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Ruth Emmon Tyson

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THE RELATIONSHIP BETWEEN COPING BEHAVIORS AND MISOPHONIA SYMPTOM  
SEVERITY AND IMPAIRMENT

By  
Ruth Emmon Tyson

A thesis submitted to the faculty of The University of Mississippi in partial fulfillment of the  
requirements of the Sally McDonnell Barksdale Honors College.

Oxford, MS  
May 2023

Approved By

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## DEDICATION

This thesis is dedicated to everyone who guided and encouraged me throughout the year.

Thank you.

## ACKNOWLEDGEMENTS

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Sincerely, I thank y'all.

## ABSTRACT

Misophonia is a complex disorder that is characterized by an extreme disliking of sounds. Individuals with misophonia may engage in anxiety-driven coping behaviors that constitute avoidance and safety behaviors. Current literature shows that while coping behavior may offer temporary relief of anxiety and distress, they can lead to persisting anxiety and avoidance of experiences. Given preliminary evidence demonstrating a link between coping behaviors and maintained or worsening symptoms, additional research is warranted to further understand the role of coping behaviors in misophonia. However, few studies have investigated the relationship between coping behaviors and maintenance or worsening of misophonia symptom severity and related impairment. As such, the aims of the current study were to 1) examine the correlation between the use of coping behaviors deployed before, during, and after misophonia triggers on misophonia symptom severity and impairment and 2) investigate the mediating role of coping behaviors on trigger count and misophonia symptom severity. The sample included 62 community members ( $M = 28.6$  years; 82.1% female; 79.1% White) who screened positive for misophonia. Participants completed self-report questionnaires. Bivariate correlations indicated that coping behaviors (before, during, and after misophonia triggers) were significantly correlated with misophonia symptom severity and impairment, supporting our hypotheses. Counter to prediction, the total frequency of coping behaviors was not a significant mediator of trigger count and misophonia symptom severity. The findings indicate that future research should consider exposure

therapy and reducing avoidance-related coping behaviors as an effective treatment for a reduction of misophonia symptom and severity.

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## **Introduction**

Misophonia, also known as selective sound sensitivity, is a complex neurophysiological condition in which individuals experience strong aversive reactions (e.g., anxiety, disgust, anger) to specific sound triggers (Brout et al., 2018; Cavanna & Seri, 2015). Common trigger sounds include chewing, crunching of foods, throat clearing, pen clicking, and slurping (Taylor, 2017). Misophonia is a devastating disorder, significantly impairing individuals as they experience a strong disliking of sounds and increased emotional responses to trigger sounds (Kumar et al., 2017; Swedo et al., 2021). Tolerance duration, defined as the length of time they can tolerate various trigger sounds without having a response depending on the type of sound, and overall symptom severity varies in this population (Brout et al., 2018; Vanaja & Abigail, 2020). Misophonia was first identified in the early 2000s; however, research investigating its prevalence, comorbidity, and possible etiological factors has advanced in recent years (Palumbo et al., 2018). Prevalence rates for misophonia have been found to vary between populations, with estimates ranging from 12.8-20% (Kiliç et al., 2021; Potgieter et al., 2019). On average, symptoms develop for individuals around twelve years of age and are known to worsen over time (Kumar et al., 2017; Rouw & Erfanian, 2018).

There is a range of misophonia symptoms, including audiologic, physiological, and psychological symptoms. Kumar et al., (2017) observed that trigger sounds were connected to hyperactivity in the anterior insular cortex for individuals with misophonia compared to control groups. Subjective experiences of physiological arousal include increases in perceived pressure

in the chest, arms, head, or whole body through clenched muscles in some misophonic individuals (Cowan et al., 2022; Fioretti et al., 2014). Physiological reactions occur in other aspects of the body as well, including higher heart rates and skin conductance responses when hearing a misophonic trigger, but not when hearing an unpleasant stimulus (Brout et al., 2018; Kumar et al., 2017). Individuals with misophonia additionally tend to experience a range of emotional responses to triggers including anger, disgust, and anxiety (Brout et al., 2018). Although there is not yet a formal diagnostic classification for misophonia (Vanaja & Abigail, 2020), many researchers have drawn parallels between misophonia and psychological disorders, and in particular, anxiety disorders (Taylor, 2017).

One key similarity between misophonia and anxiety disorders is the engagement in anxiety-driven coping behaviors, which may also be described as avoidance and safety behaviors, in response to the intense emotional reactivity to trigger sounds (Cowan et al., 2022). These behaviors may be performed overtly (i.e., in a way that is observable to others, such as wearing headphones) or covertly (e.g., attempting to ignore the sound) (Ball & Gunaydin, 2022; Cowan et al., 2022; Rachman et al., 2008; Thwaites & Freeston, 2005). Current cognitive-behavioral models of anxiety and related disorders posit that coping behaviors offer temporary relief of anxiety and distress by facilitating escape or distraction from perceived threat; however, they can lead to persisting anxiety and avoidance of experiences (Rachman et al., 2008). In the long-term, previously adaptive coping behaviors become increasingly maladaptive when the situation is perceived as threatening but poses no actual danger and the individual consistently avoids it (Ball & Gunaydin, 2022; Thwaites & Freeston, 2005). For instance, an individual with

PTSD may initially avoid the location where trauma occurred, but then begin to avoid all places that are similar (Ball & Gunaydin, 2022). Avoidance-based coping behaviors (including safety behaviors) maintain anxiety symptoms because individuals inadvertently forgo opportunities to learn that situations or experiences, although perceived as threatening, are safe and that distress can be tolerated (Ball & Gunaydin, 2022). Consequently, the individual continues to experience distress and impairment through associative and non-associative mechanisms. Associative learning through classical conditioning strengthens an individual's misophonia (Palumbo et al., 2018). Non-associative learning results in habituation or sensitization; sensitization means increased activity in response to a misophonic stimulus (Palumbo et al., 2018). Misophonic reactions are posited to be a conditioned learning response to aversive, trigger stimuli (Dozier, 2015). Individuals with misophonia report that their reactions to trigger sounds are involuntary, suggesting that it is a conditioned reflex or a sensitized response to hearing aversive stimuli (Dozier, 2015; Palumbo et al., 2018). Continued use of coping behaviors strengthens both the associative learning and non-associative learning mechanisms of misophonia (Palumbo et al., 2018).

Coping behaviors related to misophonia appear to present and function similarly to those common for concerns, such as anxiety disorders. Existing literature reveals that individuals engage in coping behaviors that are conceptually related to the threat, meaning the anxiety complaint and perceived threat typically encourage individuals to engage in a coping behavior that addresses the specific threat (Telch & Lancaster, 2012). In misophonia, this often means that individuals engage in coping behaviors that are directly related to the misophonic trigger. For

example, individuals with misophonia may remove themselves from situations where the sound is present, ask others to stop making the sound, or engage in other sound-related strategies during the interaction, such as watching TV on mute, wearing earplugs around misophonic triggers, mimicking trigger sounds, being aware of the sounds they make, distracting oneself from sounds that are made, or reciting positive internal dialogue (Cowan et al., 2022; Edelstein et al., 2013; Vanaja & Abigail, 2020). Coping behaviors are used before hearing a trigger sound to avoid hearing the sound (e.g., distraction, using a different sound; Dozier & Mitchell, 2022). Typically, an individual experiences anticipatory anxiety related to trigger sounds and responds with avoidance behaviors (Dozier, 2015). Coping behaviors used during hearing a trigger sound are used to help relieve the intense emotional reactions (e.g., covering ears, cognitive restructuring; Dozier & Mitchell, 2022). Coping behaviors used after hearing a trigger sound focus on reducing emotional distress, while performing a mental review of the sound, enforcing learning that the sound is intolerable (e.g., relaxation exercises, doing something comforting; Dozier & Mitchell, 2022). Avoiding trigger sounds is associated with higher levels of distress and anger in individuals with misophonia (Cowan et al., 2022). Social isolation can occur when individuals commonly avoid situations and others due to the possibility of hearing misophonic triggers (Cowan et al., 2022). Despite when an individual engages in a coping behavior, literature shows that these behaviors perpetuate misophonia symptom severity and impairment (Dozier & Mitchell, 2022).

One important direction for the expansion of this research is the examination of the connections between the utilization of coping behaviors and misophonia symptom severity and

impairment. Given preliminary evidence demonstrating a link between coping behaviors and maintained or worsening symptoms (Rachman et al., 2008), additional research is warranted to further extrapolate the role of these behaviors in misophonia. This study addresses several limitations in the current literature, specifically the limited understanding of the maintenance of misophonia. This is significant to identify more effective treatments as research on interventions is underdeveloped. This study accomplishes this by examining the significance of the temporal incidence of when individuals utilize coping behaviors related to misophonic triggers. We believe that the temporal incidence of coping behaviors will be significant because coping before commonly prevents an individual from interacting with aversive stimuli, while coping during and coping after more commonly correspond with the emotional reactions of hearing the sound (Ball & Gunaydin, 2022). Given the limited research on misophonia, the first aim sought to describe the triggers, emotions, coping behaviors, and impairment of misophonia. The second aim was to explore associations between the timing of the utilization of coping behaviors, symptom severity, and impairment related to misophonia. First, we predicted that coping behaviors before hearing a misophonic trigger would be correlated with higher symptom severity and impairment. Second, we predicted that engaging in coping behaviors while hearing a misophonic trigger would be associated with higher symptom severity and impairment. Third, we hypothesized that engaging in coping behaviors after hearing a misophonic trigger would be associated with higher symptom severity and impairment. Lastly, the third aim sought to test the mediating role of coping behaviors in the relation between trigger count and misophonia symptom severity. Given existing research showing that higher anxiety symptom severity

correlated to coping behaviors (Ball & Gunaydin, 2022) and misophonia trigger sounds are related to symptom type and severity (Edelstein et al., 2013), we hypothesized that coping would mediate the association between trigger count and higher symptom severity.



## Methods

### Participants and Procedures

To examine misophonia and the behaviors related to it, individuals from the Oxford, Lafayette County, and University of Mississippi communities were recruited for a larger study through flyers, online and print advertisements, clinics, announcement boards, and word of mouth. Individuals who contacted or were contacted by study personnel were asked screening questions to assess eligibility. Individuals who passed the screening questions were invited to participate in two in-person laboratory sessions and a hearing evaluation. To participate in the current study, individuals had to be aged 18-65 years old, have normal hearing and vision, and had to screen positive for misophonia. Individuals were excluded from the current study if they were: a) unable to complete all three study sessions due to known scheduling conflicts, b) unable to complete English-language questionnaires, or c) experiencing current high risk psychopathology symptoms including psychosis, a current manic episode, or suicidal or homicidal ideation.

Participants were compensated up to \$100 for completion of all three study sessions. For the purposes of this study, only self-report data from the first session was examined. In the current sample, 67 participants met the standards for misophonia. The age ranged between 18 and 61 years ( $M = 28.57$  years,  $SD = 11.84$ ), and most participants were female (82.1%) and White (79.1%). See Table 1 for a summary of demographic characteristics.

In the first session, participants provided written informed consent, and then completed self-report questionnaires and structured diagnostic interviews assessing for misophonia, mood,

anxiety, personality, and other related disorders (i.e., Diagnostic Interview for Anxiety, Mood, and Obsessive-Compulsive and related Neuropsychiatric Disorders [DIAMOND] and Diagnostic Interview for Psychological Distress [DIPD]). All study procedures were approved by the University of Mississippi's Institutional Review Board (IRB).

## **Measures**

### **Demographics**

Demographic information was obtained through a self-report questionnaire developed by the researchers. Participants answered questions about gender, racial/ethnic background, relationship status, education, and employment.

### **WSAS**

The Work and Social Adjustment Scale (WSAS) (see Appendix A) is valid and reliable (Mundt & Marks et al., 2002) five question, self-report questionnaire about functional impairment (Mundt & Marks et al., 2002). In this study, participants were asked to respond to each item by considering how their misophonia symptoms affected each area. For example, the item “Because of my misophonia, my ability to work is impaired” assesses interference with work due to misophonia. Items are rated using a 9-point scale ranging from zero (not at all) to eight (very severely impaired). The WSAS items are summed to create a total score – a total score above 20 representing severe clinical impairment, a score between 10 and 20 representing significant impairment, and a score below 10 representing subclinical results (Mundt et al., 2002). The WSAS has demonstrated good test-retest reliability, with 0.73 correlation (Mundt et al., 2002). See Appendix A.

## **A-MISO-S**

The Amsterdam Misophonia Scale (A-MISO-S) is a 6-item self-report questionnaire adapted from the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS) (Schröder et al., 2013). The Y-BOCS has previously been adapted for other disorders and was found to be reliable and valid (Schröder et al., 2013). The A-MISO-S assesses how much time an individual spends preoccupied with sounds, interference with daily activities, distress associated with trigger sounds, effort spent resisting thinking about the sounds, control over thoughts about sounds, and avoidance of the stimuli (Naylor et al., 2020). Individuals rate questionnaire statements using a 5-point Likert-type scale ranging from 0 to 4. For example, the question “Have you been avoiding doing anything, going any place, or being with anyone because of your misophonia,” with the possible responses “no deliberate avoidance, minimal avoidance, some avoidance, much avoidance, or very extensive avoidance.” Scores are totaled and range from sub-clinical [0-4], mild [5-9], moderate [10-14], severe [15-19], and extreme [20-24]. Scores over five are considered clinically significant; however, the clinical cutoff is a score greater than or equal to ten (Naylor et al., 2020). See Appendix B.

## **Duke Misophonia Questionnaire**

The Duke Misophonia Questionnaire (DMQ) is an 86-item, self-report assessment for misophonia (Rosenthal et al., 2021). The DMQ lists 14 common misophonia triggers. Two composite scales, Symptom Severity and Coping, are comprised of nine subscales: Trigger Frequency, Affective Responses, Physiological Responses, Cognitive Responses, Coping Before, Coping During, Coping After, Impairment, and Beliefs. To test hypotheses in this study, the

Coping subscales were examined. The Coping Before subscale has six items and measures behaviors used before hearing a trigger sound, such as “I avoided certain people, places, or things, so I would not have to hear sounds I dislike.” The Coping During has 10 items and assesses behaviors used while hearing a trigger sound with items such as “I produced an alternate sound.” Lastly, the Coping After subscale assesses behaviors used after hearing a trigger sound with five items (e.g., “I did something to comfort myself”) items (Rosenthal et al., 2021). The Coping Subscales are each rated on a scale from 0 (Never) to 4 (Almost Always/Always) (Rosenthal et al., 2021). In addition, the Trigger Frequency, Affective Responses, and Physiological Responses subscales were used to characterize the sample’s misophonia symptoms. The Trigger Frequency subscale includes a checklist of misophonia trigger sounds (e.g., eating or drinking mouth sounds), and participants are asked to endorse their triggers. This scale was also used to evaluate the third aim of this study (i.e., mediation analysis). The endorsed items were summed to create a total item. The Affective Responses subscale assesses eight emotional reactions (e.g., angry, anxious) to misophonia triggers on a Likert-type scale ranging from 0 (never) to 4 (always/almost always). Lastly, the Physiological Responses subscale assess five physiological symptoms (e.g., trembled or shuddered) experienced in response to misophonia triggers on a 0 (never) to 4 (always/almost always) Likert-type scale. The DMQ is a reliable and valid measure of misophonia symptoms and behaviors (Rosenthal et al., 2021). See Appendix C.

## Results

### Misophonia Characteristics

On the Duke Misophonia Questionnaire, participants reported between 2 to 14 triggers, with a mean of 8.74 triggers ( $SD = 2.62$ ). Our Duke Misophonia Questionnaire results indicate that our sample was most sensitive to mouth sounds while eating or drinking ( $n = 59, 95.2\%$ ), people making repetitive sounds ( $n = 52, 83.9\%$ ), people making nasal / throat sounds ( $n = 49, 79.0\%$ ), and people making mouth sounds when not eating ( $n = 49, 79.0\%$ ). With regards to the temporal incidence of coping behaviors, coping before and coping during had higher mean scores than coping after; the most commonly endorsed behaviors were listening to music or a different sound ( $m = 2.92, SD = 1.04$ ), focusing their attention on an activity ( $m = 2.73, SD = 1.07$ ), and using a different sound to drown out bothersome sound ( $m = 2.69, SD = 1.30$ ). See Table 2 for a summary of misophonia specific coping behaviors. Our participants reported a wide range of emotional, physiological, and cognitive symptoms on the DMQ, including frustration ( $m = 3.18, SD = 1.12$ ), becoming rigid or stiff ( $m = 2.27, SD = 1.38$ ), and thinking “how do I make this sound stop” ( $m = 3.21, SD = 1.06$ ) were the most endorsed symptoms respectively. See Table 3 for a summary of misophonia specific symptoms.

### Descriptive Statistics and Bivariate Correlations

The mean WSAS total score was 11.82 ( $SD = 7.90$ ). On the WSAS, 50.0% ( $n = 31$ ) of the participants met the cutoff indicating clinical levels of impairment (Mundt & Marks et al., 2002). On the A-MISO-S, 71.0% ( $n = 44$ ) of the participants met the 10-score cutoff recommended for a clinical misophonia diagnosis (Naylor et al., 2020), with an average total score of 11.71 ( $SD =$

3.50). On the Duke Questionnaire, the mean Coping Before score was 2.11 ( $SD = 0.89$ ), suggesting an average frequency of coping behaviors before hearing a misophonic sounds as “sometimes.” The mean Coping During score was 2.02 ( $SD = 0.58$ ), suggesting an average frequency of coping behaviors while hearing a trigger as “sometimes.” The mean Coping After score was 0.35 ( $SD = 0.18$ ), suggesting an average frequency of coping behaviors as “never.” The mean total coping score was 1.49 ( $SD = 0.49$ ), suggesting an average total frequency for coping behaviors of “rarely.”

Bivariate correlational analyses were conducted to examine the relationships between temporal occurrence of coping behaviors and misophonia symptom severity (A-MISO-S) and impairment (WSAS). Consistent with Hypothesis 1, coping behaviors utilized before hearing a trigger were associated with greater symptom severity ( $r = .687, p < .001$ ) and impairment ( $r = .544, p = .000$ ). Consistent with Hypothesis 2, coping behaviors utilized while hearing a trigger were associated with greater symptom severity ( $r = .502, p = .001$ ) and impairment ( $r = .347, p = .007$ ). Consistent with Hypothesis 3, coping behaviors utilized after hearing a misophonic trigger were associated with greater symptom severity ( $r = .411, p = .001$ ) and impairment ( $r = .405, p = .001$ ). Thus, results indicated that higher engagement in coping behaviors was associated with higher impairment levels and higher symptom severity of misophonia. This finding was observed across the three subscales of coping behaviors. See Table 4 for a summary of associations between study variables.

### **Mediation Analysis**

To further evaluate the relationships between the number of trigger sounds, coping, and symptom severity, a mediation analysis was conducted through the SPSS analyses PROCESS (Hayes, 2022). PROCESS estimates the indirect effect through bootstrapping. Mediation analyses focus on testing and identifying potential causal relationships between variables (Agler and Boeck, 2017). This study used 5,000 resamples with a 95% confidence interval. Specifically, it was hypothesized that the total frequency of coping behaviors would be a mediator for the effect of the number of misophonia trigger sounds on misophonia symptom severity. Figure 1 depicts the paths. The total effect model, or  $c$  path (i.e., number of trigger sounds to misophonia symptom severity) was significant ( $b = .40$ ,  $SE = .17$ ,  $p = .022$ ,  $CI: .06$  to  $.75$ ). The  $a$  path indicated number of trigger sounds was not a significant predictor of the average frequency of all coping behaviors,  $b = .03$ ,  $SE = .02$ ,  $p = .163$ ,  $CI: -.01$  to  $.08$ . The  $b$  path indicated that the average total frequency of coping behaviors was a significant predictor of misophonia symptom severity,  $b = 4.54$ ,  $SE = .73$ ,  $p < .001$ ,  $CI: 3.08$  to  $6.01$ . The direct effect ( $c'$  path) from number of trigger sounds to misophonia symptom severity was not significant,  $b = .25$ ,  $SE = .14$ ,  $p = .072$ ,  $CI: -.02$  to  $.52$ . The indirect path from number of trigger sounds to average frequency of all coping behaviors to symptom severity ( $a$  path  $\times$   $b$  path) was not significant, indicating that average frequency of all coping behaviors is not a significant mediator of the relationship between number of trigger sounds and symptom severity,  $b = .16$ ,  $SE = .13$ ,  $CI: -.09$  to  $.42$  (See Figure 1).

## **Discussion**

Few studies have investigated the associations between the utilization of coping behaviors and misophonia symptom severity and functional impairment. Thus, the purpose of the present study was to examine temporal engagement in coping behaviors, a factor known to affect anxiety and thought to similarly influence misophonia symptom severity and impairment (Thwaites & Freeston, 2005), among individuals with misophonia. Examining the role of coping behaviors in relation to misophonia symptom severity and impairment may inform the identification of potential treatment plans for misophonia. Understanding these relationships will be critical for treatment, as it is essential to educate the patient on the effect of their use of coping behaviors on their misophonia symptom severity and impairment (Frank & McKay, 2019). This information is of particular importance for future healthcare providers to consider regarding misophonia treatment given the prevalence of misophonia, estimated at 12.8-20% (Kiliç et al., 2021; Potgieter et al., 2019). Additionally, the present study adds to the limited literature pertaining to coping behaviors and misophonia symptom severity and impairment by investigating the correlations between subscales of coping behaviors.

With regard to impairment, participants in this study ranged from slightly to definitely impaired in regard to social leisure activities and maintaining close relationships. Wu et al. (2014) found that in individuals who met the clinical cutoff for misophonia, around half of the participants experienced moderate or high levels of functional impairment in school and work function, and around 20% experienced moderate or high levels of social and family functional impairment. Previous literature shows that clinically significant misophonia severity is correlated



to higher impairment across work and school, social, and family and home (Wu et al., 2014; Zhou et al., 2017). This is consistent with our research, as a strong positive correlation was found between misophonia symptom severity and impairment. This finding is significant because it continues to show that misophonia symptom severity is related to impairment in all aspects of life. Although these measures generally assess the same functional impairment constructs, direct comparisons of clinical scores should be interpreted with caution as there is variability in the measures. Examining specific factors that could influence the relationship between misophonia symptom severity and impairment is crucial, as misophonia symptoms commonly interfere with daily activities (Edelstein et al., 2013; Schröder et al., 2013; Wu et al., 2014).

Our results are consistent with previous literature that eating sounds, smacking, pen clicking, and clock ticking were the worst trigger sounds (Edelstein et al., 2013). However, there is a specificity in trigger sounds from person to person (Edelstein et al., 2020). Trigger sounds are traditionally background noises for most individuals, but individuals with misophonia suffer from a hyper-fixation on these sounds (Edelstein et al., 2013). The significance placed on these sounds leads to concentration issues in academic and occupational settings (Swedo et al., 2021). Inability to finish tasks and perform well is common with misophonia sufferers who are commonly around misophonic triggers (Swedo et al., 2021). On the DMQ, the most common emotional reactions upon hearing a bothersome sound were feeling frustrated, anxious, and jittery. This result is consistent with previous literature, which has found irritation is experienced in over half of the participant sample upon hearing a trigger sound (Schröder et al., 2013). In a previous study, individuals were found to endorse anxiety or stress about a trigger but were not

fearful of the sound (Edelstein et al., 2013), which was consistent with our data. The DMQ lists five common physiological reactions for misophonia. In this study, the most commonly reported physiological reaction was becoming rigid or stiff when intensely bothered by a sound. This result is consistent with previous research about the physiological reactions of misophonia (Edelstein et al., 2013). Misophonia can severely impair an individual's life due to these psychological and physiological symptoms (Edelstein et al., 2020).

With regard to the most common coping behaviors, individuals endorsed using different sounds to drown out bothersome sounds, block the sound, and focus their attention on an activity. The utilization of these coping behaviors is consistent with previous research about the types of coping behaviors individuals with misophonia use to deal with trigger sounds (Edelstein et al., 2013; Cowan et al., 2022). Edelstein et al. (2013) found that individuals avoid certain situations where the sound might be present, try to “cancel out” the sound, or use earplugs or music to cover bothersome sounds.

Consistent with our hypotheses, engaging in coping behaviors before, during, and after hearing a misophonia trigger was significantly correlated with higher symptom severity and worse impairment. The correlation between coping before hearing a misophonic trigger and impairment suggests a relationship between coping before and impairment, which could further support the idea that coping is a maintaining factor for misophonia as well as other disorders. Out of the three coping subscales, coping prior to encountering misophonia triggers was the most strongly correlated to impairment and misophonia symptom severity. Within the literature, engaging in coping before interacting with an unpleasant or feared stimulus is linked to

anticipatory anxiety (Telch & Lancaster, 2012) and negative reinforcement (Pittig et al., 2018). Anticipatory anxiety reflects an obsession with feared stimuli, so an individual will increase utilization of coping behaviors which will in turn increase anxiety related to the stimuli (Telch & Lancaster, 2012). Coping behaviors negatively reinforce anxiety related to a stimulus because there is a temporary reduction in aversive feelings. However, this conditions the individual to maintain their coping mechanisms, in turn maintaining their anxiety (Pittig et al., 2018; Telch & Lancaster, 2012). This pattern is reflected in our data through the strong positive correlation between coping before hearing a misophonic trigger and symptom severity and impairment. This is consistent with previous research. Specifically, individuals with misophonia perceive trigger sounds with an increased attention or obsession, which may amplify the negative reaction and perception of the sound (Vanaja & Abigail, 2020). Responses are typically learned specifically to one individual, then become generalized to any situation where the sound is made (Dozier, 2015). Fear generalization occurs when an individual gradually begins to generalize a neutral stimulus categorically related to the feared or unpleasant stimulus, increasing anxiety and avoidance (Christian & Levinson, 2022). Generalization sustains and heightens anxiety and avoidance related to conditioned stimuli (Christian & Levinson, 2022).

Our hypothesis that coping would mediate the association between trigger count and symptom severity was not supported by the current analyses. In the mediation model, the total effect model was significant. Both trigger sounds and the total frequency of coping behaviors are predictors for misophonia symptom severity. However, there was no indirect effect of the number of trigger sounds on symptom severity through average frequency of all coping

behaviors. In addition, the direct pathway from number of trigger sounds to misophonia symptom severity was not significant. The absence of findings may be explained by potential issues with the method of measurement for the trigger sounds and coping variables. Specifically, the average frequency of all coping behaviors may be an underestimate as the average considers responses across all coping behaviors; therefore, an individual who only uses one coping behavior (albeit constantly) would have a fairly low score. Therefore, this item considers the variability and frequency of engagement in coping behaviors, rather than total engagement in coping behaviors. A more accurate assessment of coping may be time spent engaging in coping behaviors. Secondly, the absence of findings may be explained by potential issues with the method of measurement for total trigger count. Specifically, the sum total count of trigger sounds may be an underestimate, because an individual may have one distressing sound they are exposed to constantly; therefore, an individual who experiences high levels of distress from only one sound would have a fairly low score. Our measures simplify the experience that an individual has. Future research should consider examining time spent exposed to one sound or which sounds are most distressing to the individual. A more accurate assessment of trigger count and impact would help clarify the individual variability between the number and type of trigger sounds and coping behaviors.

## **Limitations**

Several limitations warrant consideration in future investigations. First, the methodology relied on self-report measures. Although the measures are validated measures, replication of this study with the addition of formal diagnostic assessments conducted by psychology specialists

may enhance the clinical application of these findings. Second, the study's cross-sectional design prohibits casual inferences. In the future, longitudinal or experimental studies may be able to help experimenters to infer the directionality of behaviors. That is, does greater reliance on coping behaviors worsen misophonia symptom severity or do individuals with worse misophonia symptoms initiate a greater number of coping behaviors over time. A third limitation is that the sample primarily included female (82.1%) and white (79.1%) participants, which limits the scope of understanding how coping behaviors are correlated to misophonia symptom severity and impairment among individuals with diverse demographics. Although women represent the majority of misophonia cases in prior studies (Potgieter et al., 2021), future research including a more demographically diverse sample would improve the generalizability of the findings. However, this can be a limitation because these samples could also be biased, or men might not be presenting themselves for treatment. Lastly, this investigation uses measures with predetermined lists of triggers. Future research should explore the role of all possible triggers to identify and evaluate how triggers truly affect misophonia symptom severity and impairment. The limited nature of research on misophonia limits what is known about different presentations of misophonia. For example, it is unknown if it is more common for an individual to endorse two triggers or ten. This information is crucial for potential treatment because an individual may be exposed to one severely distressing sound constantly and experience high levels of impairment, or someone may be exposed to ten mildly distressing sounds and only experience mild functional impairment. Future research must investigate the differences in presentations due to trigger count to develop effective treatment.

Despite these limitations, results of the present study contribute to greater understanding of the associations between the different types of coping behaviors associated with misophonic triggers for the maintenance and worsening of symptom severity and impairment. Research investigating the impact of trigger count, intensity, and coping strategies on symptom severity is novel and new. Additional research is needed to fully understand the relationship between trigger count, coping, and misophonia symptom severity and impairment. Using this information, researchers may find direction for appropriate treatment options for individuals with misophonia, as distress reduction will be crucial for treatment (Frank & McKay, 2019). Research on effective treatment for anxiety and fear disorders reveals that exposure therapy and reducing avoidance-related coping behaviors is the most effective treatment for a reduction of symptoms (Hofmann & Hay, 2018). Avoidance is reinforced as there is a temporary reduction in aversive symptoms, however, the individual is never learning to deal with the stimuli (Hofmann & Hay, 2018). For misophonia, this looks like an individual engaging in coping behaviors (e.g., blocking trigger sound, mimicking trigger, avoiding situation where sound may be present), which leads to maintenance of symptoms and impairment. Educating patients on the correlation between coping behaviors and learning will be important as engaging with trigger sounds could be a way to reduce misophonia symptom severity and impairment.

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## TABLES

Table 1. Participant Sociodemographic Information (N = 67)

	Characteristics	n (%)
Sex	Female	55 (82.1)
	Male	12 (17.9)
Race/Ethnicity	White	53 (79.1)
	African American	9 (13.4)
	Asian	1 (1.5)
	Hispanic, Latinx, or Spanish origin	3 (4.5)
	Middle Eastern	1 (1.5)
	Other/prefer not to answer	2 (3.0)
Romantic relationship	One Partner	45 (67.2)
	Multiple Partners	3 (4.5)
	No	19 (28.4)
Education	Less than high school	1 (1.5)
	High school diploma or equivalent	25 (37.3)
	Vocational training or technical school	1 (1.5)
	Associate degree or bachelor's degree	26 (38.8)
	Graduate or professional degree	12 (17.9)
	Other	2 (3.0)
Occupation status	Employed full-time	26 (38.8)
	Employed part-time	23 (34.3)
	Unemployed	11 (16.4)
	Other	7 (10.4)
Student status	Part-time student	8 (11.9)
	Full-time student	32 (47.8)
	Non-student	27 (40.3)

Table 2. Misophonia Specific Coping Behaviors

Behavior	Mean	<i>SD</i>	<i>Mode</i>	<i>Median</i>	<i>Range</i>
<b>Coping Before</b>					
Using a different sound to drown out bothersome sound	2.69	1.30	2.00	3.00	0 – 4
Distracting oneself to not be bothered by a sound they might hear	2.26	1.24	3.00	3.00	0 – 4
Being on guard for bothersome sounds	2.21	1.69	3.00	2.00	0 – 4
Avoided certain people, places, or things, so I would not have to hear sounds I dislike	2.02	1.22	2.00	2.00	0 – 4
Using different strategies to make myself less bothered by sounds I might hear	1.90	1.39	2.00	2.00	0 – 4
Made a plan to cope with bothersome sounds if they occurred	1.60	1.29	1.00	1.00	0 – 4
<b>Coping During</b>					
Listening to music or a different sound	2.92	1.04	4.00	3.00	0 – 4
Focusing their attention on an activity	2.73	1.07	3.00	3.00	0 – 4
Blocking the sound	2.68	1.24	3.00	3.00	0 – 4
Increasing the background noise to cover up the bothersome sound	2.68	1.24	3.00*	3.00	0 – 4
Used strategies to calm myself	1.97	1.24	3.00	2.00	0 – 4
Changed my way of thinking about the sound	.98	1.00	.00	1.00	0 -- 3
Produced an alternate sound	1.50	1.20	2.00	1.50	0 – 4
Reminded myself that it could be worse	1.42	1.21	1.00	1.00	0 – 4
Looked away from the source of the sound	2.48	1.24	2.00*	2.50	0 – 4
Mindfully focused on current sensations without judgment	.82	1.04	.00	1.00	0 – 4
<b>Coping After</b>					
Listening to a comforting sound	2.40	1.22	3.00	3.00	0 – 4
Doing something to comfort oneself	2.08	1.26	3.00	2.00	0 – 4
Using the sight, smell, or touch of an object to soothe oneself	1.53	1.34	.00	2.00	0 – 4
Did some relaxation exercises	1.45	1.17	.00	1.50	0 – 4
Thought about strategies to help me cope better next time	1.27	1.19	.00	1.00	0 – 4

\* Multiple modes exist. The smallest value is shown

Table 3. Misophonia Specific Emotional, Physiological, and Cognitive Symptoms

Symptom	Mean	<i>SD</i>	<i>Mode</i>	<i>Median</i>	<i>Range</i>
<b>Emotional</b>					
Frustrated	3.18	1.12	4.00	4.00	0 – 4
Anxious	3.03	1.12	4.00	3.00	0 – 4
Jittery	2.57	1.40	3.00	3.00	0 – 4
Angry	2.42	1.22	2.00	2.00	0 – 4
Disgusted	2.44	1.07	2.00	2.00	0 – 4
Hateful	1.44	1.20	1.00	1.00	0 – 4
Panic	2.05	1.37	2.00	2.00	0 – 4
Hostile	1.77	1.37	2.00	2.00	0 – 4
<b>Physiological</b>					
Rigid or stiff	2.27	1.38	3.00*	2.00	0 – 4
Heart pounded or raced	1.98	1.48	.00*	2.00	0 – 4
Trembled or shuddered	1.69	1.34	2.00	2.00	0 – 4
Breathing intensely or forcefully	1.68	1.35	2.00	.00	0 – 4
Reflexively jumped	1.39	1.35	1.00	.00	0 – 4

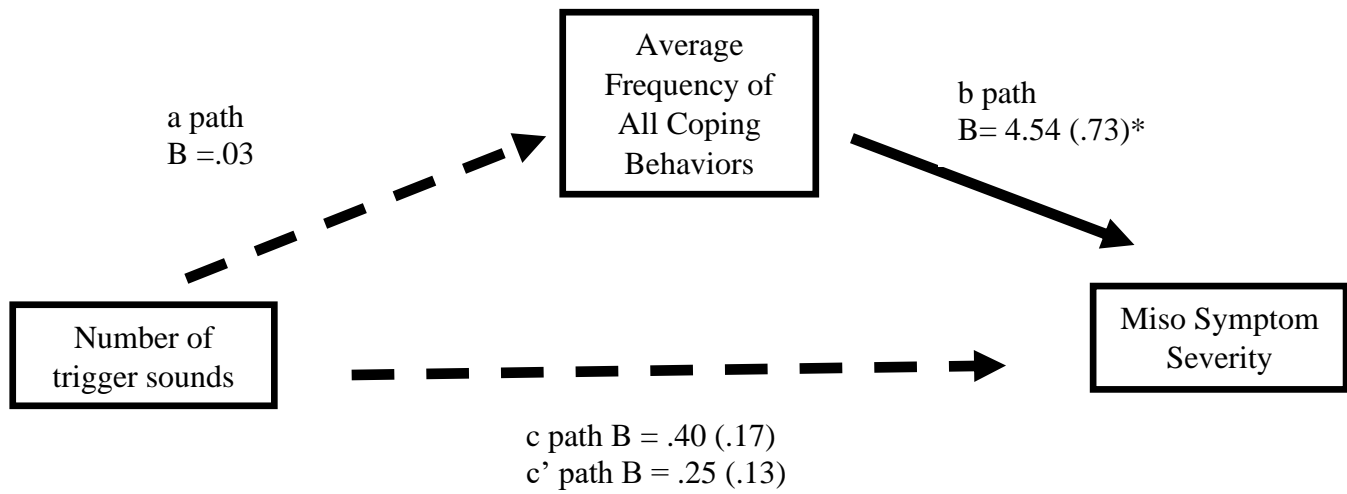
\* Multiple modes exist. The smallest value is shown

Table 4. Associations between coping behaviors and misophonia related outcomes

	1	2	3	4	5	6
1. Total coping	—	.937**	.861**	.748**	.666**	.513**
2. Coping Before		—	.641**	.626**	.687**	.544**
3. Coping During			—	.626**	.502**	.347**
4. Coping After				—	.411**	.405**
5. Total sum score for A-MISO-S					—	.726**
6. WSAS total sum score						—
Mean	1.49	2.11	2.02	.35	11.71	11.82
Standard Deviation	.49	.89	.58	.18	3.50	7.90
<i>n</i>	62	62	62	62	62	60

\*, Correlation is significant at the 0.05 level (2-tailed).

\*\*, Correlation is significant at the 0.01 level (2-tailed).

**Figure 1: Mediation Model**

Note: \* $p < .001$



## Appendix A

### Work and Social Adjustment Scale (WSAS)

Identifier:

Date:

People's problems sometimes affect their ability to do certain day-to-day tasks in their lives. To rate your problems, look at each section and determine on the scale provided how much your problem impairs your ability to carry out the activity. This assessment is not intended to be a diagnosis. If you are concerned about your results in any way, please speak with a qualified health professional.

If you're retired or choose not to have a job for reasons unrelated to your problem, tick here

☐

0	1	2	3	4	5	6	7	8
Not at		Slightly		Definitely		Markedly		Very
all								Severely

1. Because of my misophonia my **ability to work** is impaired. '0' means 'not at all impaired' and '8' means very severely impaired to the point that I can't work. ☐
2. Because of my misophonia my **home management** (cleaning, tidying, shopping, cooking, looking after home or children, paying bills) is impaired. ☐
3. Because of my misophonia my **social leisure activities** (with other people e.g. parties, bars, clubs, outings, visits, dating, home entertaining) are impaired. ☐
4. Because of my misophonia my **private leisure activities** (done alone, such as reading, gardening, collecting, sewing, walking alone) are impaired. ☐

5. Because of my misophonia my ability to form and maintain **close relationships** with others, including those I live with, is impaired.

Total WSAS Score:

## Appendix B

### Amsterdam Misophonia Scale (A-MISO-S)

Name: \_\_\_\_\_ Date: \_\_\_\_\_

#### Amsterdam Misophonia Scale (A-MISO-S)\*

Rate the characteristics of each item during the prior week up until and including the time you fill out this survey. Scores should reflex the average (mean) occurrence of each item for the entire week. "Sounds" can mean any misophonic trigger (sound, sight, touch, motion, etc.)

**1. How much of your time is occupied by misophonic sounds?** (How frequently do the (thoughts about the) misophonic sounds occur?)

<b>None</b>		0
<b>Mild</b> , less than 1 hr/day, or occasionally (thoughts about ) sounds (no more than 5 times a day)		1
<b>Moderate</b> , 1 to 3 hrs/day, or frequent (thoughts about) sounds (no more than 8 times a day, most of the hours are unaffected).		2
<b>Severe</b> , greater than 3 hrs and up to 8 hrs/day or very frequent (thoughts about) sounds.		3
<b>Extreme</b> , greater than 8 hrs/day or near constant (thoughts about) sounds.		4

**2. How much do these misophonic sounds interfere with your social, work or role functioning?** (Is there anything that you don't do because of them? If currently not working determine how much performance would be affected if you were employed.)

<b>None</b>		0
<b>Mild</b> , slight interference withi social or occupational/school activities, but overall performance not impaired.		1
<b>Moderate</b> , definite interference with social or occupational performance, but still manageable.		2
<b>Severe</b> , causes substantial impairment in social or occupational performance.		3
<b>Extreme</b> , incapacitating.		4

3. **How much distress do the misophonic sounds cause you?** (In most cases, distress is equated with irritation, anger, or disgust. Only rate the emotion that seems triggered by misophonic sounds, not generalized irritation or irritation associated with other conditions.)

<b>None</b>		0
<b>Mild</b> , occasional irritation/distress.		1
<b>Moderate</b> , disturbing irritation/anger/disgust, but still manageable.		2
<b>Severe</b> , very disturbing irritation/anger/disgust.		3
<b>Extreme</b> , near constant and disturbing anger/disgust.		4

4. **How much effort do you make to resist the (thoughts about the) misophonic sounds?** (How often do you try to disregard or turn your attention away from these sounds? Only rate effort made to resist, not success or failure in actually controlling the thought or sound.)

<b>Makes an effort to always resist</b> , or symptoms so minimal, doesn't need to actively resist.		0
<b>Tries to resist most of the time.</b>		1
<b>Makes some effort to resist.</b>		2
<b>Yields to all (thoughts about) misophonic sounds without attempting to control them, but does so with some reluctance.</b>		3
<b>Completely and willingly yields to all obsessions.</b>		4

5. **How much control do you have over your thoughts about the misophonic sounds?** How successful are you in stopping or diverting your thinking about the misophonic sounds? Can you dismiss them?

<b>Complete control.</b>		0
<b>Much control</b> , usually able to stop or divert thoughts about misophonic sounds.		1
<b>Moderate control</b> , sometimes able to stop or divert thoughts about misophonic sounds.		2

<b>Little control</b> , rarely successful in stopping or dismissing thoughts about misophonic sounds, can only divert attention with difficulty.		3
<b>No control</b> , experience thoughts as completely involuntary, rarely able to alter thinking about misophonic sounds.		4

6. **Have you been avoiding doing anything, going any place, or being with anyone because of your misophonia?** (How much do you avoid, for example, by using other loud sounds, such as music?)

<b>No deliberate avoidance.</b>		0
<b>Mild, minimal avoidance, Less than an hr/day</b> or occasional avoidance.		1
<b>Moderate, some avoidance. 1 to 3 hr/day</b> or frequent avoidance		2
<b>Severe, much avoidance. Greater than 3 up to 8 hr/day.</b> Very frequent avoidance.		3
<b>Extreme very extensive avoidance. Greater than 8 hr/day.</b> Doing almost everything you can to avoid triggering symptoms.		4

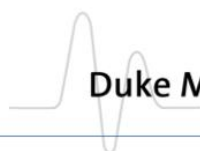
**Finally:**

**What would be the worst thing that could happen (to you) if you were not able to avoid the misophonic sounds?** Describe

## Appendix C

### Duke Misophonia Questionnaire (DMQ)

2021 v.1



## Duke Misophonia Questionnaire

#### General Instructions:

The following questions refer to the experience of being intensely bothered by a sound or sounds, even when they are not overly loud. These can be human or non-human sounds, or the sight of someone or something making a sound that you can't hear (e.g., the sight of someone biting their nails from across the room).

Please indicate whether the following sounds and/or sights bother you much more intensely than they do most other people.

	Yes	No
1. People making mouth sounds while eating or drinking (e.g., chewing, crunching, slurping).		
2. People making nasal/throat sounds (e.g., sniffing, sneezing, nose-whistling, coughing, throat-clearing).		
3. People making mouth sounds when not eating (e.g., making the "tsk" sound, heavy breathing, snoring, whistling).		
4. People making repetitive sounds (e.g., typing, tapping nails on table, pen clicking, writing, construction work, using machinery).		
5. Rustling or tearing objects (e.g., paper, plastic).		
6. Speech sounds (e.g., "p" sounds, hissing "s" sounds, someone speaking with a lisp, high-pitched voices).		
7. Body or joint sounds (e.g., snapping fingers, cracking joints, jaw clicking).		
8. Rubbing sounds (e.g., hands on pants, hands against one another, styrofoam rubbing together).		
9. Stomping or loud walking (e.g., heels clicking, flip flops, etc.).		
10. Muffled sounds (e.g., voices separated by a wall, TV/music in another room).		
11. People talking in the background (e.g., phone calls in public, many people talking at once).		
12. Repetitive or continuous sounds not made by a person (e.g., clock ticking, air conditioner humming, water running).		
13. Animals making repetitive sounds (e.g., licking, chirping, barking, eating, drinking).		
14. Seeing someone making or about to make a sound that bothers you, even if you can't hear it (e.g., seeing someone reach into a bag of chips, seeing someone eating on TV with the volume off).		
15. Other (please describe)		
16. There are no specific sounds that bother me much more than they do other people.		

Score	
-------	--

For the following sections, please use the scale below:

0	1	2	3	4
never	rarely	sometimes	often	always/almost always

In the past month on average, when intensely bothered by a sound or sounds, please rate how often each of the following happened to you.

1.	I became rigid or stiff.	0	1	2	3	4
2.	I trembled or shuddered.	0	1	2	3	4
3.	My heart pounded or raced.	0	1	2	3	4
4.	I started breathing intensely or forcefully.	0	1	2	3	4
5.	I reflexively jumped.	0	1	2	3	4

Score	
-------	--

In the past month on average, when intensely bothered by a sound or sounds, please rate how often you had each of the following thoughts.

1.	"I am helpless."	0	1	2	3	4
2.	"I want to cry."	0	1	2	3	4
3.	"How do I make this sound stop?"	0	1	2	3	4
4.	"Everything is awful."	0	1	2	3	4
5.	"I cannot handle this."	0	1	2	3	4
6.	"I need to get away from the sound."	0	1	2	3	4
7.	"I would do anything to make it stop."	0	1	2	3	4
8.	I thought about screaming at, yelling at or telling off the person making the sound.	0	1	2	3	4
9.	I thought about pushing, poking, shoving etc. the person making the sound.	0	1	2	3	4
10.	I thought about physically hurting the person making the sound.	0	1	2	3	4

Score	
-------	--

For the following sections, please use the scale below:

0	1	2	3	4
never	rarely	sometimes	often	always/almost always

In the past month on average, when intensely bothered by a sound or sounds, please rate how often each of the following happened to you.

1.	I became rigid or stiff.	0	1	2	3	4
2.	I trembled or shuddered.	0	1	2	3	4
3.	My heart pounded or raced.	0	1	2	3	4
4.	I started breathing intensely or forcefully.	0	1	2	3	4
5.	I reflexively jumped.	0	1	2	3	4

Score	
-------	--

In the past month on average, when intensely bothered by a sound or sounds, please rate how often you had each of the following thoughts.

1.	"I am helpless."	0	1	2	3	4
2.	"I want to cry."	0	1	2	3	4
3.	"How do I make this sound stop?"	0	1	2	3	4
4.	"Everything is awful."	0	1	2	3	4
5.	"I cannot handle this."	0	1	2	3	4
6.	"I need to get away from the sound."	0	1	2	3	4
7.	"I would do anything to make it stop."	0	1	2	3	4
8.	I thought about screaming at, yelling at or telling off the person making the sound.	0	1	2	3	4
9.	I thought about pushing, poking, shoving etc. the person making the sound.	0	1	2	3	4
10.	I thought about physically hurting the person making the sound.	0	1	2	3	4

Score	
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For the following sections, please use the scale below:

0	1	2	3	4
never	rarely	sometimes	often	always/almost always

Please rate how often you did the following in the past month, on average, BEFORE HEARING a bothersome sound.

1.	I avoided certain people, places, or things so I would not have to hear sounds I dislike.	0	1	2	3	4
2.	I used a different sound to drown the bothersome sound (e.g., turned on TV).	0	1	2	3	4
3.	I used strategies to make myself less bothered by sounds I might hear (e.g., deep breathing, meditation, visualization).	0	1	2	3	4
4.	I was on guard for bothersome sounds.	0	1	2	3	4
5.	I distracted myself so as not to be bothered by a sound I might hear.	0	1	2	3	4
6.	I made a plan to cope with bothersome sounds if they occurred.	0	1	2	3	4

Score	
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Please rate how often you did the following in the past month, on average, WHILE HEARING a bothersome sound.

1.	I blocked the sound (e.g., covered ears with hands, headphones, ear plugs).	0	1	2	3	4
2.	I used strategies to calm myself (e.g., self-talk, breathing exercises).	0	1	2	3	4
3.	I focused my attention on an activity (e.g., watched TV or videos).	0	1	2	3	4
4.	I produced an alternate sound (e.g., humming).	0	1	2	3	4
5.	I reminded myself that it could be worse.	0	1	2	3	4
6.	I increased the background noise to cover up the bothersome sound (e.g., turned on TV, rolled down car window).	0	1	2	3	4
7.	I changed my way of thinking about the sound.	0	1	2	3	4
8.	I looked away from the source of the sound	0	1	2	3	4
9.	I listened to music or a different sound.	0	1	2	3	4
10.	I mindfully focused on current sensations without judgment.	0	1	2	3	4

Score	
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For the following sections, please use the scale below:

0	1	2	3	4
never	rarely	sometimes	often	always/almost always

Please rate how often you did the following in the past month, on average, AFTER HEARING a bothersome sound.

1.	I did something to comfort myself (e.g., exercised, went somewhere calming, pet animals).	0	1	2	3	4
2.	I listened to a comforting sound (e.g., white noise, music).	0	1	2	3	4
3.	I did some relaxation exercises (e.g., deep breathing, meditation).	0	1	2	3	4
4.	I used the sight, smell or touch of an object to soothe myself (e.g. looked at a soothing picture, smelled a scent, or touched a soft blanket).	0	1	2	3	4
5.	I thought about strategies to help me cope better next time.	0	1	2	3	4

Score	
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For the following section, please use the scale below:

0	1	2	3	4
not at all	a little	moderately	quite a bit	extremely

Please rate the extent to which the bothersome sound/sounds and your reactions to them negatively affected the following in the past month on average.

1.	My ability to be with other people	0	1	2	3	4
2.	My performance at work or school	0	1	2	3	4
3.	The quality of my romantic relationships	0	1	2	3	4
4.	My ability to function in daily activities without help	0	1	2	3	4
5.	How much I enjoy spending time with my family	0	1	2	3	4
6.	My ability to work with others	0	1	2	3	4
7.	My self-esteem	0	1	2	3	4
8.	My ability to maintain employment	0	1	2	3	4
9.	The quality of relationships with my friends	0	1	2	3	4
10.	How connected I feel to other people	0	1	2	3	4
11.	My ability to live with other people (e.g., roommate, partner)	0	1	2	3	4
12.	My ability to "be myself"	0	1	2	3	4

Score	
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For the following section, please use the scale below:

0	1	2	3	4
never	rarely	sometimes	often	always/almost always

Please rate the extent to which the bothersome sound/sounds and your reactions to them negatively affected the following in the past month on average.

1.	"I hate being like this."	0	1	2	3	4
2.	"People do not understand me."	0	1	2	3	4
3.	"I will be rejected if people find out."	0	1	2	3	4
4.	"I am crazy."	0	1	2	3	4
5.	"My reactions to sounds are irrational."	0	1	2	3	4
6.	"I should get over it."	0	1	2	3	4
7.	"This is unfair."	0	1	2	3	4
8.	"I am weak."	0	1	2	3	4
9.	I should be able to control my reaction to these sounds	0	1	2	3	4
10.	"I am a burden on others."	0	1	2	3	4
11.	"I should have known how to cope earlier."	0	1	2	3	4
12.	"My sound issues will only get worse with time."	0	1	2	3	4
13.	"No one can help me."	0	1	2	3	4
14.	"My whole life will be affected by sound issues."	0	1	2	3	4

Score	
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Total Score	
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