,1
	31	1	1,0	1,0	99,0
	35	1	1,0	1,0	100,0
	Total	105	100,0	100,0	

What is your sex?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	11	10,5	10,5	10,5
	Female	93	88,6	88,6	99,0
	Other	1	1,0	1,0	100,0
	Total	105	100,0	100,0	

What is your nationality?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Dutch	10	9,5	9,5	9,5
	German	27	25,7	25,7	35,2
	Other	68	64,8	64,8	100,0
	Total	105	100,0	100,0	

Tables 7–9

Assumptions of the two-way repeated measures ANOVA concerning the relationship between the Interventions and ASI-3 scores.

Box's Test of Equality of Covariance Matrices [a]

,922
,301
3
1932453,337
,825

Note. Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

[a] Design: Intercept + Condition

Within Subjects Design: Pre_Post_ASI3

Mauchly's Test of Sphericity [a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon [b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Pre_Post_ASI3	1,000	,000	0	.	1,000	1,000	1,000

Note. Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

[a] Design: Intercept + Condition

 Within Subjects Design: Pre_Post_ASI3

[b] May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Levene's Test of Equality of Error Variances[a]

		Levene Statistic	df1	df2	Sig.
ASI_mean	Based on Mean	,271	1	103	,604
	Based on Median	,175	1	103	,677
	Based on Median and with adjusted df	,175	1	100,495	,677
	Based on trimmed mean	,249	1	103	,619
ASI_mean Session 2	Based on Mean	,210	1	103	,648
	Based on Median	,273	1	103	,602
	Based on Median and with adjusted df	,273	1	99,273	,602
	Based on trimmed mean	,214	1	103	,645

Note. Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

[a] Design: Intercept + Condition

 Within Subjects Design: Pre_Post_ASI3

Table 10–12

Assumptions of the two-way repeated measures ANOVA concerning the relationship between the Interventions and CSES scores

Box's Test of Equality of Covariance Matrices [a]

Box's *M*	1,916
F	,625
df1	3
df2	1932453,337
Sig.	,599

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

[a] Design: Intercept + Condition

 Within Subjects Design: Pre_Post_CSES

Mauchly's Test of Sphericity [a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's *W*	Approx. Chi-Square	*df*	*Sig.*	Epsilon [b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Pre_Post_CSES	1,000	,000	0	.	1,000	1,000	1,000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

[a] Design: Intercept + Condition

 Within Subjects Design: Pre_Post_CSES

[b] May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Levene's Test of Equality of Error Variances [a]

		Levene Statistic	df1	df2	Sig.
CSES_mean	Based on Mean	1,019	1	103	,315
	Based on Median	1,142	1	103	,288
	Based on Median and with adjusted *df*	1,142	1	101,486	,288
	Based on trimmed mean	1,027	1	103	,313
CSES_mean Session 2	Based on Mean	,072	1	103	,789
	Based on Median	,133	1	103	,717
	Based on Median and with adjusted *df*	,133	1	99,245	,717
	Based on trimmed mean	,064	1	103	,801

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

[a] Design: Intercept + Condition

Within Subjects Design: Pre_Post_CSES

Table 13

PROCESS macro-output, regressing CSES change scores against the conditions.

```
..............................................................
Run MATRIX procedure:

****************** PROCESS Procedure for SPSS Version 4.1 *****************

          Written by Andrew F. Hayes, Ph.D.        www.afhayes.com
    Documentation available in Hayes (2022). www.guilford.com/p/hayes3

**************************************************************************
Model  : 4
    Y  : ASIchang
    X  : Conditio
    M  : CSESchan

Sample
Size:  105

**************************************************************************
OUTCOME VARIABLE:
  CSESchan

Model Summary
          R         R-sq        MSE          F         df1         df2           p
      ,1115       ,0124      2,2016      1,2963      1,0000    103,0000        ,2575

Model
            coeff          se           t           p         LLCI        ULCI
constant   -,5237       ,2058     -2,5450       ,0124       -,9317      -,1156
Conditio   -,3297       ,2896     -1,1386       ,2575       -,9041       ,2446

Covariance matrix of regression parameter estimates:
          constant    Conditio
constant     ,0423      -,0423
Conditio    -,0423       ,0839

**************************************************************************
```

Table 14

PROCESS macro-output, regressing ASI-3 change scores against the conditions, controlling

for the mediator CSES change scores.

```
***************************************************************************
OUTCOME VARIABLE:
 ASIchang

Model Summary
          R         R-sq        MSE          F         df1         df2           p
      ,1137       ,0129       ,1916       ,6675     2,0000    102,0000       ,5152

Model
              coeff          se           t           p        LLCI        ULCI
constant     -,2581       ,0626     -4,1239       ,0001      -,3822      -,1340
Conditio      ,0981       ,0860      1,1407       ,2567      -,0725       ,2686
CSESchan      ,0090       ,0291       ,3100       ,7572      -,0486       ,0667

Covariance matrix of regression parameter estimates:
           constant    Conditio    CSESchan
constant      ,0039      -,0035       ,0004
Conditio     -,0035       ,0074       ,0003
CSESchan      ,0004       ,0003       ,0008

Test(s) of X by M interaction:
          F         df1         df2           p
     1,9248      1,0000    101,0000       ,1684
```

Table 15

Total, direct and indirect effect model of the Condition's effect on ASI-3 change scores, with

CSES change scores ass the mediator.

```
*************************** TOTAL EFFECT MODEL ****************************
OUTCOME VARIABLE:
 ASIchang

Model Summary
          R         R-sq        MSE          F         df1         df2           p
      ,1095        ,0120       ,1900     1,2498     1,0000   103,0000        ,2662

Model
              coeff         se          t          p        LLCI        ULCI
constant     -,2628       ,0604    -4,3484      ,0000      -,3827      -,1430
Conditio      ,0951       ,0851     1,1180      ,2662      -,0736       ,2638

Covariance matrix of regression parameter estimates:
          constant   Conditio
constant      ,0037     -,0037
Conditio     -,0037      ,0072

************** TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y **************

Total effect of X on Y
    Effect         se          t          p        LLCI        ULCI
     ,0951       ,0851     1,1180      ,2662      -,0736       ,2638

Direct effect of X on Y
    Effect         se          t          p        LLCI        ULCI
     ,0981       ,0860     1,1407      ,2567      -,0725       ,2686

Indirect effect(s) of X on Y:
            Effect      BootSE    BootLLCI    BootULCI
CSESchan    -,0030       ,0153      -,0434       ,0194

*************************************************************************
```

Table 16

Corrected Bootstrapping Confidence Intervals of the Condition's effect on ASI-3 change

scores, with CSES change scores as the mediator.

```
Bootstrap estimates were saved to a file

Map of column names to model coefficients:
          Conseqnt Antecdnt
  COL1    CSESchan constant
  COL2    CSESchan Conditio
  COL3    ASIchang constant
  COL4    ASIchang Conditio
  COL5    ASIchang CSESchan


*********** BOOTSTRAP RESULTS FOR REGRESSION MODEL PARAMETERS ************

OUTCOME VARIABLE:
 CSESchan

             Coeff    BootMean     BootSE    BootLLCI    BootULCI
constant    -,5237     -,5211      ,1949     -,9006      -,1381
Conditio    -,3297     -,3297      ,2843     -,8726       ,2166


---------|


OUTCOME VARIABLE:
 ASIchang

             Coeff    BootMean     BootSE    BootLLCI    BootULCI
constant    -,2581     -,2590      ,0602     -,3784      -,1441
Conditio     ,0981      ,1008      ,0894     -,0743       ,2754
CSESchan     ,0090      ,0103      ,0329     -,0539       ,0752


*********************** ANALYSIS NOTES AND ERRORS ************************

Level of confidence for all confidence intervals in output:
  95,0000

Number of bootstrap samples for percentile bootstrap confidence intervals:
   5000

WARNING: Variables names longer than eight characters can produce incorrect output
when some variables in the data file have the same first eight characters. Shorter
variable names are recommended. By using this output, you are accepting all risk
and consequences of interpreting or reporting results that may be incorrect.

------ END MATRIX -----
```
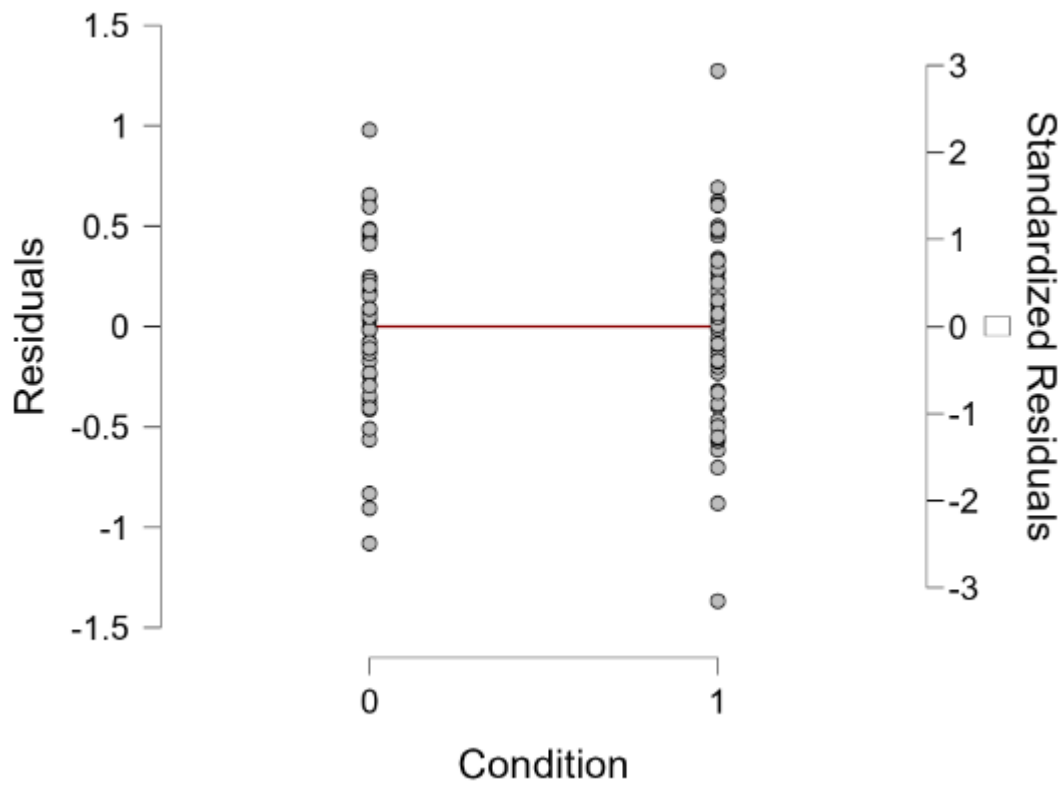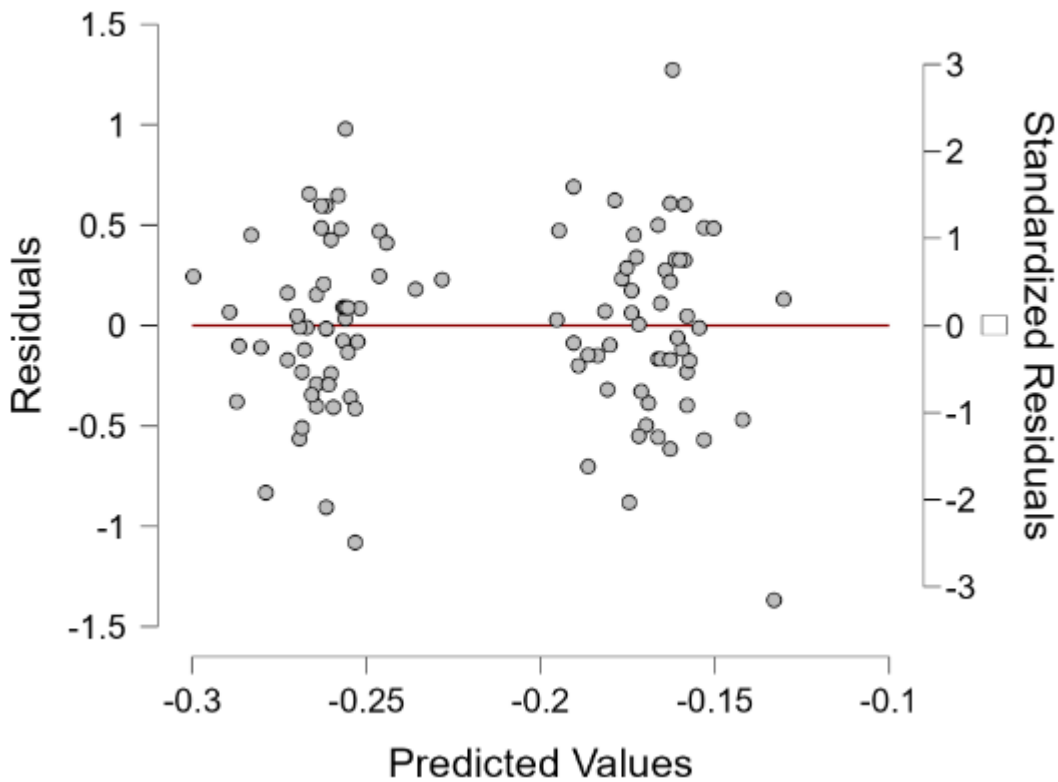
Figures *3–6*

Assumption checks.
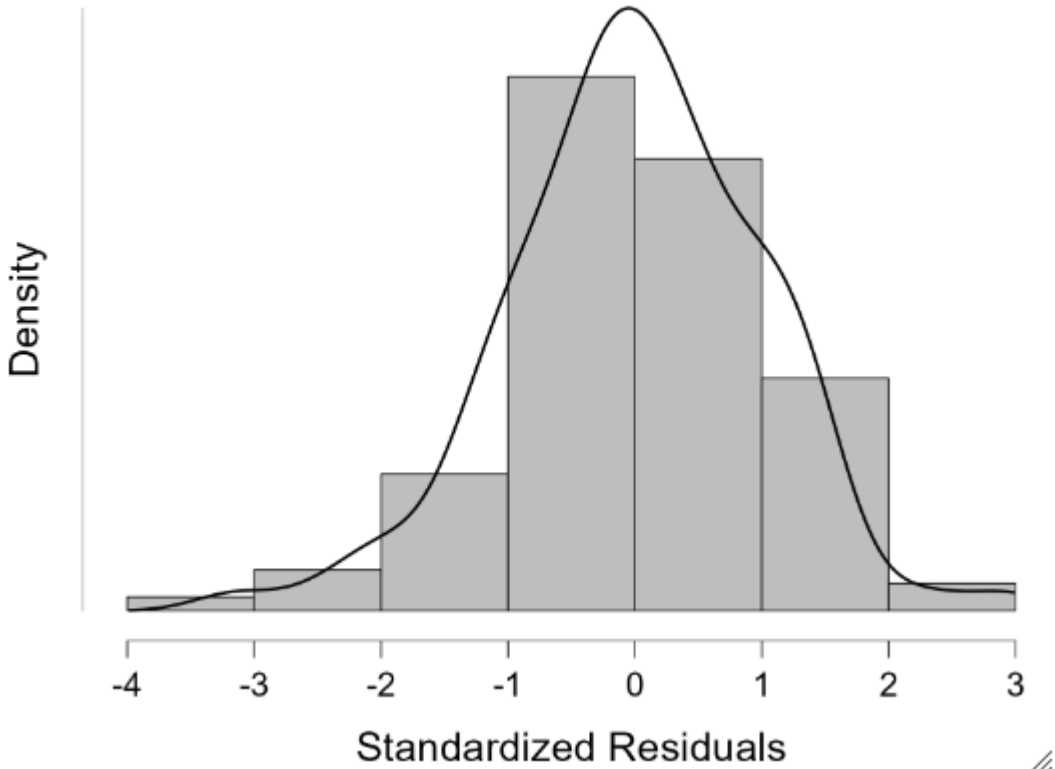
Residuals vs. Condition

Residuals vs. Predicted

Standardized Residuals Histogram ▼

Q-Q Plot Standardized Residuals