


**Research Article**

# Healing From Home: Examination of an Online Mindfulness-Based Tinnitus Stress Reduction Course During the 2020 COVID Pandemic

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[https://doi.org/10.1044/2022\\_AJA-22-00063](https://doi.org/10.1044/2022_AJA-22-00063)**ABSTRACT**

**Purpose:** The purpose of this study was to assess the effectiveness of an Internet delivered Mindfulness Based Tinnitus Stress Reduction (i-MBTSR) program during the COVID-19 pandemic. Tinnitus, often a chronic condition, is experienced by 15% of the population. For those with severe, bothersome tinnitus, quality of life is reduced and the treatment options are limited. We evaluated an approach intended to decrease tinnitus-related distress.

**Method:** This study examined the data collected for an online i-MBTSR course using a retrospective design. The intervention included an 8-week self-paced i-MBTSR course, including didactic information about mindfulness and tinnitus, as well as meditation practices. Outcome measures included the Tinnitus Functional Index (TFI) and Perceived Stress Scale (PSS), which were measured at four time periods. These time points included pretreatment, midtreatment at 3 weeks, immediately posttreatment, and at 6-month follow-up.

**Results:** Forty-three participants completed the intervention. The mean preintervention tinnitus severity rating was 59.96 (“severe tinnitus”) as measured by the TFI. Mean TFI scores dropped to 44.16 ( $p < .001$ ) at midtreatment and to 34.23 ( $p = .001$ ) at posttreatment. Repeated-measures analysis of variance and multivariate analysis of variance tests were conducted to determine changes in the two scales at the four time periods. There were significant differences in perceived stress and tinnitus self-function found in all measures and submeasures between the pre-, mid-, and posttreatment time points with the exception of the TFI Auditory subtest. These gains remained significant for those who completed the 6-month follow-up.

**Conclusions:** The i-MBTSR course appears to be a viable and effective treatment modality. A shorter 3-week course may be effective. Case-control studies to more systematically investigate the effectiveness of i-MBTSR for tinnitus are required.

Tinnitus is the auditory perception of sound by an individual in absence of physical stimulation and is experienced by nearly 15% of the population (Shargorodsky et al., 2010). According to the American Tinnitus Association (ATA), of the 50 million Americans who experience tinnitus, 20 million report this chronic condition as troublesome.

Furthermore, two million Americans indicate that tinnitus is debilitating and significantly affects their daily life (ATA, 2018), dominating and controlling the activities of the sufferer (Folmer & Griest, 2000). Those with chronic, bothersome tinnitus may experience anxiety, depression, sleep disturbances, annoyance, difficulty concentrating (Bhatt et al., 2017; Folmer et al., 1999; Halford & Anderson, 1991), and decreased quality of life (QOL; Bartels et al., 2008).

While there is no medicine or surgical procedure that cures or eliminates tinnitus presently, there are several management tools that can “effectively cure” the bothersome nature of tinnitus or reduce its impact significantly (Gans et al., 2014) by shifting the subjective nature of tinnitus from

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bothersome to nonbothersome (Fuller et al., 2020). Current treatment options often include education, sound therapy, and behavioral therapy. Sound therapy may include hearing aids, sound generators, and/or tinnitus maskers, all of which modify the auditory input to alter the signal-to-noise ratio or provide a masking function. Electronic tinnitus maskers may provide temporary relief but often do not result in long-term benefit (Henry et al., 2006).

The most common behavioral interventions are Cognitive Behavioral Therapy (CBT), Acceptance and Commitment Therapy (ACT), Tinnitus Retraining Therapy (TRT), and Progressive Tinnitus Management (PTM). Each of these approaches includes some form of behavioral modification and may also include the use of sound therapy (Cima et al., 2014; Henry et al., 2017; Phillips & McFarren, 2010; Westin et al., 2011).

Mindfulness-Based Stress Reduction (MBSR) is a treatment program in which participants learn techniques to promote nonjudgmental awareness and acceptance of chronic symptoms or conditions (Kabat-Zinn & Hanh, 2009). MBSR programs incorporate meditation, yoga, and psychoeducational support as well as instruction on how to bring a mindfulness meditation practice into daily life. MBSR is effective at reducing distress of chronic conditions (e.g., arthritis pain; Rosenzweig et al., 2010) as well as increasing immune function (e.g., Davidson et al., 2003) and improving QOL for people with cancer (e.g., Carlson et al., 2007). MBSR has been adapted for specific conditions, such as depression (Williams et al., 2000), anxiety (Toneatto & Nguyen, 2007), and sleep disturbance (Winbush et al., 2007). MBSR shows sustained treatment effects on follow-up (e.g., Kabat-Zinn et al., 1987) and may also be an effective treatment for tinnitus (Roland et al., 2015).

A modified version of MBSR, Mindfulness-Based Tinnitus Stress Reduction (MBTSR), was developed as a tinnitus-focused treatment option (Gans et al., 2014). While based on MBSR, it also includes specific education related to tinnitus. The overriding goals of the MBTSR program are to help participants feel less anxious about experiencing tinnitus, to provide accurate evidence-based tinnitus education, and to establish the beginning of a mindfulness meditation practice. Gans et al. (2014) suggested that MBTSR reduces tinnitus distress, depression, and phobic anxiety while improving social functioning and overall mental health. A follow-up study showed continued reduction of tinnitus distress while positively impacting other aspects of one's life (Gans et al., 2015). A recent study comparing MBTSR and TRT as homebased management treatments for tinnitus during the COVID-19 outbreak found MBTSR to be more useful in reducing tinnitus annoyance while increasing overall QOL (Chatterjee et al., 2021). Randomized controlled trials assessing the effectiveness of mindfulness-based interventions for tinnitus have been previously published showing effectiveness of these interventions for reducing tinnitus severity as well as a

reduction in psychological distress and disability (Arif et al., 2017; McKenna et al., 2017; Roland et al., 2015).

Particularly with the advent of the social distancing guidelines associated with the COVID-19 pandemic, telehealth services have become increasingly widespread. For example, the MBSR program has been successfully implemented online (Riley et al., 2022). Both asynchronous and synchronous telehealth formats in the management of tinnitus have been used with variable success (Beukes et al., 2019; Hashir et al., 2021). Provision of behavioral online services for audiology patients has been associated with many benefits, such as cost effectiveness, reduction in travel time, and accessibility improvements, particularly for populations with Internet access but few local resources (DeHart et al., 2022; Hashir et al., 2021; Swanepoel & Hall, 2020).

Accordingly, an Internet-delivered version (i-MBTSR) of the MBTSR course is advantageous both in terms of accessibility, cost, and time efficiency. The i-MBTSR course mirrors the in-person MBTSR program with lessons presented in an asynchronous format (participants engage with the course at a time and in a setting that is convenient for them), providing for maximum flexibility for participants across time zones. Participants of the i-MBTSR course complete 8 weekly online lessons. Each lesson includes video and audio recordings, as well as written content covering topics related to tinnitus education, mindfulness practice, and gentle yoga, with professionally led meditation recordings and videos. Participants complete 30 min of daily meditation practice on the days between weekly lessons. A daylong practice session is scheduled between the sixth and seventh weeks of the course. This daylong practice is designed to bring together the various skills learned earlier in the program reinforcing mindfulness in participants' everyday life. The course content emphasizes in-depth tinnitus education and reduced tinnitus-related anxiety. By teaching awareness building meditation skills, the course encourages participants to experience tinnitus as part of their sensory landscape, thus helping shift the tinnitus sensation from bothersome to nonbothersome.

Testing the effectiveness of the i-MBTSR course is critical and timely. While there are a variety of tinnitus treatments, many tinnitus patients may not have access to a full complement of treatment options depending on, for instance, lack of community services or reduction in group-based activities due to social distancing requirements during the COVID-19 pandemic. Effective self-paced online tinnitus treatment has the potential to reduce the pressures on existing health care systems while providing meaningful tinnitus care worldwide for those with Internet access in the privacy of their homes.

## Purpose

The aims of this retrospective study were (a) to investigate change in tinnitus intrusiveness after participation in

the i-MBTSR course and (b) to examine whether change was retained at 6-month follow-up.

## Method

### Participants

Forty-three participants (female = 21; male = 22) were recruited internationally during a 2-month period, targeting individuals with moderate to severe levels of tinnitus distress (i.e., a score of at least 25 on the TFI; see Table 1). Study availability was advertised through various online formats and through referral from health care professionals.

All participants were at least 18 years of age, could read, type, and understand spoken English and had Internet computer access. Participants currently involved in litigation or legal matters related to auditory disorders were excluded as were participants with uncorrected visual and hearing problems that interfered with reading and hearing audio recordings.

A sample of 677 people registered for the course and input at least some initial data for this study. One hundred people were excluded from analysis due to pending legal action ( $n = 19$ ), incomplete data ( $n = 7$ ), visual impairment and inability to read from the computer screen ( $n = 1$ ), precourse total TFI assessment scores below 25 ( $n = 72$ ), or being under 18 years of age ( $n = 1$ ). Forty-three completed the program, forming the study sample. Similarly low completion rates for free online courses are typical (Coffrin et al., 2014).

Participant consent was obtained when registering for the course. The study was approved by the Idaho State University Institutional Review Board, and all participants indicated permission to participate as part of the initial intake questionnaire.

## Study Design

This study sought to examine effects of an i-MBTSR program on psychological stress (PSS) and functional adaptation to tinnitus (TFI). The i-MBTSR course was offered at no charge during the COVID-19 shelter-in-place period from March 25 to June 8, 2020. Participants completed the Tinnitus Intake Questionnaire (TIQ), the TFI, and the PSS upon course entry. TFI and PSS were additionally administered at midcourse, upon course completion, and at 6-month follow-up. The data derived from the questionnaires were treated as continuous variables.

## Intervention and Procedures

i-MBTSR is an 8-week training program with each lesson focusing on applying mindfulness to tinnitus and secondary symptoms, such as anxiety, depression, and sleep difficulty. Participants complete a 2-hr lesson per week and 30 min of instructor-led meditation practice daily. Instructional videos and audio recordings are accessed through the Internet, which guide the tinnitus instruction and formal meditations. Participants are instructed on key aspects of tinnitus (i.e., pathophysiology, attentional control, and stress response) and are encouraged to develop a mindful outlook on their life as a whole. Participants develop awareness of their body, leading to recognition that perceptions arising from body states are neither rewarding nor punishing, but are rather simply perceptions, thus depersonalizing tinnitus. Additional class time focuses on guided mindfulness practices emphasizing awareness of sound and tinnitus perception and providing skills to increase overall well-being, as it relates to living with tinnitus. Participants are instructed to practice mindfulness at times when tinnitus is perceived to be both bothersome and less bothersome, including while eating meals, before sleeping, during social interactions, and in periods of quiet.

**Table 1.** Participant characteristics.

Characteristic	Male	Female	Not provided	Total
Total number who enrolled in course	290	283	4	577
Completed 8-week course	22	21	0	43
Subgroup that completed 8-week course and 6-month follow-up questionnaire	8	4	0	12
Ethnic origin of those completing the course, including follow-up subgroup				
African American or Black	1	0	NA	1
Asian/Pacific Islander	0	1	NA	1
Hispanic or Latino/a	1	0	NA	1
Native American or American Indian	0	0	NA	0
White	10	7	NA	17
Other	0	0	NA	0
Not provided	10	13	NA	23

Note. NA = not applicable.

## Instruments

All assessment measures were administered online using cloud-based survey software (SurveyMonkey). Psychometric properties using an online and a paper-and-pencil format for assessment administration have shown comparable results (Thorén et al., 2012).

### TIQ

The TIQ is an unvalidated assessment developed by the author to gather demographic information related to tinnitus and its impact on an individual including information on gender, age, language spoken, geographic location, and so forth.

### The TFI

The TFI (Meikle et al., 2012) is a 25-item questionnaire, with possible scores ranging from 0 to 100. A score of 0–25 indicates mild or no bother, and a score from 25 to 50 indicates moderate tinnitus impact and the need for intervention. Scores ranging above 50 are considered severe, and more intensive intervention is indicated. Measures include the intrusiveness of tinnitus, the degree of self-control of tinnitus sufferers, cognitive interference, sleep disturbance, auditory issues, relaxation issues, QOL, and emotional distress. All participants scored in the moderate to severe range of tinnitus impact on the TFI. The TFI was administered at all four time periods in this study. Cronbach's  $\alpha$  for the overall TFI and each of its subscales for this study was  $> .7$  (Meikle et al., 2012).

### The PSS

The PSS (Cohen, 1988) is a widely used and validated scale assessing the degree to which situations in an

individual's life are perceived as stressful during the previous month. Including this measure of perceived stress allows for a comparison of findings against the existing evidence base, as this is a widely used measure in mindfulness studies. The PSS consists of 14 items using 5-point scales, each ranging from 0 to 4, with 4 being the highest stress score and total scores ranging from 0 to 56. Perceived stress was assessed before the intervention, midcourse, on course completion, and at 6-month follow-up; Cronbach's alpha for the PSS was .78.

## Data Analysis

To assess the effects of the i-MBTSR program, measured outcomes related to the effects of tinnitus included psychological stress (PSS) and functional adaptation to tinnitus (TFI). Three analyses were completed from the results of these two scales: (a) Examination of participants who completed all three time points of the study was used to determine whether effects were sustained (Follow-Up Group); (b) comparison of results for those participants who completed pre-, mid-, and posttests (Completer Group); and (c) comparison between results of the Completer Group and the Follow-Up Group to determine whether the groups differed in scores. Completer Group analysis was performed for the entire group of participants who completed the study (male = 22; female = 21). Follow-Up Group analysis was completed for 12 participants (male = 8; female = 4). This analysis was conducted using repeated-measures analysis of variance (ANOVA) with the Greenhouse–Geisser method utilizing calculations to account for the lack of sphericity with these variables.

Post hoc comparisons between time points were examined using contrasts and by incorporating the Bonferroni

**Table 2.** Completer Group means and standards errors of Tinnitus Functional Index (TFI) subscale scores as well as combined TFI and Perceived Stress Scale (PSS) scores.

Measure	Time 1 <sup>a</sup>	Time 2 <sup>a</sup>	Time 3 <sup>a</sup>	ANOVA/MANOVA tests	
	<i>M (SEM)</i>	<i>M (SEM)</i>	<i>M (SEM)</i>	<i>F</i>	<i>p value</i>
Subscale scores					
Intrusive	67.46 (2.95)	51.27 (3.27)	39.48 (3.54)	52.4	< .001
Control	68.88 (2.59)	50.16 (3.41)	39.60 (3.63)	36.38	< .001
Cognitive	52.94 (3.74)	41.75 (3.66)	30.96 (3.67)	14.21	< .001
Sleep	61.89 (4.71)	45.32 (4.44)	32.46 (4.34)	29.96	< .001
Auditory	38.49 (4.5)	29.92 (4.13)	25.54 (3.98)	7.81	.001
Relaxation	76.27 (3.34)	55.71 (3.99)	44.84 (3.71)	43.43	< .001
Quality of life	52.98 (3.17)	36.79 (3.20)	30.42 (2.91)	26.12	< .001
Emotional	63.1 (4.04)	44.84 (3.78)	32.94 (3.69)	45.03	< .001
Combined scale total					
TFI combined	59.96 (2.61)	44.16 (2.86)	34.23 (2.91)	59.01	< .001
PSS combined	26.41 (1.29)	22.87 (1.23)	17.73 (1.11)	40.32	< .001

*Note.* These are followed by *F* statistics and *p* values for Greenhouse–Geisser repeated measures analysis of variance (ANOVA)/multivariate analysis of variance (MANOVA) for each scale/subscale. Note that gender was not significant in the omnibus ANOVA, so the data were collapsed. *SEM* = standard error of the mean.

<sup>a</sup>Time 1 = pretreatment; Time 2 = midtreatment; Time 3 = posttreatment.

**Table 3.** Completer Group post hoc *p* values of contrasts comparing each pair of time points for Tinnitus Functional Index (TFI) subscale scores as well as combined TFI and Perceived Stress Scale (PSS) scores.

Measure	Times 1–2 <sup>a</sup>	Times 1–3 <sup>a</sup>	Times 2–3 <sup>a</sup>
	<i>p</i> value	<i>p</i> value	<i>p</i> value
Subscale scores			
Intrusive	< .001	< .001	< .001
Control	< .001	< .001	.025
Cognitive	.020	< .001	.068
Sleep	< .001	< .001	.001
Auditory	.037	.002	.51
Relaxation	< .001	< .001	.004
Quality of life	< .001	< .001	.18
Emotional	< .001	< .001	< .001
Combined scale total			
TFI	< .001	< .001	.001
PSS	.002	< .001	< .001

<sup>a</sup>Time 1 = pretreatment; Time 2 = midtreatment; Time 3 = posttreatment.

correction to the alpha value determination. To test whether the responses differed between the Completer and the Follow-Up Groups, 2 (group) × 3 (time) repeated-measures (using Wilks' Lambda because of heterogeneity of variance) multivariate analysis of variance (MANOVA) tests were conducted.

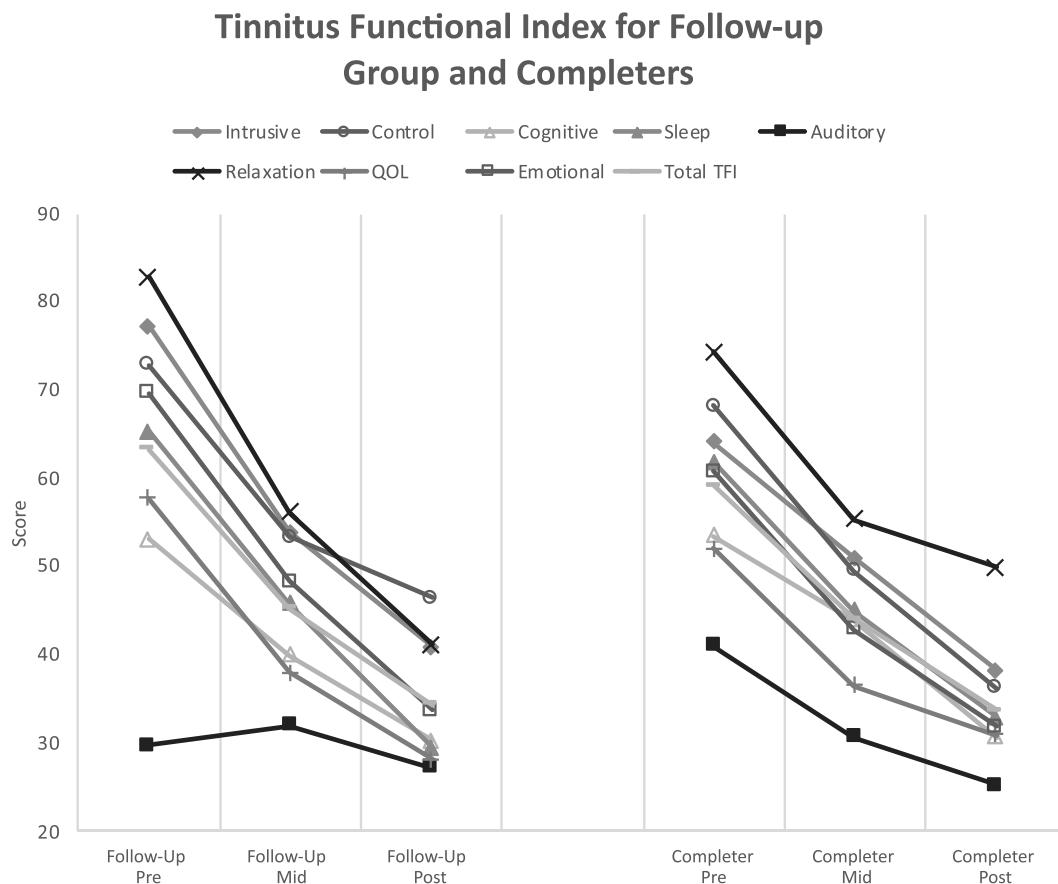
## Results

### Completer Group

The ANOVA comparing all three time periods was significant (see Table 2). Post hoc contrast comparisons with Bonferroni adjustments were utilized to examine the differences between the levels of each main effect. Contrasts revealed that the greatest gains were made in TFI and PSS between the Time 1 and either Time 2 or Time 3 time periods. Results of contrasts are presented in Table 3 and Figures 1 and 2.

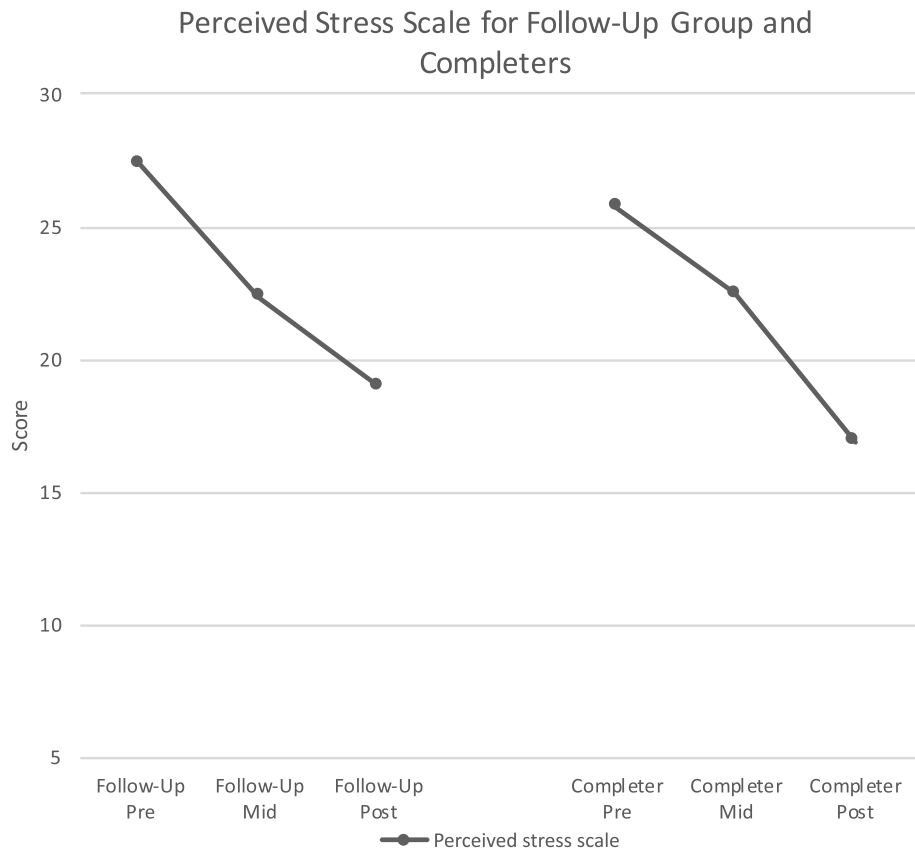
Results of the 3 (time) × 2 (sex) ANOVA revealed significant main effects for time for all TFI subscales. The

**Figure 1.** Tinnitus Functional Index (TFI) subscale scores for the Completer and Follow-Up Groups. QOL = quality of life.





**Figure 2.** Perceived Stress Scale scores for the Completer and Follow-Up Groups.



main effect for sex was significant only for QOL across all three time points ( $p < .05$ ), with female participants showing overall greater QOL scores than males. There was not a significant Time  $\times$  Sex interaction. There were no sex group effects or Time  $\times$  Sex interactions on any other TFI subtests or total score. For the PSS total score, results of the 3 (time)  $\times$  2 (sex) ANOVA revealed significant main effects for time for all scales (see Table 2). There was no Time  $\times$  Sex interaction effect. All contrasts were significant, with the exception of the Time 2 versus Time 3 contrast (Auditory and QOL subtests).

### Follow-Up Group

The analyses of TFI and PSS scores for participants who completed all three time periods and the 6-month follow-up (Follow-Up Group) are presented in Tables 4 and 5 and Figures 1 and 2. For TFI subscales, results of the ANOVA revealed significant main effects for time for all scales, with the exception of the Auditory scale. The main effect for sex was not significant for any subtests. There were no sex group effects or Time  $\times$  Sex interactions on any other TFI subtests or total score. For the PSS total score, results of the 4 (time)  $\times$  2 (sex) ANOVA

revealed significant main effects for time for all scales. The Time  $\times$  Sex interaction effect was not statistically significant. Post hoc contrast comparisons with Bonferroni adjustments were utilized to examine differences between the levels of each main effect. Notably, the greatest significant impact seen in the contrasts was found in the Time 1 versus Time 4 time period, whereas contrasts between Times 2 and 3, 2 and 4, and 3 and 4 had only one significant impact (TFI sleep for Time 3 vs. Time 4). That is, the significant TFI changes for this group all seemed to occur relative to the first (Time 1) measure.

### Clinically Significant Change

Additionally, study findings were evaluated from a clinically meaningful perspective. Based on the work of Meikle et al. (2012), a difference of 13 in TFI scores is determined to be clinically significant. Using this metric, of the 94 participants who completed the pre- to mid-assessment, 41 (44%) had clinically meaningful improvements (see Figure 3). Among the 43 participants who completed the pre- to post-TFI assessment, 31 (72%) experienced clinically meaningful improvements (see Figure 4). While 13 participants did not experience a clinically meaningful change, there was a trend in this direction with

**Table 4.** Follow-Up Group means and standards errors of TFI subscale scores as well as combined TFI and PSS scores.

Measure	Time 1 <sup>a</sup>	Time 2 <sup>a</sup>	Time 3 <sup>a</sup>	Time 4 <sup>a</sup>	ANOVA/MANOVA tests	
	<i>M (SEM)</i>	<i>M (SEM)</i>	<i>M (SEM)</i>	<i>M (SEM)</i>	<i>F</i>	<i>p value</i>
Subscale scores						
Intrusive	78.34 (4.71)	52.71 (6.09)	39.16 (7.22)	38.98 (7.44)	15.49	< .001
Control	72.70 (4.91)	52.91 (4.96)	47.08 (7.95)	38.12 (7.41)	6.80	.003
Cognitive	64.79 (9.14)	42.08 (7.52)	26.87 (8.78)	28.33 (9.86)	7.31	.001
Sleep	30.41 (11.47)	28.34 (9.97)	23.11 (8.40)	20.83 (9.61)	13.68	< .001
Auditory	81.88 (5.82)	54.99 (7.06)	38.96 (7.42)	38.12 (6.23)	0.87	.45
Relaxation	56.72 (7.07)	36.72 (6.83)	24.95 (7.48)	21.41 (6.3)	21.43	< .001
Quality of life	67.08 (7.14)	45.43 (8.06)	31.48 (8.43)	23.95 (7.37)	15.29	< .001
Emotional	78.34 (4.71)	52.71 (6.09)	39.16 (7.22)	38.98 (7.44)	16.96	< .001
Combined scale total						
TFI combined	62.68 (5.50)	43.35 (5.65)	32.05 (7.22)	29.00 (6.88)	18.78	< .001
PSS combined	27.44 (2.19)	21.88 (2.77)	19.13 (2.42)	16.38 (2.79)	15.59	< .001

*Note.* These are followed by *F* statistics and *p* values for Greenhouse–Geiser repeated measures analysis of variance (ANOVA)/multivariate analysis of variance (MANOVA) for each scale/subscale. Note that gender was not significant in the omnibus ANOVA, so the data were collapsed. *SEM* = standard error of the mean.

<sup>a</sup>Time 1 = pretreatment; Time 2 = midtreatment; Time 3 = posttreatment.

seven participants showing a 10-point reduction in tinnitus severity. No adverse consequences were reported.

## Discussion

This study sought to examine whether an 8-week i-MBTSR program alleviates symptoms of bothersome tinnitus in individuals, particularly in those isolated during the COVID-19 pandemic. The answer to this question is certainly in the affirmative. Individuals who completed the program benefited across all TFI subscales, with the exception of the Auditory subscale for the smaller sample Follow-Up Group. The greatest changes occurred early in the program with continued gains to the final measure and maintained long after course completion.

The full Completer Group showed the greatest changes between Time 1 (precourse) and Time 2 (3-week midcourse), indicating the possibility that a 3-week course could provide effective treatment for tinnitus intrusion, albeit with no gains in Cognitive and Sleep subtests, which showed marked changes from Time 2 (3-week midcourse) to Time 3 (course completion). It might be possible to recommend reduced treatment time for those with whom sleep or cognitive function (concentration, clear thinking, and attention) issues do not appear to be dominant. The results of the Follow-Up Group may indicate that gains are either retained or continue beyond the study period, although the sample size was insufficient to warrant further speculation.

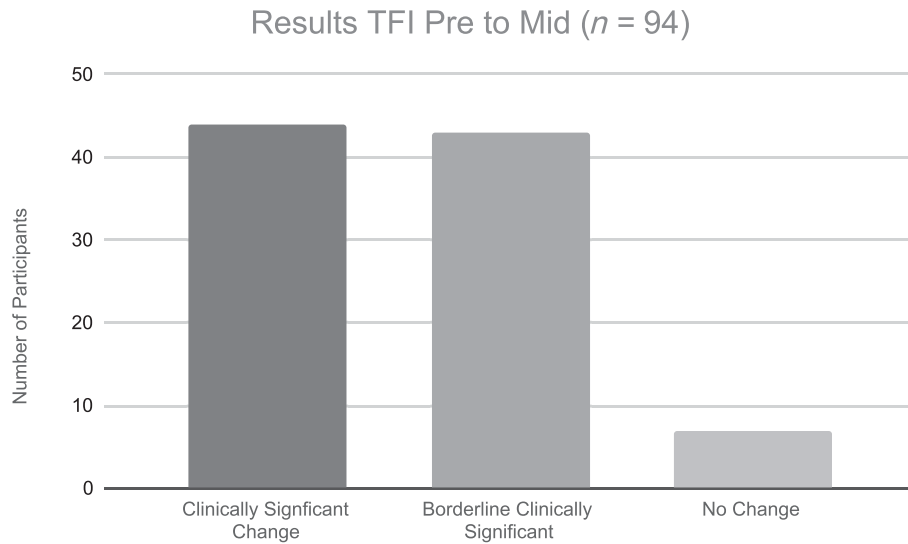
This study group was unique in that participants were an international sample observed during the COVID-19 pandemic and were self-referred to the program and were

**Table 5.** Follow-Up Group post hoc *p* values of contrasts comparing each pair of time points for Tinnitus Functional Index (TFI) subscale scores as well as combined TFI and Perceived Stress Scale (PSS) scores.

Measure	Times 1–2 <sup>a</sup>	Times 1–3 <sup>a</sup>	Times 1–4 <sup>a</sup>	Times 2–3 <sup>a</sup>	Times 2–4 <sup>a</sup>	Times 3–4 <sup>a</sup>
	<i>p value</i>	<i>p value</i>	<i>p value</i>	<i>p value</i>	<i>p value</i>	<i>p value</i>
Subscale scores						
Intrusive	.05	.002	< .001	.33	.85	1.00
Control	.03	.11	.009	1	.80	1.00
Cognitive	.10	.04	.002	1	.86	1.00
Sleep	.10	.006	.006	.03	.31	1.00
Auditory	1.00	1.00	.46	1	.94	1.00
Relaxation	.02	.001	< .001	.1	.19	1.00
Quality of life	.007	.006	.002	.56	.17	1.00
Emotional	.009	.002	.001	.19	.07	1.00
Combined scale total						
TFI	.007	.002	< .001	.30	.20	1.00
PSS	.036	.007	.001	.62	.008	1.00

<sup>a</sup>Time 1 = pretreatment; Time 2 = midtreatment; Time 3 = posttreatment.

**Figure 3.** Change in Tinnitus Functional Index subscale scores from pre to mid. TFI = Tinnitus Functional Index.



not a clinical sample, since information on mental health status or audiologic factors beyond self-report were not gathered. Future research may wish to investigate if objective measures of audiologic function and mental health status influence course effectiveness.

The current data do not reveal characteristics of those who are likely to complete the online 8-week course. However, because the data suggest that a shorter program may be beneficial, future research may wish to identify if an abbreviated course length increases course compliance.

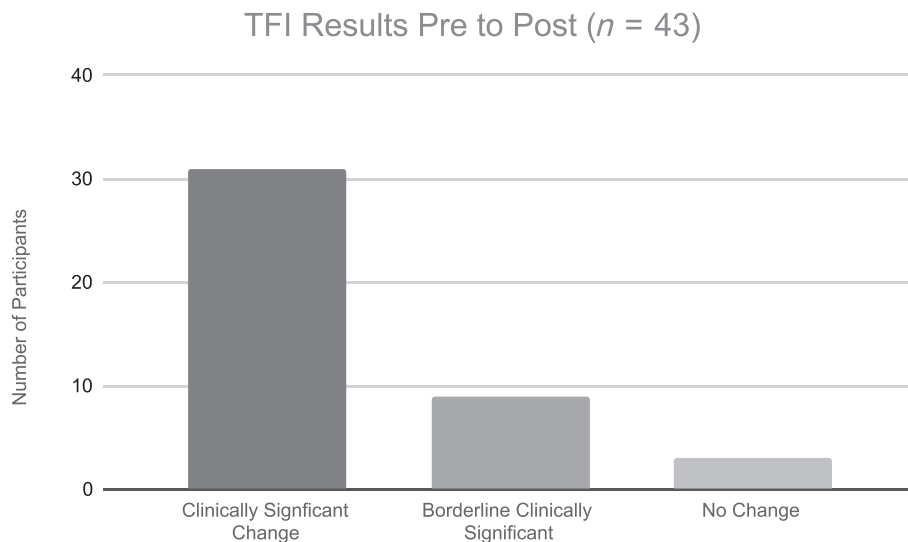
This study suggests that the majority of individuals who completed the course experienced a treatment-related

change in tinnitus. Importantly, participants who completed the program also experienced an improved QOL. This further supports that an i-MBTSR course may be a viable tinnitus treatment option, especially for those who would not otherwise have access to in-person tinnitus treatment.

### Limitations

Attrition is a major concern in this study. Course completion is defined as the number of study subjects who submit the final assignments relative to those who initially enrolled in the course. The completion rate for participants in the study was approximately 10%. However, this is in line

**Figure 4.** Change in Tinnitus Functional Index subscale scores from pre to post. TFI = Tinnitus Functional Index.





with the 5%–15% rate expected for a free online course (Coffrin et al., 2014; Koller, 2012). Several changes to the course may lead to higher course engagement and completion. These changes may include charging for course access, offering financial incentives for completion (e.g., money back), and creating a professionally moderated online community providing a platform where participants can connect with others, get feedback and support, and ask questions. Future research should more closely measure participant course engagement through tracking time spent on course content.

Second, this study was limited by the absence of a control group, arising from the opportunistic acquisition of the data set. Relatedly, we cannot establish a causative effect of the i-MBTSR program on improvement of tinnitus symptoms, particularly as these symptoms sometimes subside over time (Phillips et al., 2018). This limits the generalizability of our findings, making it difficult to identify candidates who would most benefit from i-MBTSR. We plan to ameliorate this in future research by implementing a wait-list control design model. Future research will address these difficulties, allowing us to perform predictive statistics in an effort to determine the best fit of this program to the patient.

Despite these limitations, our study importantly found statistically significant improvements among all measures and submeasures among the pre-, mid-, and posttime points. The gains were apparently maintained 6 months following the intervention. Thus, the online MBTSR course appears to be a viable and effective treatment modality for this population. Furthermore, as this was an international sample, translation of the i-MBTSR course into other languages may be warranted.

Future research should explore differences when participants present with a meditation practice prior to entry. A clinical sample having been evaluated and referred by an audiologist or other health care provider would strengthen the findings and their generalizability. Case-control studies using representative populations to more systematically investigate the effectiveness of i-MBTSR for tinnitus are required. A subsequent study that examines more closely time-on-task, completion of assignments, and other treatment-related variables could help us establish a predictive model that would allow us to identify people this program is most likely to benefit. Similarly, future research should be able to determine whether a shorter (possibly 3 weeks) intervention might prove equally beneficial to the participant.

## Data Availability Statement

The data sets generated during and/or analyzed during this study are available from the corresponding author on reasonable request.

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