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UNIVERSITY OF NORTHERN COLORADO

Greeley, Colorado

The Graduate School

AN APPROACH TO TINNITUS THROUGH MINDFULNESS

A Doctoral Scholarly Project Submitted in Partial Fulfillment
Of the Requirements for the Degree of
Doctor of Audiology

Trista Ann Hauser-Smith

College of Natural and Health Sciences
School of Human Services
Audiology and Speech-Language

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This Scholarly Project by: Trista Ann Hauser-Smith

Entitled: *An Approach to Tinnitus Through Mindfulness*

has been approved as meeting the requirement for the Degree of Doctor of Audiology in the College of Natural and Health Sciences in the School of Human Sciences, Program of Audiology and Speech-Language Sciences.

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ABSTRACT

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Tinnitus is the perception of sound when there is no external source. It is also known as “ringing in the ears.” Those who experience the effects of bothersome tinnitus may suffer from a multitude of symptoms that may include depression, anxiety, suicidal thoughts, sleep disturbances, anger, etc. Bothersome tinnitus has further been compared to chronic pain (both are phantom symptoms and occur from reorganization of the central nervous system). With a multitude of symptoms, management of tinnitus may be difficult. For this reason, a whole-health approach using a multidisciplinary team may be warranted. An audiologist may be able to help a patient with bothersome tinnitus by evaluating the health of the auditory and/or balance systems to recommend an appropriate management option. It is recommended by the American Academy of Otolaryngology-Head and Neck Surgery Foundation (AAO-HNSF) that an audiologist provide tinnitus counseling, fit and adjust hearing aids, if needed, and/or recommend the use of a sound machine (Tunkel et al., 2014). For some patients with bothersome tinnitus, these strategies may be enough to provide relief from the tinnitus; however, for others these management options may not be sufficient and thus finding another option to manage the effects of tinnitus will be vital to their quality of life.

The research literature addresses many management options for tinnitus. One emerging approach to managing the effects of tinnitus is mindfulness. Mindfulness focuses on creating awareness in the present moment with acknowledgment of thoughts, feelings, and bodily

sensations. Mindfulness refocuses the individual's awareness back to the present moment through the shifting of attention so that negative thoughts will become less emotionally destructive. The review of literature in this area suggests that a mindfulness approach to tinnitus may be beneficial to those who suffer from associated depression, anxiety, sleep disturbances, and chronic pain.

Mindfulness-based stress reduction (MBSR) is a mindfulness course that is typically presented as an eight-week program. Preliminary results with the use of an MBSR course focused on tinnitus have shown a reduction in negative emotion, irritability, and rumination as well as decrease in tinnitus distress, psychological distress, and tinnitus awareness, and improvements in tinnitus acceptance. For sustained benefit, daily mindfulness practice is encouraged. While evidence for the use of mindfulness as a management option for tinnitus is not as strong as that for other management options, preliminary evidence is promising, and an audiologist may recommend the use of mindfulness as an adjunct to other evidence-based management options for tinnitus. Mindfulness may one day prove to be a tool that audiologists could recommend as the sole management option for a patient with tinnitus. Audiologists are encouraged to better understand the role mindfulness may play in patient care, now and in the future.

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LIST OF ABBREVIATIONS

AAA	The American Academy of Audiology
AAO-HNSF	The American Academy of Otolaryngology-Head and Neck Surgery Foundation
ABA	American Board of Audiology
AC	Auditory Cortex
ACT	Acceptance and Commitment Therapy
ASHA	The American Speech-Language-Hearing Association
ATA	American Tinnitus Association
BA 41	Brodmann's Area 41
BDI	Beck Depression Inventory
BSI	Brief Symptom Inventory
CBT	Cognitive-Behavioral Therapy
CCC-A	Certificate of Clinical Competence- Audiology
CGI-I	The Clinical Global Impression-Improvement
CN	Cochlear Nucleus
CNS	Central Nervous System
CORE-NR	Clinical Outcomes in Routine Evaluation- Non-Risk
CORE-OM	Clinical Outcomes in Routine Evaluation- Outcome Measure
CT	Chronic Tinnitus
CTAQ-G	Chronic Tinnitus Acceptance Questionnaire-German version

DMN	Default Mode Network
EEG	Electroencephalogram
ES	Effect Sizes
FFMQ	Five-Facet Mindfulness Questionnaire
GABA	Gamma-Aminobutyric Acid
GM	Gray Matter
GM-M	Gray Matter Modulated
GM-U	Gray Matter Unmodulated
HADS	The Hospital Anxiety and Depression Scale
HG	Heschl's Gyrus
HQ	Hyperacusis Questionnaire
IFG	Inferior Frontal Gyrus
IHC	Inner Hair Cells
IMTA	International Mindfulness Teachers Association
ISI	Insomnia Severity Index
MAAS	Mindful Attention Awareness Scale
MBCT	Mindfulness-Based Cognitive Therapy
MBRE	Mindfulness-Based Relationship Enhancement
MBRP	Mindfulness-Based Relapse Prevention
MBSR	Mindfulness-Based Stress Reduction
MBTSR	Mindfulness-Based Tinnitus Stress Reduction
MGN	Medial Geniculate Nucleus
MRI	Magnetic Resonance Image

NCRAR	National Center for Rehabilitative Auditory Research
NIH	National Institutes of Health
OHC	Outer Hair Cells
PAS	Percent of Awareness Scale
PIFF	Post-Intervention Feedback Form
PMR	Progressive Muscle Relaxation
PTM	Progressive Tinnitus Management
PTSD	Post-Traumatic Stress Disorder
PVAQ	The Pain Vigilance & Awareness Questionnaire
QIPA	Tinnitus Psychological Impact Questionnaire
QoL	Quality of Life
QOLI	Quality of Life Inventory
RCT	Random Control Trials
SBM	Surface-Based Morphometry
SCL-90-R	Symptom Checklist-90-Revised
SF-36	Short Form Health Survey
SMRT	The Self-Efficacy for Managing Reactions to Tinnitus Questionnaire
SOC	Superior Olivary Complex
STAI	State-Trait Anxiety Inventory
STG	Superior Temporal Gyrus
STS	Superior Temporal Sulcus
TFI	Tinnitus Functional Index
THI	Tinnitus Handicap Inventory

THQ	Tinnitus Handicap Questionnaire
TQ	Tinnitus Questionnaire
TRQ	Tinnitus Reaction Questionnaire
TRT	Tinnitus Retraining Therapy
VAMC	Veterans Affairs Medical Centers
VAS	Visual Analog Scale
VBM	Voxel-Based Morphometry
vmPFC	Ventromedial Prefrontal Cortex
WHO	The World Health Organization
WLC	Wait-List Control
WM	White Matter

CHAPTER I

INTRODUCTION

When sound vibrations from the air enter the auditory system through the ear canal, the signals become coded through the firing of nerve fibers, which the brain interprets as sound. Tinnitus is the perception of sound without an external source. It is commonly referred to as a “ringing” in the ears. Tinnitus is derived from the Latin word *tinnire* which means “to ring” (Dietrich, 2004). Tinnitus occurs when nerve fibers in the auditory pathway fire abnormally in the absence of external sound vibrations. The brain will interpret these abnormal firings which creates the perception of sound. Tinnitus is not a disease but a symptom of the nerve fibers firing without sound vibrations (Dalrymple et al., 2021).

Tinnitus is not a new occurrence. Reports of tinnitus date back to ancient Egypt (Singh, 2014). Around 1240 A.D. the first complete English medical text, the *Compendium* written by Gilberts Anglicus, referenced tinnitus as a “ringing in the ear.” Finding a cure for tinnitus has a long history as well. Oils and herbs have been used for hundreds of years in the ear canal to treat tinnitus. Even a respected otologist (physician specializing in the medical and surgical treatment of the ear), Joseph Toynbee, attempted to cure his own tinnitus in 1866 with a mixture delivered to the middle ear (Betlejewski & Betlejewski, 2009). This mixture consisted of chloroform and prussic acid and was delivered into the tympanic cavity by using the Valsalva maneuver. This attempt however proved fatal. A cure to eliminate tinnitus altogether still remains elusive to this day and the impact of tinnitus is widespread.

The impact of tinnitus world-wide is significant. Approximately one in ten adults across the United States has tinnitus. Tinnitus is a common occurrence. Epidemiologic studies report a prevalence rate between 8% and 25.3% of the population in the United States and in other nations ranging from 4.6% to 30% (Bhatt et al., 2016). Tinnitus affects an estimated 50 million adults in the United States with a peak occurrence between ages 60 and 69 years. It is more common for males to have tinnitus than females, most likely because at the time of the analysis in 2012, males were more likely than females to be employed in settings in which loud noise is present. (American Tinnitus Association, 2021). In the 2007 National Health Interview Survey, higher rates of tinnitus were found in those who had loud noise exposure with work and/or recreational activities, with a correlation of work-related noise exposure increasing with the prevalence of tinnitus $r = 0.130$ (Bhatt et al., 2016).

The estimated personal financial consequences (cost) of tinnitus is estimated to be an upwards of \$30,000 (American Tinnitus Association [ATA], 2021). This estimate includes lost earnings, productivity, and health expenses. Societal economic cost of tinnitus is estimated to be an upwards of \$26 billion annually. A large part of that cost is awarded for disability to veterans with an annual aggregate cost of \$1.5 billion.

Even with a high prevalence rate, only about 20% of patients will seek medical evaluation for their tinnitus (ATA, 2021). Tinnitus that is not caused by an underlying condition could be a cause of concern, especially for those who experience bothersome tinnitus, or tinnitus that causes negative reactions and is hard to ignore. For those who suffer from the effects of bothersome tinnitus, a lot of time and energy may be put into researching the “causes of tinnitus” or “how to get rid of tinnitus.” The effects of tinnitus could affect quality of life.

Mindfulness is a type of meditation that has been used to help improve quality of life (Kabat-Zinn, 2003). Mindfulness techniques can be used to reduce constant cyclical thoughts that lead to maladaptive habits and behaviors (Segal et al., 2002). Mindfulness is used to refocus and be more present in the moment. It is also used reduce emotion(s) associated to cyclical thoughts. Mindfulness can be practiced through formal meditation or through informal awareness with daily activities. Consistent mindful practices may help to reduce the negative effects that stress, anxiety, depression, etc. could have on quality of life (Hoge et al., 2013; Kabat-Zinn, 1982; Ludwig & Kabat-Zinn, 2008; Segal et al., 2002; Shapiro et al., 1998; Teasdale et al., 2000).

A Look Forward

Chapter II of this manuscript will provide the reader with a literature review of tinnitus, tinnitus management approaches, and the clinical evidence for implementing tinnitus management. The term management options will be used in this manuscript instead of treatment options because there is no course of treatment that will cure tinnitus or inherently change the tinnitus (i.e., the loudness or sound quality). Management options help control the negative reactions to tinnitus. The review will be of non-medical management options. Chapter III will critically consider the research literature in terms of gaps and challenges that exist for audiologists caring for tinnitus patients. Influential factors in the clinical management of tinnitus in the forms of education, skills, and access to trusted information will also be discussed. Chapter IV will introduce the fundamentals of mindfulness and mindfulness programming. Informational handouts discussed in Chapter IV can be found in appendices A-E to be used by an audiologist to aid a patient's knowledge of tinnitus and provide an understanding of mindfulness as a tinnitus management approach. Chapter V encompasses a self-reflection of the author's participation in a

Mindfulness-Based Stress Reduction course and will discuss experiential viewpoints regarding mindfulness as a tinnitus management strategy.

The goal of this manuscript is to provide an understanding of tinnitus as a challenging auditory symptom that audiologists will routinely encounter during clinical practice. Mindfulness is emerging as a potential tinnitus management strategy due to strong evidence regarding the success of mindfulness approaches in managing disorders that parallel tinnitus, such as depression, anxiety, chronic pain, and stress. The aim will be to provide information on mindfulness and its potential benefits as a management option for tinnitus that have been noted in preliminary research. The information on mindfulness and its potential patient benefits will enable the audiologist to make better informed recommendations regarding current evidence-based research and identify gaps and challenges in the research literature. The reader will learn that mindfulness can be used as an adjunct to other evidence-based tinnitus management options that have stronger clinical evidence to date.

CHAPTER II

REVIEW OF THE LITERATURE

Tinnitus is not yet fully understood. It is complex in nature and does not always express itself in the same way across different populations of people. This is shown in the magnitude of tinnitus research throughout the world. This chapter delves further into tinnitus by describing what tinnitus is, origination theories, parallels to pain perception, diagnosis, and management, including the benefits of mindfulness as an emerging management option for those who suffer from the effects of tinnitus.

Terminology

Tinnitus can be described from a psychological perspective, with the most common lay description of tinnitus as “a ringing in the ears” (Khatri, 2019). A psychological definition by Bauer (2018) described tinnitus as “the perception of a sound that has no external source” (p. 1224). A more extensive definition by McFadden (1982) indicated that “tinnitus is the conscious experience of a sound that originates in the head of its owner” (p. 1).

Due to the complex nature and various presentations of tinnitus, numerous terms are used to help accurately diagnose tinnitus, with the goal of providing the best management option. The quantitative terms acute, chronic, subjective or primary, objective or secondary, intermittent, constant, bilateral, and unilateral may be used to help diagnose the type of tinnitus. Qualitative terms describing the perceived sound (i.e., ringing, chirping, swooshing, pulsatile, etc.) are also important diagnostic factors.

Acute tinnitus is described as short-term and chronic tinnitus as long-term. Duration of acute versus chronic tinnitus varies, with some experts suggesting that anything less than 3 months in duration would be considered acute tinnitus while others recommend anything more than 12 months as chronic tinnitus (Bauer, 2018). Subjective or primary tinnitus is the most common type of tinnitus, whereas objective or secondary tinnitus is rare. Objective tinnitus is a sound that emanates from the external auditory canal and is audible to another person (Han et al., 2009). Subjective tinnitus is a sound that is only perceived by the patient.

Origination of Tinnitus

The pathophysiology of tinnitus is still being investigated. There have been several advances in the knowledge of where tinnitus stems from in the body, but there is still much that is unknown since tinnitus cannot be observed directly in humans. Theories of where tinnitus originates most commonly suggest that it originates in the auditory system, due to the increased correlation between those who perceive tinnitus and those who also have hearing loss. However, that does not encompass all possible sites of origin when considering those who perceive tinnitus but do not have hearing loss. Other common theories suggest that tinnitus may originate in the brain or may also stem from a combination of the auditory system and the brain. In other words, tinnitus may be of a central or of a peripheral origin. As such, as research continues in the area of tinnitus, origination sites and definitions may change.

The Auditory System's Role in Tinnitus

The auditory system is responsible for receiving acoustic information, transducing the air vibrations into neural impulses, and sending the neural-coded information to the brain to be processed (Musiek & Baran, 2020). The system is broken down into two parts: the peripheral auditory system and the central auditory system. The peripheral auditory system houses the

outer, middle, and inner ears. Sensory receptors in the inner ear are stimulated by hydro-mechanical vibrations from sound sources in the environment. These sensory receptors transduce the hydromechanical vibration into electrochemical information sent to the auditory nerve. The central auditory system conveys information from the auditory nerve and relays neural impulses up the central auditory pathway, from the cochlear nucleus in the brainstem to the primary auditory cortex that resides in the temporal lobe of the brain. The central auditory system is responsible for processing auditory signals for recognition of speech and environmental sounds, localization of sound sources, pattern recognition, and facilitation of attention to target sounds in the presence of background noise.

When there is damage to the auditory sensory receptors (outer hair cells [OHC] and inner hair cells [IHC]), transfer of acoustic information to the brain is disrupted due to reduction or elimination of the sensory cells function (Wong & Ryan, 2015). Damage occurs more frequently to the OHC than the IHC which causes a disinhibition of neurons that are found in the dorsal cochlear nuclei (Han et al., 2009). Spontaneous activity is increased in these neurons due to excitation from the IHCs but not from the damaged OHCs. Tinnitus is perceived due to this spontaneous activity (Jastreboff, 1990). The perceptible subjective tinnitus in some patients can be pitch-matched to the frequency at which the high-frequency OHC loss occurred (Hazell & Jastreboff, 1990). Patuzzi (2002) also suggested that OHC dysfunction may cause an excessive release of the neurotransmitter glutamate from the IHCs, which causes synaptic activity from the IHCs to be sustained for longer periods of time. This damage to OHCs and resulting dysfunction of IHCs can occur for a multitude of reasons, including but not limited to aging, noise exposure, diabetes, high blood pressure, ototoxic medication, genetics, or even infection (Wong & Ryan, 2015).

The Brain's Role in Tinnitus

When investigating the origination of tinnitus in the body, the brain's involvement must be included. Researchers have tried to pinpoint the origination of tinnitus in the brain, by considering changes to the functional and structural components of the brain. However, the outcomes have provided inconsistent results, possibly due to the inherent variability of tinnitus, comorbid factors, changes in the body over time, or even the strength, weaknesses, and limitations of the technology used within the studies.

One mechanism that may underlie the perception of tinnitus are the neural changes in the auditory pathways. Neural changes in the auditory pathways consist of tonotopic map reorganization in the auditory cortical and thalamic structure and hyperactivity causing increased burst firing in the subcortical auditory nuclei (Noreña & Eggermont, 2006). Reduction of auditory input, which may result in auditory deprivation, can trigger shifts in the excitation and inhibition responses throughout the auditory pathway causing an increase in the spontaneity of neural activity (Schaette & Kempter, 2012).

The relationship between brain gray matter and the perception of tinnitus has also been investigated. Gray matter (GM) plays a significant role in the functioning of the body. It makes up of the outermost layer of the brain and has a high concentration of neuronal cells. Boyen et al. (2013) investigated changes in brain GM between three groups of participants. The first group consisted of 16 participants who had a hearing loss with a pure tone average (PTA) at 1, 2, and 4KHz greater than 30dB HL and less than 60dB HL in both ears. The second group consisted of 31 participants who had the same degree of hearing loss as in group 1 but who also perceived tinnitus. Twenty-two of these participants perceived their tinnitus bilaterally, 7 perceived their tinnitus only in the left ear, and 2 only in the right ear. All participants who perceived tinnitus

had chronic continuous tinnitus with a duration of at least a year or more. Group 1 (hearing loss) and group 2 (hearing loss and tinnitus) were then compared to a third group that consisted of 24 healthy controls with normal hearing. Each participant filled out Dutch translated versions of the Tinnitus Handicap Inventory (THI; Newman et al., 1996), Hyperacusis Questionnaire (HQ; Khalfa et al., 2002), and the Edinburgh Inventory (Oldfield, 1971).

Boyen et al. (2013) measured unmodulated (GM-U) and modulated (GM-M) images using voxel-based morphometry that was applied to magnetic resonance images (MRI). GM-U measured the concentration of GM and GM-M measured the volume of GM. They reported that GM increased in both the superior and medial temporal lobes in the groups that had hearing loss; however, there was a more prominent increase of GM in the left temporal primary auditory cortex, specifically in Brodmann's Area 41 (BA 41) in the group that also perceived tinnitus. To verify that these results were an outcome of perceived tinnitus, "an ANCOVA regression model was set up that included either GM-M or GM-U of the BA 41 as the response variable, age and HQ score as additional explanatory variables of no interest, and THI score as the explanatory variable of interest" (Boyen et al., 2013, p. 71). A significant effect of THI score on both the GM-M ($F = 4.18, p = 0.045$) and GM-U ($F = 4.40, p = 0.040$) was found in the BA 41, supporting the idea that the significant increase in brain gray matter was credited to tinnitus.

Results of anatomical changes in the brain in those with tinnitus have been inconsistent across many studies. Allan et al. (2016) aimed to address some of the methodological issues that may have provided some inconsistent results across brain-based research in association with tinnitus. Data were collected from MRIs using voxel-based morphometry (VBM) and surface-based morphometry (SBM) to measure changes in gray matter (GM) and white matter (WM) in volume, area, and thickness of the brain from 128 participants. Three groups were compared.

The first group consisted of all participants in the study and compared those with tinnitus to those without tinnitus. The second group consisted of participants with severe or catastrophic tinnitus compared to controls that were matched for age, gender, and hearing loss, but did not have severe tinnitus. Group three consisted of participants with tinnitus compared to normal hearing control participants that were age and gender matched with normal hearing. The use of several groups allowed for control of effects of hearing loss and age as well as for the severity of tinnitus. Normal hearing was defined as an average hearing threshold at 250, 500, 1000, 2000, and 4000 Hz less than 20 dB HL. The THI or the Tinnitus Handicap Questionnaire (THQ; Kuk et al., 1990) was used to determine the severity of tinnitus. Severe or catastrophic tinnitus was categorized as a score of either 57-76 out of 100 for “severe tinnitus” and a score of 77-100 out of 100 for “catastrophic tinnitus” on either the THI or the THQ. The results are summarized in Table 1.

Table 1

Magnetic Resonance Imaging Measurements Using Voxel-Based Morphometry and Surface-Based Morphometry

Comparisons	Voxel-Based Morphometry	Surface-Based Morphometry
All tinnitus participants vs. all controls	<p>Grey Matter</p> <ul style="list-style-type: none"> • Tinnitus participants had a reduction in right HG • Increasing DMN with increasing tinnitus severity • Tinnitus participants had an increased SOC 	<p>Thickness</p> <ul style="list-style-type: none"> • Tinnitus participants had a decrease in the left AC/STG, left superior frontal gyrus, right, STS, and right HG • Increasing right middle temporal gyrus and right rostral medial frontal gyrus with increasing tinnitus severity • Tinnitus participants had a decrease in AC
	<p>White Matter</p> <ul style="list-style-type: none"> • Tinnitus participants had a reduction in the right MGN 	<p>Area</p> <ul style="list-style-type: none"> • Decreasing right precuneus with increasing tinnitus severity • Tinnitus participants had an increase in vmPFC and decrease in AC
		<p>Volume</p> <ul style="list-style-type: none"> • Tinnitus participants had a decrease in the right HG • Decreasing right precuneus with increasing tinnitus severity • Decrease AC and STG for tinnitus participants

Table 1 (continued)

Comparisons	Voxel-Based Morphometry	Surface-Based Morphometry
Severe tinnitus vs. matched controls	White Matter <ul style="list-style-type: none"> Severe tinnitus participants had a reduction in the right MGN 	Thickness <ul style="list-style-type: none"> Tinnitus participants had a decrease in left AC
Tinnitus participants with normal hearing vs. matched controls	White Matter <ul style="list-style-type: none"> Tinnitus participants had an increase in the left HG Increasing left CN with increased tinnitus severity 	Thickness <ul style="list-style-type: none"> Tinnitus participants had a decrease in AC/STG and right rostro-middle frontal gyrus Increased left mid-temporal gyrus with increasing tinnitus severity Area <ul style="list-style-type: none"> Decreased left HG/AC, right superior parietal gyrus, and right posterior cingulate with increasing tinnitus severity Volume <ul style="list-style-type: none"> Decreased left HG/AC with increasing tinnitus severity

Note: HG = Heschl's gyrus; DMN = default mode network; SOC = superior olivary complex; MGN = medial geniculate nucleus; CN = cochlear nucleus; AC = auditory cortex; STG = superior temporal gyrus; STS = superior temporal sulcus; vmPFC = ventromedial prefrontal cortex. Adapted from "Neuroanatomical alterations in tinnitus assessed with magnetic resonance imaging," by Allan et al., 2016, *Frontiers in Aging Neuroscience*, 8(221), p. 7.

Copyright 2016 by Allan et al.

These anatomical changes were then compared to a systematic review of anatomical changes in the brain in patients with tinnitus by Adjajian et al. (2014). They identified 17 studies that compared participants with tinnitus with controls who did not have tinnitus and combined the results to identify some common structural changes as well as some discrepancies that were found between the studies reviewed. Further discrepancies were found between the Allan et al. (2016) study and the Adjajian et al. (2014) study. Some anatomical changes that had not been noted in the Adjajian et al. (2014) study were changes in the precuneus area, as well as increases in GM concentration in the SOC and decreases in WM in the MGN. Allan et al. (2016) stated that these variations in the literature could be due to the heterogeneous nature of tinnitus, as well as with the variability of tinnitus severity, comorbid disorders, age of onset, laterality, duration of tinnitus, among other factors, suggesting a more complex role of the generation of tinnitus in the brain.

Parallels to Models of Pain Perception

Tinnitus and neuropathic pain can both be considered phantom perceptions and there are physiological similarities between the two. Vanneste et al. (2019) evaluated tinnitus and neuropathic pain to identify a common underlying neural substrate by using an electroencephalogram (EEG). One hundred participants with continuous tinnitus lasting at least a year were evaluated. Within the 100 tinnitus participants, 49 had unilateral and 51 had bilateral tinnitus. Thirty-eight participants had a tinnitus characteristic of a pure-tone sound and 62 described a narrow-band noise sound. Each tinnitus participant rated the loudness of their tinnitus ranging from 0 = *no tinnitus* to 10 = *tinnitus* that is as loud as possible. The average score was 7.14. The Dutch translated version of the Tinnitus Questionnaire (TQ; Hallam, 2009) was used to measure the emotional and cognitive distress caused by the tinnitus, as well as the

intrusiveness, auditory perceptual difficulties, sleep disturbances, and somatic complaints associated with the tinnitus. Twenty-seven tinnitus participants had slight tinnitus distress, 31 moderate, 23 severe, and 19 had very severe tinnitus distress.

This study also evaluated 100 neuropathic pain participants (Vanneste et al., 2019). Neuropathic pain in this study was considered to be pain related to deafferentation and lasting longer than one year. Of these 100 pain participants, 21 had pain on the right side, 58 on the left side, and 21 had bilateral pain. Pain was measured on a scale of 0 = *no pain* to 10 = *as painful as possible*. The mean pain score was 7.34. The Pain Vigilance & Awareness Questionnaire (PVAQ; Roelofs et al., 2003) was used to measure preoccupation with or attention to the pain. This questionnaire also measured pain-related fear and perceived pain severity by focusing on two categories: attention to pain and attention to changes in pain.

The tinnitus group and the pain group were compared to a healthy control group (Vanneste et al., 2019). The healthy control group had 100 participants who did not have tinnitus and pain. This group was age, gender and education matched with both the tinnitus and pain groups. Electrical activity from the left and right auditory and somatosensory cortex was recorded using an EEG during a resting state while participants in this study thought about perceived their phantom perceptions. The same electrode placement was used on the healthy control group and the EEG was recorded while in a resting state. Electroencephalogram results showed that both tinnitus and pain participants have increased activity in the dorsal anterior cingulate cortex compared to the healthy control group. Electroencephalogram results also showed hyperactivity in the gamma frequency band of the auditory cortex and the somatosensory cortex for both tinnitus and pain participants. Vanneste et al. (2019) suggested that both tinnitus and neuropathic pain share some overlapping brain networks and connectivity patterns in the

dorsolateral prefrontal cortex. Increased delta and gamma activity was seen in both the tinnitus and neuropathic pain groups that involved the left anterior middle temporal cortex and the right dorsolateral prefrontal cortex. Increased activity was seen in the dorsal anterior cingulate cortex in both the tinnitus and neuropathic pain group. Furthermore, the results from this study suggest that phantom percepts are centrally processed.

Comparing models of tinnitus generation with models of chronic pain, Møller (2000) found that several studies showed that both tinnitus and chronic pain can occur from the reorganization of the central nervous system. Changes in the central nervous system result from hyperactivity and by the opening of synapses that have been dormant. This may occur by overstimulation or by deprivation of input for both chronic pain and tinnitus. In those with tinnitus, overstimulation may be caused by noise exposure. Noise exposure can cause neurons to become hyperexcited thus decreasing GABAergic (gamma-Aminobutyric acid) inhibition (Szczepaniak & Møller, 1996). This may result in a reduction in inhibitory input from the cochlea. Similar to pain, a reduction of inhibitory input from low-threshold mechanoreceptors to the wide dynamic range neurons results in an increase in excitability (Møller, 2000). Neural activity from the peripheral nervous system that generates the sensation of acute (short term) pain reorganizes into self-sustained neural activity or long term pain (chronic) because of overstimulation or deprivation of normal responses from the central nervous system (Møller, 2000). Bushnell et al. (2013) reiterates this point in a review article on chronic pain, stating that “pain may be detrimental to the brain in that long-term pain itself can both decrease an individual’s ability to endogenously control the pain and may lead to many of the comorbidities that plague individuals with chronic pain” (p. 508).

In the same way that tinnitus is affected by an individual's emotional and cognitive state, pain is also affected by emotional and cognitive states (Trevis et al., 2016). Individuals with chronic pain and tinnitus have demonstrated high comorbidity levels, resulting in an increase in depressive symptoms, anxiety, cognitive deficits, sleep disturbances, and a poorer quality of life (Baliki & Apkarian, 2015; Trevis et al., 2016; Wong & Anitescu, 2017). Long-term pain in a rat model have also shown increased comorbidity levels resulting in an anxiety-like profile, decreased ability in cognitive tasks, and an increased response to aversion (Llorca-Torralba et al., 2019). In individuals with no tinnitus or chronic pain, gamma-aminobutyric acid (GABA) is used by the body as an inhibitory neurotransmitter in the central nervous system (CNS). One of the roles for GABA is to reduce neuronal excitability. In those with tinnitus and chronic pain, GABA is reduced which results in an increase in the excitation and central sensitization of the central nervous system (Malcangio, 2018; Yang & Chang, 2019). Individually, tinnitus and chronic pain have each been well researched; however, experimental studies investigating the shared underlying physiological basis for the perceptions of each is limited.

Factors Influencing the Management of Tinnitus

The symptoms of tinnitus are highly variable and occur differently in each patient. The tinnitus symptoms may also change over time within the same patient. For this reason, the management of tinnitus should be individualized to each person to provide the most relief from the effects of tinnitus. One management option may not work for everyone, and multiple management options may need to be tried or combined before finding what works best for the individual patient. Kaltenbach (2009) stated that there are three components that contribute to tinnitus and each needs to be understood to be able to manage the symptoms of tinnitus. He said that the brain is plastic and highly sensitive to alterations of its neural circuitry. The first

component to understand is an “acoustic component,” which is the perceived tinnitus. This component varies in its pitch and loudness and is thought to be caused by plastic changes in the auditory system that may affect the balance of excitatory neurotransmitters, such as glutamate and acetylcholine, and inhibitory neurotransmitters, such as glycine and GABA. Reductions of glycine and GABA and increases of glutamate and acetylcholine may increase the levels of spontaneous activity causing the auditory neurons to fire at an abnormally high rate. The second component is the “attentional component,” which is how much the individual pays attention to the perceived tinnitus. The third component is the “emotional component.” This is the patient’s reaction to the perceived tinnitus and usually determines the severity of the tinnitus for that individual. These three components work interconnectedly and all play a role in the management of tinnitus.

Ongoing engagement and awareness of the perception of tinnitus may result from an “impaired cognitive control and poor emotional down regulation” (Trevis et al., 2016, p. 239). To effectively switch attention, the ability to control cognitive resources using inhibitory control and working memory as well as regulating emotions in response to stimuli are imperative to reducing the intrusion of unwanted information, such as the perception of tinnitus. Trevis et al. (2016) investigated the cognitive role in the ability to switch attention away from the perceived tinnitus, as well as understand the impaired cognitive control and emotional down regulation in the maintenance of tinnitus. They found that those with chronic tinnitus (CT), tinnitus constantly present for ≥ 3 months duration, had slower reaction times in cognitive and inhibitory control, but the function of their working memory was not significantly different than those without CT. Poorer emotional well-being was also present, which was demonstrated by elevated depressive symptoms, but “anxiety-proneness” was not significantly different to those without CT. Trevis et

al. (2016) found that depressive symptoms in those with CT had a direct influence on the perceived severity of the CT. These findings suggest that those with CT have a harder time with cognitive control, due to the failure to attention-switch, and was not due to the presence of the tinnitus sound itself or to the presence of hearing loss. These authors suggested that symptoms of depression are involved with maintaining the awareness and severity of CT causing a hypoactivation of the cognitive control network. Top-down inhibition of the perceived tinnitus is decreased while somatic depressive symptoms increase the severity of the tinnitus sound. This is associated with the autobiographical memory network and affective network and may cause an increase in negative thinking about the perceived tinnitus. The function of the cognitive control network is to goal-direct cognition, attention, and memory resources and this network is housed in the prefrontal cortex and the intraparietal sulcus. The affective network regulates the experience of emotions and is housed within the cingulate cortex, prefrontal cortex, amygdala, and nucleus accumbens. These findings suggest that the effects of tinnitus involve more than just the perceived sound, and therefore managing the attentional and emotional effects of tinnitus are also warranted.

With varying tinnitus symptoms for patients, as well as the effects that tinnitus can have on a patient's significant others, narrowing down what is an important tinnitus-related complaint can be difficult. Tinnitus-related complaints can be broad in scope and may affect the diagnostic assessment and evaluation of tinnitus, as the outcomes rely fully on self-reports by the patients. There are no objective, diagnostic indicators of tinnitus in humans. In 2018, Hall et al. conducted a comprehensive review of the tinnitus literature and synthesized tinnitus-related symptoms that were reported as problems in everyday lives of adults and their significant others. The tinnitus-related symptoms that Hall et al. (2018) reported are summarized in Table 2 and span multiple

areas including physical health, psychological health, independent activities, social relations, and leisure activities. This table also includes negative attributes of the tinnitus sound that were reported during the research studies. The use of a valid tinnitus assessment tool, that adequately reflects tinnitus complaints, is necessary to best address the overall effects of tinnitus.

Table 2

Effects of Tinnitus on Health and Quality of Life

Physical Health Effects	Psychological Health Effects	Quality of Life Effects
<ul style="list-style-type: none"> • Sleep difficulties • Bodily complaints • Difficulty relaxing • Feeling tired • Pain • Loss of appetite 	<ul style="list-style-type: none"> • Functional difficulties due to tinnitus • Negative effects on hearing • Concentration difficulties • Cognitive difficulties • Ability to ignore 	<ul style="list-style-type: none"> • Negatively impacts Social life • Work activities • Individual activities • Relationships • Ability to cope • Support from friends and family • Sexual difficulties
Tinnitus-Related Distress	Negative Thoughts About Tinnitus	Mood States
<ul style="list-style-type: none"> • Annoyance • Worries/ Concern • Irritable • Distress from bodily sensations • Fear • Frustrations 	<ul style="list-style-type: none"> • Loss of control • Change in sense of self • Suicidal thoughts • Loss of peace • Irrational beliefs 	<ul style="list-style-type: none"> • General distress • Anxiety • Depressive symptoms • Lack of joy • Anger

Note: Adapted from “A narrative synthesis of research evidence for tinnitus-related complaints as reported by patients and their significant others,” by Hall et al., 2018, *Health and Quality of Life Outcomes*, 16(1), p. 7. Copyright 2018 by the Author(s).

The relative importance of tinnitus management relies heavily on how quality of life (QoL) is defined by an individual. The World Health Organization (2020) defines QoL as “An individual’s perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns” (para. 1)

Psychological distress can have a negative impact on QoL. Riedl et al. (2015) investigated the relationship between quality of life (QoL) and psychological distress in patients with chronic tinnitus who had different levels of tinnitus acceptance. Ninety-seven participants took part in a tinnitus coping group. To determine the correlation between tinnitus acceptance, psychological distress, and QoL measures, the TQ, Brief Symptom Inventory (BSI; Derogatis, 2017), Short Form Health Survey (SF-36; Ware & Sherbourne, 1992), and the German version of the Chronic Tinnitus Acceptance Questionnaire (CTAQ-G; Moschen et al., 2010) were used. There was no significant difference ($p = .15$) in tinnitus acceptance between those who had hearing loss and those who did not have hearing loss. A highly significant positive correlation was found between tinnitus acceptance and social functioning ($r = .55, p < 0.01$) and mental health ($r = .49, p < 0.01$). Comparison of tinnitus acceptance with all BSI subscales and BSI global severity index (GSI) showed significantly low-to-moderate negative correlations ($p < 0.05$). Use of the CTAQ-G showed the strongest correlations between tinnitus acceptance and depression ($r = -.48, p < 0.01$), anxiety ($r = -.48, p < 0.01$), and global psychological distress ($r = -.43, p < 0.01$).

Participants who showed more tinnitus acceptance had a lower tinnitus distress and general psychological distress and higher QoL, suggesting that it is important to manage the effects of tinnitus in order to improve the QoL. The outcomes from this study demonstrated that the more tinnitus acceptance there is, the greater the reduction of symptoms in somatization, obsessive-compulsive behavior, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety,

paranoid ideation, psychoticism, and global psychological distress. Participants with higher acceptance also reported more vitality, better general health, more engagement in social activities, and better mental health.

Evidence-Based Management Options for Tinnitus

Numerous options are available for managing the effects of tinnitus, but not all options are evidence-based. Management options that are not strongly supported by research should not be used because they do not follow evidenced-based practice at this time and may actually cause harm (Zenner et al., 2017). In this section, only evidenced-based management options that are currently used in general practice will be reviewed.

Recommended Guidelines for Managing Tinnitus

The American Academy of Otolaryngology-Head and Neck Surgery Foundation (AAO-HNSF) created clinical practice guidelines on treating tinnitus (Tunkel et al., 2014). These guidelines offer evidence-based recommendations based on random control trials (RCTs) for clinicians who manage patients with tinnitus.

These guidelines recommend starting with a case history and a physical examination. If during this time, tinnitus with an underlying condition or disease is suspected then appropriate medical intervention is warranted. If the tinnitus is not suspected to be caused by an underlying condition or disease and is chronic then an audiologic examination may be warranted to verify or rule out a hearing loss.

During the audiometric evaluation, if it is determined that the tinnitus is bothersome and chronic, clinicians should educate patients on tinnitus and the management options available. Bothersome tinnitus is distinguished from non-bothersome tinnitus by using a questionnaire such as the THI, tinnitus reaction questionnaire (TRQ; Wilson et al., 1991), THQ, Tinnitus Functional

Index (TFI; Meikle et al., 2012) and/or documenting complaints of distress from tinnitus that affect cognitive focus, sleep, or other concerns that warrant pursuing potential management options. If hearing loss is present, then clinicians should recommend a hearing aid evaluation. Hearing aids may be found to be beneficial for both the hearing loss and tinnitus, which will be discussed further in a later section. If hearing loss is not present, or if hearing aids alone do not help with the tinnitus, the AAO-HNSF first recommends cognitive behavioral therapy (CBT) due to the number of RCTs and large population studies of CBT found in research. They further suggest that sound therapy (the use of sounds that are played in the background) may also be recommended.

The AAO-HNSF further states that these guidelines are not the sole source of guidance. These are recommendations to assist in determining how to best help a patient manage symptoms of tinnitus. The clinician must determine what is best for the patient. The AAO-HNSF concludes that sticking strictly to these recommendations does not guarantee success for each patient and the guidelines do not include all proper treatment decisions or methods of care available (Tunkel et al., 2014).

Multidisciplinary Teams

Management by multidisciplinary teams is warranted as management options may include medical intervention and/or need for medical expertise (Langguth et al., 2013; Zenner et al., 2017). Tinnitus may be caused or exacerbated by known factors due to comorbidities that can be associated with the tinnitus. Comorbidities with tinnitus may result from physical concerns, dental problems, emotional reactions, or even cognitive awareness. Multidisciplinary teams may include professionals in audiology, dentistry, otolaryngology, primary care, cardiology, oncology, psychology, psychiatry, and/or physical therapy (Langguth et al., 2013). At this time,

there are no known drugs to cure tinnitus, however, drugs that treat comorbid factors relating to tinnitus (i.e., depression, anxiety) are sometimes warranted and can be used with the oversight of a psychiatrist or physician (Zenner et al., 2017).

Tinnitus Education

As recommended in the AAO-HNSF guideline, tinnitus education is an important management option that should be provided to a patient with tinnitus (Tunkel et al., 2014). Thompson et al. (2017) did a scoping review of 64 studies that focused on psychological therapies for people with tinnitus. Their review collected the results and identified the most common therapies studied. General tinnitus education was the second-most-common management option delivered to patients with tinnitus and ranked behind cognitive-behavioral therapy (CBT; Beck, 1976) as the most common approach.

While general tinnitus education is warranted, there is no clinical guideline to follow regarding the information that should be provided to the patient with tinnitus (Occa et al., 2020). Occa et al. (2020) found in a scoping review of the literature that the general tinnitus education varied. Across studies, there was no consistent definition of tinnitus education or consistency in the tinnitus information provided to the patient. Tinnitus education topics consisted of information about the anatomy and physiology of the ear and auditory pathways, the origination of tinnitus, and general options to help reduce the attention paid to the tinnitus by the patient.

Sound Therapies

Enriched acoustic environments may help decrease the perception of tinnitus in some patients, with beneficial effects that are immediate, delayed, or a combination of both (Henry et al., 2005). According to the ATA, “sound therapy” is a broad term that may be used in many

ways (ATA, 2021). In general, sound therapy means the use of external noise in order to alter a patient's perception of, or reaction to, tinnitus.

The ATA recognizes four “general mechanisms” of sound therapy. These are masking, distraction, habituation, and/or neuromodulation. Masking refers to external noise that is loud enough to cover the tinnitus sound partially or completely (ATA, 2021; Henry et al., 2008). Complete masking renders the perceived tinnitus inaudible, but the intensity level required of the masker may cause increased damage in the auditory system (Henry et al., 2008). Partial masking reduces the perceived loudness of the tinnitus. Distraction refers to using an external sound to draw attention away from the perceived tinnitus (ATA, 2021; Henry et al., 2008). Habituation occurs when the brain reclassifies the perceived tinnitus as unimportant and it can be consciously ignored (ATA, 2021). Neuromodulation is “the use of specialized sound to minimize the neural hyperactivity thought to be the underlying cause of tinnitus” (ATA, 2021, para. 3).

Henry et al. (2008) reported that sound therapy or “therapeutic sound” involves three objectives to manage the effects of tinnitus. The first objective is to produce a sense of relief from the effects of tinnitus by using a soothing sound. A soothing sound is just that, a sound that is soothing to the individual. This soothing sound should induce a sense of relief from stress caused by the perceived tinnitus and may be different among individuals. The second objective is to passively divert attention away from the perceived tinnitus by reducing the contrast between the tinnitus and the acoustic environment by using background sound. The background sound is a sound that creates an environment in which the tinnitus can be less noticed by creating less contrast between the tinnitus and the background sound. Tinnitus can be hard to ignore when in quiet, but the addition of background sound reduces the signal-to-noise ratio (i.e., tinnitus to background sound ratio). The third objective is to actively divert attention away from the

perceived tinnitus by using an interesting sound. Using an interesting sound creates distraction from the tinnitus by shifting the focus away from the tinnitus and onto the interesting sound.

Sound masking devices, hearing aids, ear-level noise generators, combination devices (hearing aid and noise generator), personal listening devices, and sound and sleep apps can all be used for sound therapy (ATA, 2021; Henry et al., 2008). A sound masking device will provide generic background noise. These could be any sound-producing device that provides some masking benefit. Hearing aids provide auditory stimulation and may help in diverting attention from the perception of tinnitus. A combination device uses integrated “sound generated technology” to provide some level of masking noise either on an ongoing basis or in a separate program setting in the hearing aid. However, the intensity of sound therapy stimuli in a hearing aid are not commonly verified because of discrepancies between intensity and settings that are displayed in the software and the hearing aid output (Hong et al., 2020).

Formby and Keaser (2007) found that patients with tinnitus and hearing loss experienced more improvement wearing “noise generators” that were hearing aids with a low-level broadband noise (combination device) compared to wearing conventional hearing aids. This finding agreed with those from other studies showing that sound therapy may be beneficial in helping to reduce the perception of tinnitus (Pienkowski, 2019; Tutaj et al., 2018; Tyler et al., 2020).

Some sound therapy studies did not isolate the effects of sound therapy from other potential benefits of tinnitus counseling and/or hearing aid use. As a result, the full benefit of sound therapy is unknown (McKenna & Irwin, 2008). The benefits of sound therapy may also be hard to fully recognize as most studies are limited to using tinnitus questionnaires that show

subjective measures of tinnitus distress as opposed to objective measurements that provide quantifiable outcomes.

Hearing Aids

The primary use of hearing aids is to amplify sound for those who have a hearing loss, which can enhance communication and awareness of external stimuli. A secondary use for hearing aids is for the management of tinnitus in patients with hearing loss (McNeill et al., 2012). Hearing aids may be used alone or as a combination device (i.e., a hearing aid with an internal sound generator) as management options for tinnitus. Knowledge of the reduction in the perception of tinnitus with the use of hearing aids is longstanding (Saltzman & Ersner, 1947). Hearing aids may provide a reduction in maladaptive neuroplastic changes by reducing auditory deprivation, which may reduce the perception of tinnitus (Noreña & Eggermont, 2006). This occurs when there is not enough acoustic stimulation of the auditory system, causing changes in some of the function and chemical makeup of this system. The use of a hearing aid may stimulate the auditory pathway to reverse auditory deprivation (Schaette & Kempter, 2006). However, the degree of benefit may be dependent upon the continuous use of hearing aids, the length of auditory deprivation, and the degree of hearing loss (Silverman & Silman, 1990).

Benefits from hearing aids are shown by improving the patient's reaction to tinnitus by masking tinnitus and changing attentional focus (McNeill et al., 2012). In a retrospective study by McNeill et al. (2012), a review of records was completed for 70 patients who had hearing loss and tinnitus to evaluate if their perception of tinnitus differed before and after hearing aid fitting. Hearing losses ranged from mild to severe, and bothersome chronic tinnitus was either a primary or secondary complaint. Hearing aid manufacturer and hearing aid features were selected based on the patient's needs and were not the same across the patients. Tinnitus distress was measured

using the TRQ prior to hearing aid fitting and at least 3 months after fitting of the hearing aids. At the session following the hearing aid fitting, patients were also asked, “How do you hear your tinnitus with your hearing aid switched on in your ear?” (McNeill et al., 2012, p. 916).

A reduction in the perception of tinnitus was found in the patients who experienced masking of their tinnitus immediately after fitting the hearing aids but not for those who did not ($p < 0.001$). When hearing aids were fit to participants with tinnitus, without special programming, 40% had a reduction in their perception of the tinnitus, 37% had complete masking of their tinnitus, and 23% found that the hearing aids did not mask their tinnitus at all. There was no change in the TRQ for those who did not experience tinnitus masking with the use of hearing aids. However, TRQ scores showed a reduction in distress for those who experienced partial masking with an even greater reduction for those who experienced total masking. Prolonged effect of these improvements was also seen after 3 months of hearing aid use. No participants reported an increase in their tinnitus while wearing hearing aids. McNeill et al. (2012) also found that those whose tinnitus pitch fell within the amplified frequency range of the hearing aids had an improved treatment effect on their tinnitus in comparison to those whose tinnitus pitch did not fall within the frequency range of the hearing aids.

Tinnitus may be perceived unilaterally, on one side of the head, or bilaterally, on both sides of the head. Yokota et al. (2020) aimed to study any therapeutic effects of hearing aids for patients with both unilateral and bilateral tinnitus, but whose chief complaint was hearing difficulty. Tinnitus distress was measured on 66 patients using the THI, the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983), and a visual analog scale (VAS; Hayes & Patterson, 1921) as a way to measure tinnitus discomfort, severity, and persistence. These measurements were administered prior to hearing aid fitting and 12 months post hearing aid

fitting. Of the 66 patients, tinnitus was perceived bilaterally in 41 of the patients and unilaterally in 25 of the patients. Sixteen of the 25 patients with unilateral tinnitus had “poor” hearing in the ear where the tinnitus was perceived and 9 had “good” hearing. The degree of hearing was not defined in this study. Hearing aids were worn bilaterally for 23 of the 66 patients and unilaterally for 43 of the patients. In 17 of the 23 bilateral hearing aid users, 6 had unilateral tinnitus. In 19 of the 43 unilateral hearing aid users, tinnitus was perceived unilaterally. In 13 of the unilateral hearing aid users, their tinnitus was perceived on the contralateral side that the hearing aid was fit. Significant improvements were seen in the THI scores ($p = 0.000030$), VAS score for tinnitus severity ($p = 0.00000066$), and VAS score for tinnitus discomfort ($p = 0.0000013$) for all patients after 12 months of hearing aid use. They further found that those with bilateral tinnitus showed significant reduction in the perception of tinnitus, with no significant difference between wearing one or two hearing aids, suggesting that the perception of bilateral tinnitus may be reduced even when one hearing aid is worn. However, for those with unilateral tinnitus, the side on which a hearing aid is worn is important. Patients who wore a hearing aid on the contralateral side of their perceived tinnitus did not have significant treatment effects from wearing the hearing aid (THI; $p = 0.11$; VAS score for severity; $p = 0.064$; VAS score for discomfort; $p = 0.20$), but those who wore a hearing aid on the ipsilateral side to their tinnitus did show significant treatment effects from wearing a hearing aid (THI; $p = 0.0012$; VAS score for discomfort; $p = 0.073$).

Psychological Therapies

Psychological therapies have emerged since the 1980s as a management option for adults with tinnitus (Sweetow, 1986). The management of tinnitus largely relies on treating the effects of tinnitus on the patient, not the tinnitus itself, because there is no current cure for tinnitus. As

mentioned previously, the effects of tinnitus range from depression, anxiety, sleep deprivation, social isolation, anger, among others. If the sole focus is on the tinnitus itself, the care provider's role would be on eliminating the perception of tinnitus (i.e., the specific pitch or sound that is heard); however, by focusing on the effects of tinnitus, the focus can extend to the emotional reaction, as well as the cognitive effects of the tinnitus. Several psychological therapies have demonstrated reductions in the effects of tinnitus. These include cognitive behavioral therapy, acceptance and commitment therapy, tinnitus retraining therapy, progressive tinnitus management, and mindfulness.

Cognitive Behavioral Therapy

The most common type of psychological therapy for the management of tinnitus is cognitive behavioral therapy (CBT). This behavioral therapy also has the most supportive peer-reviewed evidence and has been the most recommended management approach for tinnitus (Zenner et al., 2017). Cognitive behavioral therapy focuses on operant learning, conditioning, and processing of information. Cognitive behavioral therapy can include things like “psycho-education about tinnitus, applied relaxation, positive imagery, cognitive restructuring of negative beliefs about tinnitus, exposure to the sounds, behavioral activation, and mindfulness/attention exercises” with the primary focus being on directly changing the content of the patient's thoughts regarding tinnitus (Hesser et al., 2011, p. 546).

The aim of the Hesser et al. (2011) systematic review was to determine if CBT was effective in reducing the distress and annoyance that is associated with the perception of tinnitus and to examine “possible moderators of effect sizes in CBT for tinnitus” (p.546). In this review, only randomized controlled trials (RCTs) were included resulting in 15 studies totaling 1091 participants. Hesser et al. (2011) found that CBT was an effective treatment therapy for reducing

the annoyance and distress that is associated with the perception of tinnitus and that improvements were maintained over 6 months. However, a significant regression slope estimate did indicate that a smaller effect size was associated with follow-up intervals longer than 6 months. Furthermore, a waiting-list control condition resulted in a higher effect size as compared to results in studies that used education and treatment controls. Hesser et al. (2011) reported that there are limited studies comparing CBT to other therapies. Cognitive behavioral therapy was also found to have a statistically significant positive effect size on measures of anxiety and depression symptoms, but the authors noted that this outcome may have been due to these two measures being combined into a single “mood” construct in this review.

The effectiveness of face-to-face CBT has been compared to guided self-administered forms of CBT in a systematic review by Landry et al. (2020). This review found that face-to-face CBT showed statistically significant improvements to tinnitus health-related quality of life outcomes. The guided self-administered forms of CBT did have larger effect sizes, but they did not show statistically significant improvements in health-related quality of life, depression, and anxiety in those who perceive tinnitus. Results from this study suggest that CBT is more effective in a face-to-face form.

Acceptance and Commitment Therapy

Unlike CBT, acceptance and commitment therapy, as well as tinnitus retraining therapy and mindfulness, focuses on the process of thought and patient values (Thompson et al., 2017). Acceptance and commitment therapy (ACT) orients therapy with an action-approach, which helps tinnitus patients reduce avoidance, denial, and struggles with emotions and accept their personal feelings as appropriate responses to help them move forward. Acceptance and commitment therapy has been shown to be effective with symptoms associated to tinnitus (i.e.,

depression, chronic pain, anxiety, stress) with preliminary evidence found in the literature in reducing the perception of tinnitus.

Tinnitus Retraining Therapy

Tinnitus retraining therapy (TRT) uses directive counseling, which focuses on emotional reactions, cognitive distortions, and false perceptions, alongside the use of acoustic enrichment devices (i.e., hearing aids, sound generators) to improve habituation to the tinnitus by reducing the attention to the perceived tinnitus and the annoyance created by the tinnitus (Bauer et al., 2017). This therapy is based on the neurophysiological model of tinnitus that postulates that there is a fundamental role in the perception of tinnitus that comes from an interaction between specific structures in the central nervous system, the cochlea, and the auditory pathways and that the limbic and autonomic nervous systems are responsible for the negative reactions and irritation that is induced by the perceived tinnitus (Baracca et al., 2007).

The efficacy of TRT was investigated by Baracca et al. (2007). Fifty-one patients were given TRT after an ENT evaluation and audiologic testing. Questionnaires were given to the patients before and 18 months after TRT was provided. The type of questionnaires was not named, however they were described as a way to quantify “the discomfort evoked by tinnitus and its impact on their quality of life, attributing a score to the severity of their tinnitus and to the tinnitus-induced irritation” (p. 219). In this study, 54.9% of patients showed improved concentration, 25.5% did not show any improvement, and 19.6% did not have any concentration issues before or after TRT. Regarding sleep quality, 47% found an improvement in sleep, 23.5% had no change, 2% worsened, and 27.5% had no sleep issues before or after TRT. Relaxation improved in 72.5%, 7.8% showed no improvement, and 19.7% did not have any relaxation issues prior to or after TRT. Men showed greater improvement in relaxation than women did ($p < 0.05$).

A greater improvement was shown in those who worked compared to those who did not work. Further, patients who had been suffering from the effects of tinnitus for less than one year had more improvements in relaxation ($p=0.026$) and concentration ($p=0.024$) compared to those whose tinnitus effects lasted longer than one year.

Bauer et al. (2017) obtained THI scores in patients with chronic bothersome tinnitus and compared the outcomes from those who had TRT to those who had general aural rehabilitation, counseling, and hearing aids (SC group) to manage the effects of chronic bothersome tinnitus. A larger reduction in the severity and negative impact of tinnitus was demonstrated as a decrease in THI scores for those who participated in TRT and was defined in this study as a 50%-or-better decrease in THI total score from entry to 18 months post treatment. This was considered a significant improvement in THI scores. Seventy-four percent of the TRT participants and 37% of the SC group had a significant improvement in THI scores. The significant reduction in THI scores was shown to occur within 6 months of initiation of therapy ($p < .005$) and was maintained through 18 months of therapy ($p < .000$).

Comparison of Two Therapies

By comparing the effects of ACT with TRT for participants with tinnitus, Westin et al. (2011) found significant improvements in tinnitus-related distress, with more improvement in some categories for the ACT group. Sixty-four adult participants who had normal hearing and tinnitus were randomized into either an ACT group, a TRT group, or a wait-list control (WLC) group. Each participant had tinnitus as their primary problem and had a score of ≥ 30 on the THI. Those in the WLC group started treatment after 10 weeks and used CBT. Those who participated in ACT had 10 weekly 60-minute sessions. Those who participated in TRT had one 150-minute consultation in which a medical history was taken, education on tinnitus was given, and sound

generators were fit bilaterally. This was followed up with one 30-minute telephone conversation. It was not specified when the follow-up call occurred. Those in the TRT group were instructed to wear the sound generators daily for at least 8 hours per day for 18 months.

Questionnaires including THI, Tinnitus Acceptance Questionnaire (TAQ; Westin et al., 2008), Insomnia Severity Index (ISI; Bastien et al., 2001), Quality of Life Inventory (QOLI; Frisch et al., 1992), HADS, and The Clinical Global Impression-Improvement (CGI-I; Guy, 1976) were given at pre-treatment, 10 weeks, 6 months, and 18 months after treatment. The TAQ was also given to the WLC group and the ACT group at 5 weeks after treatment started.

Over the course of the 18-month study, there was more benefit with the use of the ACT management option when compared to the TRT management option for tinnitus. Acceptance and commitment therapy showed a significant advantage compared to TRT on sleep problems ($p = 0.043$). Both ACT and TRT showed improvements in quality of Life, anxiety, and depression but there was no significant difference between the two management options. When measured at 6 months, calculations of a reliable change index showed 54.5% had more improvement in their tinnitus symptoms using ACT compared to 20% in the TRT group. Results from the CGI-I subscale at 6 months showed a 15% improvement in those who were in the ACT group compared to 0% improvement with those in the TRT group. When compared at 10 weeks, patients receiving ACT showed better TAQ scores compared to the baseline than those on the WLC for their tinnitus ($p = 0.002$).

Progressive Tinnitus Management

Progressive tinnitus management (PTM) is a type of therapy that incorporates CBT, sound therapy and mindfulness approaches and uses a structured approach to the management of the effects of tinnitus (Beck et al., 2019). The structured approach is a “progressive” hierarchical

method to provide the appropriate type of tinnitus services to those that need more than just tinnitus education and/or hearing aids (Henry et al., 2017).

Henry et al. (2017) evaluated the effectiveness of PTM at two Veterans Affairs medical centers (VAMC). Three hundred participants were randomized into either a PTM group or a 6-month WLC group at both sites. Using a multidisciplinary approach, audiologists and psychologists delivered the PTM to veterans who reported experiencing at least one “tinnitus-specific problem.” The TFI was used to measure tinnitus severity and negative impact of tinnitus both before PTM and 6 months after PTM. The THI was also used as a secondary outcome measure. Further the Self-Efficacy for Managing Reactions to Tinnitus (SMRT) questionnaire was developed specifically for this study to “measure the degree of confidence patients have in their ability to manage their reactions to tinnitus” (Henry et al., 2017, p. 8).

Results of this study show that the TFI and THI were similar and that there was a reduction of TFI scores at the 6-month follow up for the PTM group that was statistically significant at the Memphis VA ($p = .0194$) and ($p = .0476$) and the West Haven VA. The WLC group did not have a statistically significant difference in TFI scores at the Memphis VA ($p = .9990$) and ($p = .3802$) at the West Haven VA. The use of the SMRT questionnaire for this study showed an improvement in confidence in a patient’s ability to manage their reactions to their tinnitus by 9.9 points at the Memphis VA and 3.7 points at the West Haven VA for the PTM group. The WLC group at the Memphis VA showed a reduction of 3.0 points for the SMRT and 7.3 points at the West Haven VA. A THI and SMRT was also provided to the PTM group at a 12-month follow-up showing sustained changes to the measurements. Differences between the two sites were observed in the study, which could be due to differences in clinicians and populations served. The patients at the Memphis VA had higher TFI scores at baseline and also

reported lower levels of education, worse health, were less-often employed, and were more racially diverse compared to the West Haven VA.

Mindfulness as a Management Option to Tinnitus

Mindfulness components are found in psychological therapies such as CBT, ACT, and PTM. Mindfulness focuses on creating awareness in the present moment with acknowledgment of thoughts, feelings, and bodily sensations (Kabat-Zinn, 1982). The mind continuously shifts attention throughout the day. Mindfulness refocuses the individual's awareness back to the present moment through the shifting of attentions. The shifting of attention is not negatively viewed but is accepted for what it is to give each thought and feeling its own space and value.

Mindfulness is inspired by teachings in the Eastern world, primarily from Buddhist meditative practices, but it has made a place in Western culture and modern medicine, which is largely credited to Jon Kabat-Zinn (Gans, 2010). Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1982) is a mindfulness program developed by Jon Kabat-Zinn, typically presented in an 8-week format, that teaches the principles of exercising control of one's attention through mindfulness training. MBSR does this by developing skills and autonomy in mindfulness that become integrated into daily life.

Application of Mindfulness in Medicine

Mindfulness can be an important component in a provider's relationship with a patient by promoting effective clinical decision making, reducing medical errors, and facilitating the provider's compassion (Epstein, 1999). Any provider can be engaged in mindfulness by attentively listening to patient's concerns, recognizing their own errors, refining their skills, acting with compassion, making evidenced-based decisions, being present, and offering insight (Epstein, 1999). Epstein (1999) further states that "reflection and self-awareness help physicians

to examine belief systems and values, deal with strong feelings, make difficult decisions, and resolve interpersonal conflict” (p. 833).

Research has shown that clinical judgment involves both explicit and tacit knowledge (Feinstein, 1994; Goldman, 1990). Explicit knowledge can be quantified, communicated, and used for evidence-based clinical practice guidelines, whereas tacit knowledge is learned through observation and practice. A provider with a mindful attitude will have the ability to perform a task and listen at the same time, thus using both the explicit and tacit knowledge together, which will enhance their patient’s experience as well as their own skills (Epstein, 1999). Keeping a journal, practicing meditation, reviewing videotaped sessions, using peer evaluations and completing self-evaluation forms can enhance self-awareness (Novack et al., 1997, 1999). Practicing mindfulness requires mentoring, guidance, and recognition of one’s limitations. Physician educators can better help themselves by becoming more self-aware through mindfulness concepts and can help trainees become more aware by modeling mindfulness attributes (Epstein, 1999).

The use of mindfulness has been implemented in many medical fields to help promote patient improvement with regard to pain, stress, coping, QoL, and depression. In the United Kingdom, the National Health Service recommends mindfulness-based cognitive therapy (MBCT; Segal et al., 2002) for individuals who have had three or more episodes of depression (Teasdale et al., 2000). Mindfulness has shown preliminary evidence of efficacy in the treatment of other diseases, such as psoriasis, type 2 diabetes, sleep disorders, attention-deficit hyperactivity disorder, and eating disorders. Mindfulness can be used to help prevent and treat disease and to manage the symptoms of conditions to improve QoL (Ludwig & Kabat-Zinn, 2008).

Ludwig and Kabat-Zinn (2008) state that mindfulness may be beneficial in “influencing susceptibility to, or ability to recover from, disability and disease” by decreasing the perception of pain, increasing the tolerability of pain, reducing stress, anxiety, or depression, increasing motivation for lifestyle changes, and enhancing relationships with family and friends (p. 1351). The reduction of psychological stress has also been shown with the use of mindfulness (Shapiro et al., 1998). Mindfulness has been shown to affect brain function (Creswell et al., 2007), increase gamma activity (Lutz et al., 2004), and increase left-sided anterior activation as shown in EEG activity, which are patterns associated with positive emotional experience (Davidson et al., 2003).

One of the benefits of mindfulness is the reduction of chronic pain symptoms (Kabat-Zinn, 1982). Chronic pain shares connections with tinnitus, which was illustrated above (Møller (2000). Mindfulness has shown a reduction of physical symptoms and improvement in quality of life in fibromyalgia patients (Schmidt et al., 2011), reduction of depression relapse (Teasdale et al., 2000), reduction in post-traumatic stress disorder symptoms (PTSD; Polusny et al., 2015), reduction of anxiety symptoms (Hoge et al., 2013), and reduction of loneliness among older adults (Creswell et al., 2012). Some limitations in mindfulness research are related to studies that are based upon a small number of participants, lack an active control group, and in general lack a consensus about the working definitions of mindfulness (Creswell et al., 2012).

General Mindfulness Training for Tinnitus

Benefits to patients with tinnitus have been seen in studies that included a general MBSR course that did not have a focus on tinnitus. Roland et al. (2015) investigated whether a general MBSR course would provide benefits to patients with chronic bothersome tinnitus and if these benefits would reduce the severity of tinnitus symptoms and change the functional connectivity

in neural attention networks. Thirteen adults with idiopathic bothersome tinnitus, who had tinnitus for 6 months or longer, were recruited for the study. The THI and TFI questionnaires were given before intervention, immediately after MBSR and 4 weeks after intervention. A resting state functional connectivity MRI was used at pre- and post-MBSR intervention to document any changes to functional connectivity in neural attention networks. The MBSR course was taught by a certified MBSR instructor. The course was conducted through 8 weekly 2-hour sessions with a 3-hour retreat (it is unknown when the retreat occurred). During the course, participants were asked to engage in mindfulness meditation, mindful movements and exercises. Weekly homework assignments were given, and participants were asked to practice mindfulness meditation at home for 30 to 45 minutes per day. Each participant was asked to fill out a mindfulness log to document mindfulness practice at home and these were collected each week.

The THI and TFI scores were then compared from pre- to post-MBSR and at a 4-week follow-up to determine if there were any significant changes. Roland et al. (2015) used an alpha level (not specified) and adjusted with a Bonferroni correction for statistical analysis. A clinically meaningful reduction for the TFI was defined as a decrease of 13 points or more. It was reported that in 62% of the participants from pre-MBSR to the 4-week follow-up assessment a clinically meaningful reduction was shown ($p = .012$). There was no significant difference in TFI scores that were measured at post-MBSR and at the 4-week follow up assessment ($p = .249$). Clinically meaningful difference was defined as 7 points or greater reduction in THI scores. Seventy-seven percent of participants had a clinically meaningful difference in their THI scores from pre-MBSR to the 4-week follow up assessment ($p < .001$). The MRI showed functional connectivity in the left inferior frontal gyrus (IFG) in three regions was significantly increased

following MBSR: left superior temporal gyrus ($Z = 4.41$), posterior cingulate peak ($Z = 4.15$), and visual cortex ($Z = 3.83$; (p -values were not recorded for these findings). Functional connectivity in the right IFG in one region was increased following MBSR: posterior cingulate cortex ($Z = 4.14$; a p -value was not recorded for this finding). There were no regions that showed significant decrease in connectivity. Roland et al. (2015) concluded that following a general MBSR course there was a reduction in tinnitus symptoms and that changes in functional connectivity were shown in cortical attention networks that coincide with clinical improvement of symptoms.

Mindfulness training can reduce the psychological difficulties associated with tinnitus (Philippot et al., 2012). In a study by Philippot et al., 25 participants, who had tinnitus within the past 6 months, were randomly allocated into one of two treatment groups, with one treatment group receiving relaxation training in the form of progressive muscle relaxation (PMR), and the other group receiving mindfulness training (PMR; Bracke, 2010). Both groups received a psychoeducation course that included education about the nature and characteristics of tinnitus, its epidemiology, and adaptive and ineffective coping strategies. Two and a half months after the psychoeducation course, each treatment group started either PMR or mindfulness training. Mindfulness training and PMR consisted of 6 weekly group sessions. The mindfulness training was derived from a mindfulness manual for depression by Segal et al. (2002). Content that was related to depression relapse was omitted for this study and a focus on dealing with the adversity of tinnitus was included. The PMR training focused on breath training, relaxation of body parts, and maintenance of relaxation competence. Assessments were measured before intervention, after psychoeducation training, and at a 3-month follow-up after either PMR or mindfulness training. Assessments included the Tinnitus Psychological Impact Questionnaire (QIPA;

Philippot et al., 2012, unpublished data), Beck Depression Inventory (BDI; Beck et al., 1987), and the State-Trait Anxiety Inventory (STAI; Spielberger, 1983).

From the assessments, the two most prominent emotional responses to tinnitus were overall negative affect and frustration. Negative emotion was significantly decreased in the mindfulness group (Cohen $d = 1.44$) but not in the PMR group (Cohen $d = 0.22$) with $p < 0.01$. Negative affectivity decreased from baseline to follow-up in the mindfulness group (Cohen $d = 0.75$) with a non-significant increase in the PMR group (Cohen $d = 0.34$) with $p < 0.02$. Feelings of frustration were diminished after the psychoeducation training for both groups but continued to be diminished in the mindfulness group but not the PMR group (Cohen $d = 0.75$) with $p < 0.04$. At follow-up, the mindfulness group showed more acceptance of their tinnitus than the PMR group (Cohen $d = 1.71$) with $p < 0.000$. Philippot et al. (2012) concluded that psychoeducation is an important component in the management of tinnitus and their results showed that it provided reductions of negative affectivity, rumination, and difficulties experienced with tinnitus. Mindfulness and PMR did not bring immediate improvement in reduction of negative affectivity, rumination, and difficulties experienced as a consequence of tinnitus; however, mindfulness did produce improvements in these areas post-intervention with better maintenance of the benefits of psychoeducation compared to PMR. Improvements from mindfulness were less negative emotion, irritability, and rumination.

There are times that a management option does not work for a patient with tinnitus, which can be frustrating for the patient. Arif et al. (2017) compared mindfulness meditation with relaxation therapy in participants whose primary complaint was tinnitus and who had not responded to other management options, including hearing aids, maskers, background music or reassurance. They also included participants who were not interested in trying the conventional

management options for tinnitus. Relaxation therapy provided in this study was based on the work of Lars-Goran Öst (1987). Sixty-one participants who completed the study were randomly allocated to either the relaxation therapy group (control group) or the mindfulness therapy group. Each participant had 5 face-to-face sessions of either the relaxation therapy or the mindfulness therapy for 40 minutes over the course of 15 weeks. The mindfulness group had in-person mindfulness exercises and mindfulness exercises to do at home. The relaxation therapy group had in-person relaxation therapy exercises and relaxation therapy exercises to do at home. The use of the TRQ, the HADS, VAS, and a Health State Thermometer [not referenced] were administered as pre- and post-assessments of tinnitus-related severity and handicap and psychological effects. Results showed that those who participated in the mindfulness therapy group showed significantly better scores on the TRQ when compared to the relaxation therapy group ($p = 0.047$). Tinnitus severity in participants was measured by the TRQ and showed a significantly better scores for those who participated in the mindfulness therapy group than those who participated in the relaxation therapy group ($p = 0.002$). Both therapy groups showed overall improvement in patient's tinnitus symptoms between the two therapy groups, except for the overall health status indicator. The health status indicator showed no improvement for either group. Overall, both therapies showed significant improvements in patients' symptoms, with some results (i.e., tinnitus severity, patient's state of mind, awareness of tinnitus) showing statistically significant better results for the mindfulness therapy when compared to the relaxation therapy.

Other Mindfulness Training Programs Specifically Focused on Tinnitus

Effects of MBCT on patients with chronic tinnitus were studied by McKenna et al. in 2018 and compared these effects to a wait-list group. Seventy-five adult participants were

included in this study. A total of 10 groups participated in this study and subjects followed an 8-week program based on Segal's MBCT course. This experimental intervention focused on the cognitive behavioral model of tinnitus (McKenna et al., 2014), psychoeducation, meditation practices, and group discussions. Questionnaires were completed at pre- and post-intervention, and at a 1 month and 6 month follow-up using the TQ, the Clinical Outcomes in Routine Evaluation-Outcome Measure (CORE-OM; Evans et al., 2002), the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003), and the TAQ. Results from these assessments at pre- and post-treatment showed that tinnitus severity was significantly reduced in all the mindfulness and the relaxation group but was significantly greater in the mindfulness group ($p = 0.016$). A clinically significant reduction on the TQ was considered as a reduction by 11 points on the TQ. This was observed in 59% of participants post-intervention for the mindfulness group. Both groups showed a significant reduction for psychological distress at both the pre- and post-treatment. There was not a difference between the two groups. Significant changes in cognition, behavior, and acceptance related to tinnitus was seen at post-treatment and was significantly greater for the mindfulness group ($p = 0.029$). Results from the MAAS showed significantly increased mindfulness ($p < 0.05$) and this positive change was sustained at follow-up. McKenna et al. (2018) stated that "changes in mindfulness and tinnitus acceptance were found to be associated with changes in tinnitus distress. This demonstrates how mindfulness may benefit tinnitus patients via the development of greater acceptance of thoughts and feelings associated with tinnitus" (p. 364).

An important component to mindfulness is practice. By practicing the skills of mindfulness, the facilitation of change has a greater chance of lasting over time. For this purpose, Gans et al. (2014) incorporated a 7-hour retreat between the normal sixth- and seventh-week

weekly group meetings, in a randomized controlled study using mindfulness-based stress reduction (MBSR) with a specific focus on tinnitus (MBTSR). This 7-hour retreat gave the opportunity to practice the mindfulness skills taught in the previous weeks. Eight participants in the MBTSR program were introduced to mindfulness in the form of sitting meditations, body awareness, mindful movements, and mindful practices in a similar fashion as the MBSR program. The MBTSR program included a tinnitus foundation to focus on psychoeducation relating to co-morbidities of tinnitus such as sleep disorders, anxiety, and depression. The following areas were focused on: sound awareness, tinnitus perception, education on sleep and sleep hygiene and the connection of stress and tinnitus exacerbation, skills in relaxation and awareness, improving overall well-being as it relates to living with tinnitus, connection of tinnitus and comorbid symptoms, recognition of early warning signs of tinnitus exacerbation, moment-by-moment awareness, mindfulness skills, and skills to bring your mind back to the present. Participants were instructed to practice at home to work on the concepts and skills learned in class for 30 minutes per day 6 days per week, with the use of meditation CDs that were made by the course director. The participants were also instructed to use the skills taught in the MBTSR program throughout the day. Between classes participants were instructed to read course materials in a participant manual and read through the book *Full Catastrophe Living* (Kabat-Zinn & University of Massachusetts Medical Center/Worcester, 2005). Each weekly class lasted 150 minutes. During the 7-hour retreat between weeks 6 and 7, participants were able to practice in a group setting the skills they had been provided during the previous weeks. A group discussion was held at the end of the day to give participants the opportunity to talk about their experiences and reflect on what they had learned.

Gans et al. (2014) used the THI, the Tinnitus VAS, the Percent of Awareness Scale (PAS; unpublished data), the SF-36 Health Survey, the Symptom Checklist-90-Revised (SCL-90-R; Derogatis, 2017), HADS, and the Five-Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2008) as pre- and post-assessment measurement tools. Cohen's *d* statistic effect sizes (ES) were measured rather than levels of significance due to the small sample size. According to the authors, an ES below 0.3 was small, around 0.5 was moderate, and above 0.8 was large. Results are posted in Table 3 below. Quantitative results showed that there were moderate to large improvements in reduction of tinnitus annoyance and awareness, in increased mindfulness, reduction of mood disturbances, and in QoL. Qualitative results using a Post-Intervention Feedback Form (PIFF) that was developed for this study, as well as participant comments suggested that participants had a reduction in the need for sleep medication, more acceptance of their bodies, and a shift in the perception of their tinnitus.

Table 3*Pre- and Post-Mindfulness-Based Tinnitus Stress Reduction (MBTSR) Measurement Outcomes*

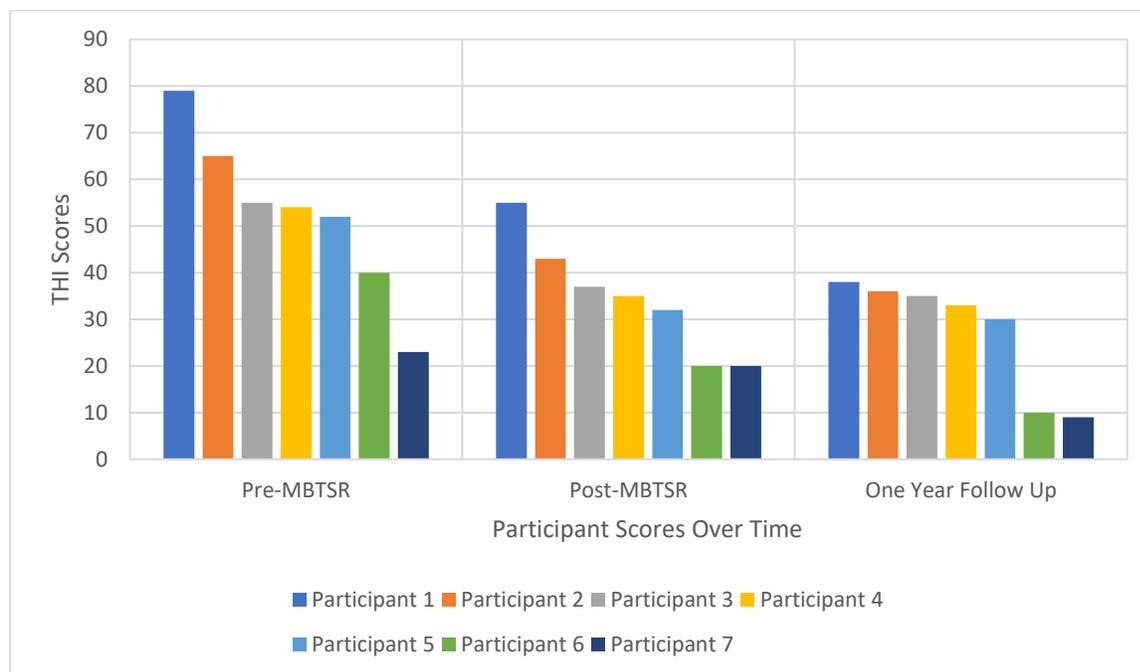
Measure	Pre-MBTSR Mean	Post-MBTSR Mean	Effect size (Cohen's <i>d</i>)
Tinnitus Handicap Inventory (THI)	50.63	39	0.69
Visual Analog Scale (VAS)	59	36.88	0.99
Tinnitus awareness	60	41.25	0.64
Five-Facet Mindfulness Questionnaire (FFMQ)			
Non-Judge	28	32.35	-1.29
Observing	30.13	31.75	-0.46
Non-reactivity	20.38	23	-0.52
Describe	29.75	32.38	-0.57
Acting with awareness	28	27.75	-0.05
Short Form Health Survey (SF-36)			
Social Functioning	39.5	49	-0.70
Mental Health	44.78	49.33	-0.62
Vitality	50.83	53.78	-0.46
HADS	15.5	13.38	0.30
Symptom Checklist-90-Revised (SCL-90-R)			
Depression	66.5	56.38	0.52
Phobic anxiety	65.38	50.39	0.62
Somatization	60.13	49.89	0.58
Anxiety	63.38	54.88	0.41

Note: Adapted from “Mindfulness Based Tinnitus Stress Reduction Pilot Study,” by Gans et al., 2014, *Mindfulness*, 5(3), p. 328. Copyright 2013 by the Springer Science + Business Media.

In a follow-up study, Gans et al. (2015) studied the long-term benefits of MBTSR. The eight participants who completed the original MBTSR training participated in a follow-up session 12 months post training at the same location of the pilot study. The follow-up session consisted of a 30-minute meditation, participation in group conversation where they shared about their personal experience with their mindfulness practice over the previous 12 months, any barriers to their practice, and any changes they noted in their tinnitus distress. They also shared in an open-discussion about their experience with tinnitus at the present, if MBTSR had any usefulness over time, and whether they practiced the skills taught over the previous 12 months. Measurements of this follow up were obtained by using the THI. Results shown in Figure 1 below suggest that a continued reduction in the THI scores can be sustained over time. Eighty-five percent of the participants reported that they regularly practice mindfulness.

Figure 1

Tinnitus Handicap Inventory One Year After Mindfulness-Based Tinnitus Stress Reduction



Note: Adapted from “Sustained Benefit of Mindfulness-Based Tinnitus Stress Reduction (MBTSR) in Adults with Chronic Tinnitus: A Pilot Study,” by Gans et al., 2015, *Mindfulness*, 6(5), p. 1233. Copyright 2015 by Springer Science + Business Media.

Summary

Simply stated, tinnitus is a complex pathology. Theories about tinnitus origination, effects, and management options are numerous. Those who are affected by tinnitus may have different comorbidities or symptoms. Due to the complex nature and unexplained pathophysiology of tinnitus, management options should be individualized, and evidence-based practice should be used. Numerous studies have shown success with CBT, ACT, TRT, and mindfulness. The expertise of a multidisciplinary team should also be used for best practice management due to the nature of tinnitus and the possible comorbidities that may be present. The

next chapter will consider the gaps in the literature and challenges for an audiologist needing evidence-based practice guidance.

CHAPTER III

CLINICAL CHALLENGES IN THE MANAGEMENT OF PATIENTS WITH TINNITUS

Management of tinnitus can be complicated for audiologists, since tinnitus-related complaints can be complex, variable, and diverse both within and across patients. Because there are no objective, diagnostic measures of tinnitus in humans, diagnostic assessment and evaluation of tinnitus are purely subjective, and clinical reports are based upon the patient's perception. Thus, the management of tinnitus may differ for each patient. There are numerous options available to manage the negative reaction to tinnitus since there is no medical cure to eliminate the tinnitus itself. In 2017, Zenner et al. performed a systematic review of management options for chronic idiopathic tinnitus. They reported that almost 60 different treatment modalities had been studied. Identifying which management option is appropriate for the patient with tinnitus may be difficult due to the vast amount of management options available.

Gaps in Literature

The importance of managing the effects of tinnitus is high due to the commonality of tinnitus. Review of the literature shows many studies aiming to identify the causes of tinnitus and how to successfully manage its effects. However, even with the studies available on tinnitus, there are gaps in the literature that must be filled to improve the clinical management of tinnitus.

As stated previously, the evidence-based management options available to audiologists can only succeed if they reduce the negative impact of the tinnitus on a person's QoL. Intervention does not change the occurrence of tinnitus in itself (McFerran et al., 2019).

Exploration of the significant financial burdens and economic impacts that result from tinnitus is warranted. However, because there are diverse characteristics of tinnitus, unclear definitions of tinnitus, unclear pathophysiology of tinnitus, and lack of research funding, tinnitus research is limited in comparison to other chronic health conditions (McFerran et al., 2019). In 2019, there were 5,509 total registered clinical trials for depression but only 200 for tinnitus. Of those registered trials for depression, 2,440 were trials using drug interventions, and of the 200 trials for tinnitus, there were only 55 using drug interventions. There is currently no drug to cure tinnitus and consequently the medical profession often looks to audiologists for the non-medical management of tinnitus (McFerran et al., 2019).

A cure for tinnitus would mean something different to different communities of people. Researchers, audiologists, general practitioners, ENT physicians, pharmaceutical companies, and patients may all have different ideas as to what a “cure” would look like (McFerran et al., 2019). In a study by Husain et al. (2018), a questionnaire was given to 230 adults with tinnitus and to 68 audiologists. Results indicated that “successful” tinnitus treatment meant something different between the two groups. The audiologists defined treatment success as a decrease in awareness of the tinnitus and stress/anxiety relief. However, for the patient with tinnitus, the defined treatment success was a reduction in the tinnitus loudness and the elimination of tinnitus.

Tinnitus Counseling

In Chapter II, tinnitus counseling was reviewed as a management option for tinnitus. The AAO-HNSF recommends using tinnitus “counseling/education” (Tunkel, et al., 2014). In the guidelines, “counseling/education” for the patient refers to basic information on tinnitus including information “that tinnitus itself is a symptom and not a dangerous disease,” that there is no cure for primary tinnitus, information on the association of tinnitus and hearing loss, areas

primarily affected by tinnitus (i.e., thoughts, emotions, sleep, concentration, etc.), the use of hearing protection, assessment of tinnitus and associated hearing loss, effects that drugs have on tinnitus, and tinnitus management options (Tunkel et al., 2014, p. S18). However, in the tinnitus literature, the definition of counseling and tinnitus education are intertwined. Tinnitus counseling/education has not been studied in a randomized control trial, which would compare tinnitus outcomes for patients receiving counseling/education to patients without treatment or receiving a placebo treatment (Zenner et al., 2017). This could be due to methodological and ethical reasons. As per the review by Zenner et al. (2017), there were no studies available that compared various types of counseling/education. When tinnitus counseling/education was recommended, it was done so in a study that used tinnitus counseling/education in conjunction with other procedures (i.e., CBT, hearing aids, etc.). This lack of evidence-based information may create a dilemma for an audiologist who cannot determine if simply providing tinnitus counseling/education for a patient will be enough to reduce the symptoms of tinnitus or if other management options should be used in conjunction.

Clinical Dilemma

While researching management options for tinnitus and evaluating the gaps in the literature, other questions may cause clinical dilemmas for audiologists. Some of these questions may include: Is it best practice to send a patient out the door with just having tinnitus counseling/education? What if the patient is unable to afford other management options? Will it be best practice to provide only tinnitus counseling/education? Is there one best way to counsel/educate a patient regarding tinnitus when there are so many symptoms associated with tinnitus? When providing a patient with a recommendation for a management option, should it always include tinnitus counseling/education? Suffice it to say that any sort of information or

resources would be better than none. For an audiologist, it is important to know how to present the right kind of information to achieve the most benefit for a patient with tinnitus. Further research in this area is warranted.

Hearing Aids

The use of hearing aids for the management of tinnitus has also been recommended by the AAO-HNSF when tinnitus occurs in conjunction with hearing loss. Studies included in the literature review in Chapter II revealed that hearing aids may reduce auditory deprivation which may reduce the perception of tinnitus (Noreña & Eggermont, 2006). Hearing aids may also reduce tinnitus distress (McNeill et al., 2012). However, the McNeill et al. (2012) research was not designed as a RCT and did not account for incidental changes to tinnitus distress by other factors (i.e., tinnitus education, changes to tinnitus distress related to other comorbidities, etc.). In a review by Hoare et al. (2014), only one RCT was found out of 330 records on the effectiveness of hearing aids for the management of tinnitus. All other records in this search could not adequately assess the effectiveness of hearing aids for management of tinnitus due to missing data, not addressing the research question, non-RCT study designs, not using a tinnitus questionnaire as an outcome measurement, or not using a control group. Further, there were no studies that compared individuals wearing hearing aids to a placebo group. Consequently, audiologists who rely on hearing aids for the treatment of tinnitus likely do so in the absence of clear clinical evidence and reliance on personal, subjective clinical experience.

Sound Therapy

As reviewed, sound therapies include several options but generally pertain to the use of any external noise to help reduce the perception of tinnitus (ATA, 2021). Sound therapy options are numerous, and some studies demonstrate that the use of external noise may provide a sense

of relief, divert attention away from, or even create an environment where it is easier to ignore the perception of tinnitus by the patient (Formby & Keaser, 2007; Henry et al., 2008; Tyler et al., 2020). There are gaps in the sound therapy research literature, as most studies did not isolate the potential benefits from sound therapies and results were confounded by incidental influencers, such as tinnitus education or the use of hearing aids.

Psychological Therapy

Psychological therapies have been used as a management option for tinnitus due to the comorbidities that can be associated with the perception of tinnitus. Dependent upon the type of psychological approach, these therapies may focus on different aspects of tinnitus distress, such as improving coping skills, reducing negative emotions associated with the tinnitus, or even increasing a patient's confidence in influencing the condition. Cognitive behavioral therapy does show high efficacy in several RCT studies. A reduction in tinnitus distress and negative impacts of tinnitus on quality of life has been demonstrated with CBT. However, these improvements have not been shown to decrease the actual perception of the loudness of tinnitus (Zenner et al., 2017). In other words, the therapy improves patient coping, but it does not directly improve the tinnitus condition. In a systematic review by Fuller et al. (2020), seven studies reported "serious adverse effects" from CBT for use of the management of tinnitus. "Serious adverse effects" were categorized as deterioration according to reliable change calculations using the TQ, however this was not explicitly defined. They also did not report the total number of subjects affected by the "serious adverse effects." Fuller et al. (2020) further reported that they were uncertain whether CBT could reduce tinnitus related anxiety or whether it actually increased tinnitus related QoL.

While CBT leads in the amount of RCTs reported in the literature, other psychological therapies have emerged over the years. Acceptance and commitment therapy, TRT, PTM, and

mindfulness have all shown preliminary evidence of their effectiveness in reducing symptoms associated with tinnitus, but studies are typically limited to small sample sizes or are not well controlled. These studies do not fully focus on the effects of psychological therapy but instead compare the effects to other modalities.

Level One Studies

There may be several reasons behind the lack of studies that are well-controlled, are peer reviewed, and offer a large enough sample size to warrant clinical effectiveness. One such reason may be that while tinnitus is common, tinnitus severity and tinnitus comorbidities may be hard to control for or may complicate the development and evaluation of intervention strategies (Agency for Healthcare Research and Quality [AHRQ], 2019). Dependent upon the type of research, inclusion requirements may limit sample size to successfully show clinical effectiveness. Inclusion requirements are not the same across studies. Further there is no one questionnaire to assess all aspects of tinnitus and its effects and thus questionnaires are not the same across studies. Lastly, large, randomized control studies or longitudinal studies are expensive to conduct and if research into tinnitus treatments is not a high priority for large funding agencies, or is beyond the budget of smaller funding agencies, the work goes undone.

Future Needs in Tinnitus Research

There is a need for future studies in tinnitus to eliminate incidental factors and to compare each management technique to a placebo group. Further, while many psychological therapies incorporate the use of mindfulness into therapeutic approaches, there are few studies that focus on the “mindfulness” portion as a singular management option for tinnitus. The few studies that have used a mindfulness-based program to manage the symptoms of tinnitus have been very small in sample size. Effect sizes are used instead of levels of significance and are not

consistent across all studies. However, for a mindfulness-based program, a small class size is warranted for appropriate focus from the instructor to the student. Further, a typical mindfulness-based class is 8 weeks in length. For research studies to incorporate a mindfulness-based therapy for tinnitus, patients from several classes would need to be enrolled. If the mindfulness course is taught by different instructors at different points in time for different patients, the results may be confounded. These issues are difficult to control. Further, some of the existing studies on mindfulness as a tinnitus treatment did not disclose whether the participants were using other management options (i.e., hearing aids, sound therapies, or tinnitus education). These studies did not compare mindfulness with a control group, which again could be due to methodological or ethical reasons. However, even if a control group was included in the research design, it may be difficult to have a well-controlled study because the diversity within the tinnitus patient population, varied experiences with unconventional treatment approaches, and the lack of knowledge regarding the underlying pathophysiology would make categorization of patients into cohesive tinnitus groupings very difficult and likely expensive to screen the large numbers needed to find similarities.

From a clinical viewpoint, differentiating what may in fact be beneficial for each individual patient may be overwhelming when considering all the research that might guide evidence-based practice. There is no consensus in the research literature. Research in the general area of mindfulness has shown improvement in many symptoms with lasting benefits. However, further research in this area is needed as there are only a handful of studies and the number of participants is small. Further, a protocol for a mindfulness-based program for tinnitus is warranted as the research studies to date varied in terms of the MBSR format.

Influential Factors on the Clinical Management of Tinnitus

To improve the clinical management of tinnitus, some influential factors need to be considered. Adequate and consistent training is needed in the areas of tinnitus and counseling during coursework in a doctoral audiology program and throughout an audiologist's career. Not all universities that offer a graduate program in audiology require the same courses to graduate. Guidelines are provided to universities through accrediting bodies, such as American-Speech-Language Hearing Association (ASHA); however, this does not mean that all classes and clinical experiences are similar. For those universities that offer courses in tinnitus, there is variability with regard to course content. The same concept goes for other healthcare professionals who will likely encounter patients who suffer from the effects of tinnitus during their routine clinical practice. In these fields outside of audiology, adequate or consistent training in counseling, tinnitus education, and tinnitus management is vital.

Knowledge and skills in the following areas are recommended for audiologists credentialed by American Speech-Language-Hearing Association (2021):

Providing assessments of tinnitus severity and its impact on clients'/patients' activities of daily living and quality of life. ... Counseling clients/patients regarding the audiologic significance of tinnitus and factors that cause or exacerbate tinnitus to resolve misconceptions and alleviate anxiety related to this auditory disorder. ... Counseling clients/patients to promote the effective use of ear-level sound generators and/or the identification and use of situationally appropriate environmental sounds to minimize their perception of tinnitus in pertinent situations. ... Counseling clients/patients to facilitate identification and adoption of effective coping strategies to reduce tinnitus-induced stress, concentration difficulties, and sleep disturbances. (sections 9-11)

The American Board of Audiology (ABA) is part of the American Academy of Audiology, which is another credentialing agency for audiologists (The American Academy of Audiology, 2022). Currently, there is a certificate program in tinnitus to provide information on assessing and managing patients with tinnitus.

Access to trusted information is an important factor for both audiologists and for their patients. Trusted information can be hard to find when there are so many management options available for tinnitus, and reporting practices could potentially distort the interpretation of studies to influence the decisions of clinicians (Velde et al., 2021). Velde et al. (2021) reviewed RCTs with tinnitus-related outcomes for “spin” in PubMed that were published from 2015 to 2019. “Spin” was referred to as “reporting practices that could distort the interpretation and mislead readers by being more optimistic than the results justify, thereby possibly changing the perception of clinicians and influence their decisions” (Velde et al., 2021, p. 1). Results indicated that 39% of the 87 studies reviewed contained “actual spin” that was mostly found in the conclusions. “Selectively focused spin” was found in 56% of the studies, and “linguistic spin” (“tendency towards an effect”) was found in 17% of the studies. They concluded that there is room for improvement for reporting and interpreting results so as not to mislead the readers and that there must be an awareness of “spin.” These authors suggested that editors of journals themselves should be responsible for the review of tinnitus research articles to assess and address “spin.” Consumers of research should be assured that research results are presented accurately and truthfully.

Summary

There are gaps in the tinnitus management research literature. There is a disconnect between what a patient wants (reduction or elimination of the loudness of their tinnitus) and the

reality that there is no cure for tinnitus. Instead, the only realistic option is to attempt to manage the tinnitus to help reduce the negative effects that tinnitus has on quality of life. High-quality research is needed in the area of tinnitus and its management options. Credible resources are warranted for audiologists as they consider the best evidence-based management options for patients. There is no consensus regarding management options that would apply to all patients with tinnitus, and there is incomplete information regarding emerging strategies such as mindfulness. The next chapter will delve into the fundamentals of mindfulness and mindfulness-based training programs as a potential management option for tinnitus from a practical point of view.

CHAPTER IV

FUNDAMENTALS OF MINDFULNESS AND MINDFULNESS PROGRAMS

Mindfulness is rooted in Buddhist meditative practices with multiple benefits substantiated by many different medical fields (Creswell, 2017; Gans, 2010). Although, research in the area of managing tinnitus through the use of mindfulness is not widely investigated, research in using mindfulness for reducing general negative reactions is available. Negative reactions can occur with tinnitus. These reactions can be expressed in a variety of ways and include, but are not limited to, anxiety, depression, loneliness, sleeplessness, anger, and frustration (Sweetow, 1986). Evidence-based mindful practices can help to reduce a variety of those negative reactions (Gans et al., 2014; Ludwig & Kabat-Zinn, 2008). By extension, mindfulness may reduce the reactions to tinnitus and help an individual develop strategies to change their perception of tinnitus (Creswell, 2017; Gans, 2010).

The recommendations in this manuscript for the use of mindfulness as a management option for tinnitus are based on the limited studies in managing tinnitus with mindfulness and on evidence-based practice in reducing negative reactions in other health-related fields. Recommendations also come from research evaluating mindfulness and chronic pain, as chronic pain and tinnitus have similar links and characteristics (Coderre et al., 1993; Møller, 2000; Price et al., 1992; Vanneste et al., 2019).

The following sections attempt to answer some of the questions that an audiologist may have about mindfulness and provide possible resources to audiologists who work directly with patients suffering from the effects of tinnitus.

Defining Mindfulness

“Mindfulness” is a type of meditation. Meditation can be defined as continued or extended thought, reflection, or contemplation. The word originates from the Latin root *meditationem* meaning “a thinking over” (Random House, 2021, section 2). Meditation is also defined as a “continuous and profound contemplation or musing on a subject or series of subjects of a deep or abstruse nature” (IXL Learning, 2022, section 2).

The mind needs to be calm and focused in order to meditate and give contemplation or reflection. The average number of thoughts per day for adults has been speculated about in the literature with varying numbers. One recent research article suggests that an adult human has on average 6,000 thoughts per day, with many of those thoughts being repeated or linking to a multitude of different thoughts (Tseng & Poppenk, 2020). With multiple thoughts every day, it can make it difficult to concentrate because most of these thoughts tend to be cyclical. When thoughts are repeated several times throughout the day, caused by rumination/worry, anxiety, depression, or even isolation, the ability to slow down and relax, reflect, or even concentrate, can become difficult due to the constant distraction. Maladaptive habits and behaviors can be created by this constant rumination on thoughts (Segal et al., 2002).

The use of “meditation” offers a way to focus a person’s thinking to help calm the ever ebbing and flowing thoughts. But to go a step further, the use of “mindfulness” takes the ever ebbing and flowing thoughts and reduces the emotion(s) associated with them. The use of mindfulness teaches the brain to identify the presence of the thought but attaches no negative or

positive association to it, and then guides the brain back to focusing or re-centering back to the breath. By reducing the attachment of emotions to thoughts, the brain is able to focus attention on whatever arises in thought and simply just observe that a thought is present at that moment in time.

When difficult or painful thoughts occur, mindfulness teaches compassion as an important component when observing the thoughts. In Asian languages, the words for “mind” and “heart” are the same, giving rise to “self-compassion” to what is happening in the moment (Kabat-Zinn, 2013). Self-compassion is composed of self-kindness (grace and understanding towards oneself in times of pain and failure), common humanity (one’s experience is not separate and isolated, but part of a larger human experience that is shared by many), and mindfulness (balancing painful thoughts and feelings without over-identifying with them; Neff, 2003).

The mere presence of thoughts is valued through cultivation of mindfulness by awareness of cognitive, emotional, and physical processes. Kabat-Zinn (2013) calls this a “present-moment awareness.” This “present-moment awareness” helps to decrease maladaptive habits and reactions and create a psychological flexibility, which is another key component in mindfulness (Kabat-Zinn, 2013). “Present-moment awareness” cultivates a way to purposefully pay attention by being more responsive and noticing more through paying attention to the moment and not focusing on the past or future. The rationale is based upon the observation that the “present moment” is the only time that the body can learn, experience all the senses, express love, and communicate simultaneously. Kabat-Zinn (2013) notes that the body is in the present and so should the mind be. Focusing on the present moment also offers a better connection with the body to better accept bodily pain and lower stress and creates connection with others, generating

more community harmony, compassion (including self-compassion), improved focus, and reduction in the constant cycling of brain chatter.

Mindfulness practices can be used in a formal or informal practice approach. Formal practice involves meditation only, in which the mind is only focused on the meditative technique, with an intentional commitment of time. Types of meditative techniques can be done in various ways (i.e., sitting down, body scan, mindful movement, mindful yoga, etc.). These formal practices occur on a regular basis and have varying periods of time depending on the type of meditative technique. These practices start with small meditation time frames and increase as the mind adapts to concentrating for longer periods of time. However, informal practice aims at “cultivating a continued awareness in all activities of daily living” (Kabat-Zinn, 2003, p. 147). The informal practices involve developing awareness in the present moment through body sensations, sensory inputs, and thoughts during day-to-day activities, such as while eating, walking, or brushing the teeth (Kabat-Zinn, 2003). Informal mindful practices are taking the meditation used in formal practice and applying it to circumstances, events, and activities, in everyday life.

Mindfulness takes patience and time to develop with continued practice over time. This practice “is better understood as a way of being, a way of seeing, which is embodied, inhabited, grown into, through the implementation of the methods and techniques that comprise the discipline,” without the expectation of anything specific (Kabat-Zinn, 2003, p. 148). The practice of mindfulness is typically cultivated through a structured course in a mindfulness training program.

Determining if Mindfulness is Appropriate

The research reviewed in Chapter II of this manuscript showed the benefits of incorporating mindfulness into a professional healthcare setting, benefits of mindfulness in reducing negative reactions, as well as the preliminary benefits of mindfulness for those who have tinnitus. However, determining the appropriateness of mindfulness for a patient requires consideration of several important factors while being cognizant of contraindications to considering mindfulness as a tinnitus management option. A few of these considerations are listed in Table 4. Audiologist and/or patient responses to these questions may help to determine if mindfulness would be appropriate to recommend for a patient. However, some responses may need to be addressed by other members of a multidisciplinary team if they fall outside of the clinician's scope of practice.

Table 4*Audiologist Considerations for Implementation of Mindfulness in the Management of Tinnitus*

Audiologist Questions	Possible Success of Mindfulness
What are the patient's main frustrations with tinnitus (i.e., annoyance, sleep deprivation, frustration, etc.)?	Sleep deprivation, stress, anxiety, and the reduction of tinnitus distress have been shown to be reduced with mindfulness (Gans et al., 2014; Hoge et al., 2013; Ludwig & Kabat-Zinn, 2008; McKenna et al., 2014; Philippot et al., 2012; Shapiro et al., 1998; Teasdale et al., 2000).
What is the patient's motivation for reducing their perception of tinnitus?	
Is the patient familiar with other tinnitus management approaches?	Those who participated in a mindfulness therapy group showed significant improvements in tinnitus severity, patient's state of mind, and awareness of tinnitus in those who had tried other management options (i.e., hearing aids, maskers, background music; Arif et al., 2017).
What has the patient tried in the past to help reduce their perception of tinnitus?	
Has the patient been successful with any management options to reduce their perception of tinnitus?	
What does the patient hope to gain from a tinnitus management option?	Long-term benefits in the reduction of tinnitus annoyance and awareness, increased QoL, and reduction of mood disturbances (Gans et al., 2014, 2015).
What kind of time commitment will the patient be able to commit to?	Mindfulness-based stress reduction (MBSR) is typically an 8-week class with recommended daily practice (Kabat-Zinn, 1982) This may be difficult for those who feel that they do not have that kind of time commitment; however, mindfulness skills are developed in these classes so that they can become integrated into daily life easily (Gans, 2010; Kabat-Zinn, 1982, 2013).

There may be contraindications to the appropriateness of mindfulness. Assessing potential harm from mindfulness-based programs is important because prevention of harm is a primary ethical duty (Baer et al., 2019). Baer et al. (2019) stated that when harm is understood, improved treatment methods can be created. Using mindfulness may elicit reflection on

challenging and difficult experiences and this is more likely to occur when practiced at higher intensities or when intentionally bringing attention towards the difficult experiences. Britton et al. (2021) evaluated harm in mindfulness-based programs by assessing meditation-related side effects and lasting bad effects in 96 participants who recently participated in an 8-week mindfulness-based cognitive therapy program. Side effects were termed as any effects not intended from the goal of the treatment. Increased risk of lasting “bad effects” was found in those who reported executive dysfunction, insomnia, emotional blunting, self-disturbance, and dysregulated arousal (dissociation and hyperarousal). The lasting “bad effects” were found in 6% to 14% depending on the duration of the effects reported from one week to up to 5 months after the 8-week mindfulness-based cognitive therapy program. Those who experienced a lasting “bad effect” practiced informal mindfulness more frequently than formal mindfulness.

To determine if a mindfulness-based program is appropriate for a patient, considerations of the answers to the questions in Table 4 as well as understanding of potential contraindications are essential to potential patient success. Determination is also dependent upon knowledge of what a mindfulness-based program’s foundation is.

Mindfulness-Based Stress Reduction Program

“Mindfulness-based stress reduction” (MBSR) is a formal mindfulness program that was created by Jon Kabat-Zinn in 1979 and was first offered through the University of Massachusetts Medical School (Kabat-Zinn, 1982). Other mindfulness programs have been developed that share the same basic program structure as MBSR, but some components in the program are further specialized to focus on and treat specific populations (Creswell, 2017). These programs include but are not limited to mindfulness-based cognitive therapy (MBCT; Teasdale et al., 2000), mindfulness-based relapse prevention (MBRP; Bowen et al., 2014), and mindfulness-

based relationship enhancement (MBRE; Carson et al., 2004). Evidence supporting use of the MBSR program has grown from a single RCT study conducted during the years 1995 to 1997 to 216 RCT studies from 2013 to 2015 (Creswell, 2017). A typical MBSR program is constructed within an 8-week course that can be delivered in person or through an online model. An MBSR program is designed to be free of cultural, religious, or ideological factors in order to create an environment that is focused on relieving suffering in the body and the mind while understanding the mind/body connection (Kabat-Zinn, 2003).

Mindfulness-based stress reduction classes are designed to be small so that there can be an appropriate focus from the instructor to the student. Each week of instruction typically consists of a 2.5-hour class in one day, along with a single full-day retreat that occurs between the sixth and seventh week of the program and lasts around 7.5 hours. Daily homework assignments are given each week that should take around 45 to 60 minutes to complete. These will include meditative techniques as well as possible journaling or reflection assignments (Creswell, 2017; Gans, 2010; Kabat-Zinn, 2013).

Mindfulness-based stress reduction classes are designed to encourage a degree of responsibility for the well-being of one's mind and body and to cultivate an "innate capacity for paying attention and for a deep, penetrative seeing/sensing of the interconnectedness of apparently separate aspects of experience, many of which tend to hover beneath our ordinary level of awareness regarding both inner and outer experience" (Kabat-Zinn, 2003, 149). The main topics of an MBSR course are compassion, psychological well-being, psychological distress, emotional-cognitive control, and mindfulness (Roca et al., 2019). Content within these five main topics may include guided meditation practices, body-scanning, breathing exercises, assumptions, reactions, attention, application and integration of mindfulness, resilience, and

self-reflection. Completion of a mindfulness course does not mean one will never have distracting thoughts or over-identification and attachment to one's thoughts. Successful completion would mean that one would have better strategies for facing distracting or distressing thoughts and negative reactions in a day-to-day context and be better equipped to handle stressors. Successful completion would also mean that one would be more present in the moment regardless of the situation.

Finding and Evaluating Mindfulness-Based Stress Reduction (MBSR) Programs

To find a credible MBSR program for a patient, simply searching “mindfulness programs” may give too many options to choose from. Start with a known credible source to limit your search. The University of Massachusetts Medical Center may be a great place to start, as it is where MBSR originated (UMass Memorial Health, 2021b). An MBSR program through universities or healthcare providers may also be another option due to their healthcare connection and ethical responsibilities. These entities may offer in-person sessions, online courses and/or courses in other languages. A good MBSR program's website may share resources about mindfulness, help with finding a qualified mindfulness instructor, offer their own classes, answer common mindfulness questions, and may even provide information on how to become certified to teach mindfulness.

When evaluating other MBSR programs through their websites, it is important to not only look at the content provided on the website but other key factors too, as content on the Internet is not regulated. Things that signal a high-quality website are resources for research, no grammatical or spelling errors, footnotes, bibliographies, or reliable references to verify information, credentials of who published the page, publication by a known organization,

affiliation with a university, contact information, unbroken links, domain name (i.e., .gov), and a current date of publication or updated website (U.S. Department of Health and Human Services, 2011).

Mindfulness-Based Stress Reduction Instructor Training

To teach MBSR, a mindfulness instructor must be trained. Instructor qualifications vary among MBSR programs. Qualification credentials are not mandated or regulated. Each program may have its own standards of practice but will likely require the instructor to have taken an MBSR course prior to teaching it. The International Mindfulness Teachers Association (IMTA) is one organization that is attempting to regulate/standardize practice guidelines for MBSR for individual consumers and for those wanting to teach MBSR (IMTA, 2020).

The recommended minimum requirement to become eligible for advanced training as a mindfulness instructor is to have completed a beginner 8-week MBSR program (Kabat-Zinn, 2003; UMass Memorial Health, 2021b). The beginner course would be suitable for a patient who suffers from the effects of tinnitus. This course would also be suitable for a clinician who is wanting to implement a mindful attitude or informal practice into their work. Completion of a beginner MBSR requirement will enable them to pursue additional training to become a mindfulness instructor and begin a teaching program through a university, healthcare organization, or stand-alone MBSR certification course. This advanced instructor training would be suitable for those wanting to personally teach MBSR to individuals. The IMTA offers a 200-hour professional level certification (IMTA, 2020). The IMTA professional level certification and other MBSR advanced instructor training courses may include courses guiding instructors in the mechanics of teaching introductory programs and applications of MBSR in medicine and science and opportunities to build their teaching skills through practice as well as completion of

an advanced practice retreat. Once these courses are completed, the instructor will become certified and may teach their own MBSR course that could be found in multiple practice settings (i.e., private practice, medical office, hospital, universities, etc.)

Mindfulness-based stress reduction program instructors should practice mindfulness in their own lives to be authentic (Kabat-Zinn, 2003). An instructor must have extensive personal practice with mindfulness to offer appropriate energy, authenticity, and relevance. Authenticity will come from extensive personal practice and discipline and does not occur with brief encounters of mindful meditation or through readings and course instruction. To have a mindful attitude is an ongoing effort that is developed, refined and maintained over time.

Audiology Resources for Patients with Tinnitus

Patient retention of information is often very low following an appointment with a healthcare professional (Kessels, 2003). Although, retention of information could be dependent upon other factors (i.e., patient age, education, encounter length, clinician's communication skills, etc.) the information correctly recalled is less than one-fifth of the total information received in a medical appointment with 40% to 80% of that information immediately forgotten (Jansen et al., 2008; Kessels, 2003).

To help with retention of information, the author has created resources that can be found in the Appendices of this manuscript, with the hope that they will be used to provide patients easy access to information that may not have been retained after their appointments. These resources can be used in addition to educational counseling on tinnitus and mindfulness that an audiologist would provide in-person to the patient. The handouts could be provided to patients while they wait in the office or to take home for reference after an appointment. They with

someone else following the counseling session. Further tailoring and adaptation of the handouts may be useful for other disciplines who may have patients who experience bothersome tinnitus.

Tinnitus Education

Audiologists who have patients who suffer from the effects of tinnitus may benefit from general tinnitus education (Thompson et al., 2017). In Appendix A, the “Tinnitus Education Handout” provides information about what tinnitus is, causes of tinnitus, symptoms of tinnitus, information that an audiologist may want to know about the patient and their perceived tinnitus, as well as some general management options. The information presented in the sample “Tinnitus Education Handout” is integrated from the tinnitus information found on websites for the American Speech-Language-Hearing Association (ASHA, 2021), the American Academy of Audiology (AAA, 2021), American Tinnitus Association (ATA, 2021), the National Institutes of Health (NIH; U.S. Department of Health and Human Services, 2017) and National Center for Rehabilitative Auditory Research (NCRAR; The Department of Veterans Affairs, 2021).

Tinnitus Education Websites

A general search of “tinnitus” on a web browser will bring up numerous websites. The need to find a website that has factual information is important for a patient who suffers from the effects of tinnitus. Found in Appendix B, the “Tinnitus Websites Handout” lists websites that provide a thorough overview of tinnitus from credible sources. Several websites were included on the “Tinnitus Websites Handout,” as each website may offer a different perspective point on tinnitus. The characteristics of desirable websites were previously described in the section above titled “Finding and Evaluating MBSR Programs.” These guidelines were used in the selection and review of each website that is listed on the “Tinnitus Website Handout” in Appendix B (U.S. Department of Health and Human Services, 2017).

Mindfulness Education

To this point, the information presented here suggests that a management approach to tinnitus through mindfulness may be beneficial for a patient who suffers from the effects of tinnitus. In Appendix C, the information presented in the “Mindfulness Handout” presents a quick summary description of mindfulness, how stress can affect the brain, and what mindfulness can do to counteract those negative effects on the brain, as well as some quotes from some influential mindfulness creators. The patient should be advised that these are not specific to tinnitus but apply to mindfulness in general.

Mindfulness Education Websites

The guidelines for finding high-quality websites also apply to the review and inclusion of websites considered for the “Mindfulness Websites Handout” (Appendix D). The websites listed in Appendix D provide information on what mindfulness is, as well as beginner ways to practice mindfulness, benefits of mindfulness, and links to finding information and registering for an MBSR course, along with links to assist in locating a mindfulness instructor. Mindfulness websites include information from Mindful Communications and Such, PBC (2021), Greater Good Magazine (2021), UMass Memorial Health (2021a), and Gans (2015).

Mindfulness Exercises

The information found in the “Mindfulness Exercises Handout” does not represent all mindfulness exercises (Appendix E). The exercises presented offer introductory ways to focus and bring awareness to sensations while being present in the moment. The exercises were adapted from mindfulness exercises recommended by the Mayo Clinic (Mayo Foundation for Medical Education and Research, 2020), Healthline (Gotter, 2020), Harvard Medical School (2021), and Headspace Inc (2021) websites on mindfulness.

Summary

Those who suffer from the effects of tinnitus may develop maladaptive behaviors and have increased tinnitus symptoms (i.e., anxiety, sleep disturbances, depression, etc.). Successful implementation of “mindfulness” can teach the brain to identify the presence of a thought without attaching a negative or positive emotion to reduce maladaptive behaviors and habits (Kabat-Zinn, 2013; Segal et al., 2002). If determined appropriate for a patient, mindfulness may provide sustained benefits (Gans et al., 2015). Even if implementation of an MBSR program is not feasible for audiologists to offer in their clinics, the use of mindfulness handouts to aid in tinnitus management may be beneficial. Resources that could be provided for patients with bothersome tinnitus are found in the Appendices A through E.

CHAPTER V
SELF-REFLECTION ON PARTICIPATION IN A
MINDFULNESS-BASED STRESS REDUCTION
COURSE

While researching the areas of mindfulness for this manuscript, I successfully completed a “mindfulness-based stress reduction” (MBSR) course offered by a local university to better understand what a mindfulness program might offer patients and to experience the potential benefits personally. The information that was provided during this course covered many topic areas, with a focus on oneself as well as focus on compassion and kindness towards others. The content presented throughout the course is outlined below in Table 5. This MBSR course was a generic course that focused on the body as a whole. It had no specific treatment modality.

Table 5*Topic Outline from Mindfulness-Based Stress Reduction Course*

Module	Main Content	Sections Within Each Module	Important Content within Each Section
1	Creating mindful habits	Our habits of mind Coming to our senses Fundamentals of practice Mindful STOP Breath awareness	<ul style="list-style-type: none"> • Anchor yourself in the present (not the past or the future) • Present moment is the only time we learn, can express love, be in our present body, only time we can see, hear, touch, taste, smell, communicate • Suffering comes from wanting things to be different than they are
2	Responding to stress	The psychology of stress The physiology of stress Breathing techniques	<ul style="list-style-type: none"> • How to make stress your friend • Body response to stress • Changing how the body responds to stress • Responding vs. reacting • Rewiring the brain
3	Rewiring our brains	Our negativity bias Awareness of sensations The power of thoughts Labeling thoughts Seeding positivity HEAL by taking in the good	<ul style="list-style-type: none"> • Emotion's life span is about 15 minutes • Thoughts keep emotions circling • Thinking mind vs. observing mind • Interrupting negative thoughts • Positive neuroplasticity vs. positive thinking • Power of gratitude

Table 5 (continued)

Module	Main Content	Sections Within Each Module	Important Content within Each Section
4	Emotional resilience	Going beneath the storm Walking meditation The emotion of fear Anxiety and depression Meditative exercises	<ul style="list-style-type: none"> • Relating to emotional pain • Acceptance of emotional fear • Body perceptions of threat • Psychological effects of fear • Name it to tame it
5	Coping with pain and loss	Interrupting the pain cycle Body scan exercise Tracking daily changes Accepting aging and loss Befriending the changes	<ul style="list-style-type: none"> • Releasing control • Choices in responding to pain • Damaging “fix it” mentality
6	Authentic connection	The gift of presence Mindful listening Self-compassion Heart breathing exercise	<ul style="list-style-type: none"> • Attentional capacity • Ability to pay attention and sustain attention • Allowing for space to be seen, heard, and understood • Being in touch with the inner experience
7	Widening our circles of compassion	The heart of the matter Compassion meditation A wise society Tonglen meditation Lovingkindness Circle of lovingkindness	<ul style="list-style-type: none"> • Barriers and benefits to compassion • Empathy • Self-criticism • Self-compassion • Factors that influence happiness • Development of positive emotions • Sense of feeling that you are enough • Spreading compassion into the community

This course was offered through the university's online course platform. The instructor was a medical anthropologist. A medical anthropologist examines "how the health of individuals, larger social formations, and the environment are affected by interrelationships between humans and other species; cultural norms and social institutions; micro and macro politics; and forces of globalization as each of these affects local worlds" (Society for Medical Anthropology, 2018, paras. 2). The instructor had been practicing mindfulness since 2003. In 2012 she completed an MBSR program to incorporate mindfulness into her community work and university teaching. She further developed a 15-week online mindfulness class that was implemented at another university in 2015. These accomplishments provided for an authentic experience, which truly made me feel that she was knowledgeable and passionate about mindfulness.

The online course that I experienced was delivered with a self-paced design. While the availability of the online offering was very beneficial for my schedule, I found that trying out some of the activities, such as breathing techniques and meditation, was harder without having an instructor physically in front of me. One way the instructor attempted to make up for this deficiency was by offering additional resources, for example, a written summary of how the techniques were to be performed and videos demonstrating the techniques. The self-paced format at first seemed like it would be beneficial; however, it turned into "I'll get to it later" as the COVID-19 pandemic, graduate school, and general life took precedence. This self-paced format may in fact be more beneficial to some, but for me, structure is important. I began the course in the spring of 2019 and finished in the fall of 2020. I completed the first two modules in two weeks as it was recommended that each module be completed in a week's time with a total of 7 weeks altogether. A traditional MBSR course lasts 8 weeks. I then took several months off with the start of the pandemic. Trying to get back into it, I picked up where I left off and completed

the next two modules in a month. However, with the time gap between the first couple of modules and the second couple, I didn't feel as though I was gaining the benefits as I should. I did not practice what I had learned in the beginning and so it didn't feel authentic. Again, I took time away from it and then, at the beginning of fall 2020, I committed to finishing all 7 modules in 7 weeks' time and truly took the time to practice each evening. I appreciated the continued availability of the course over the extended time period.

While the content encompassed many different topics and provided a lot of information, I felt that finishing it in 7 weeks was rushed. I did not feel like there was time to complete the activities required. I felt like there should have been less content provided each week and that another week could have been added on. However, I did feel that I learned a lot through lecture and self-practice. In my personal life, I felt more present in moments that I had not been before.

This course also required keeping an activity journal to write down the things that I learned and serve as a way to take note of the differences in my mindfulness practices and emotional reactions along the way. My activity journal was submitted to the professor at the end of each section. Multiple journals were submitted within the 7 modules (18 sections within 7 modules). While I feel that having an activity journal to keep track of course information and progress was personally useful, the lack of professor review was not beneficial. The need for instructor interaction to know whether I was on track with my progress was indeed warranted, as I did not fully know if I was progressing as I should or if I was fully understanding the content in each module. I would suggest that when an audiologist is looking into a mindfulness-based program for patients to attend, they should keep in mind what the instructor's involvement may be as some patients may prefer a more hands-on face-to-face program and more immediate feedback.

Takeaways From A Mindfulness-Based Online Course

While I did not go into this program with a set of goals to accomplish or a set of benefits to obtain, I did come out with a better understanding of myself and how to better respond to stressful situations, an understanding of the processes that occur within my body through fear, stress, anxiety, and depression, and knowledge of how to be more aware and present in the moment and more self-compassionate. A year later, I have found that I have retained some bits of information that I learned in the course, mostly in the form of informal mindful practices. In these instances, I find myself using mindfulness informally with better focus on one thing at a time, being more present in the moment, and offering more compassion towards others in my work setting. That said, I know that I have not retained as much information as I would have liked. I do not formally practice mindfulness as often as I should. Because of this, I feel that a booster training session would be beneficial to help motivate me to practice formally more often than I currently do. I also feel that having a local community to practice mindfulness with would be helpful. Because this course was offered online, I did not have the opportunity to meet others who have the same interest in mindfulness. I feel that could be a potential hinderance to continue practicing mindfulness for others who need that community support.

For an audiologist, recommending a mindfulness-based program that focuses on tinnitus could potentially provide a patient with tinnitus with information on how the body responds to the stress of the perceived tinnitus, how to find ways to attend to the present moment (i.e., being aware of the food their eating, the feeling of water, the smell of baked cookies, etc.) instead of attending to the sound of their tinnitus, and how to offer themselves self-kindness. An MBSR course focused on tinnitus is available through an online format instructed by Dr. Jennifer Gans who did some preliminary research on managing tinnitus through mindfulness that is described

in the literature review in Chapter II (Gans et al., 2014, 2015). The MBSR course that she offers was researched and developed at the University of California San Francisco and focuses on bringing awareness to the “experience with tinnitus, approaching it with acceptance, compassion, openness, and even curiosity” and seeks to “help participants learn to free themselves from the endless internal monologue about living with tinnitus. . . . It provides a way out of this endless cycle of regret and anxiety that can actually be as upsetting as the sounds themselves” (Gans, 2015, paras. 6-7). The introductory cost of this program is \$225, with a retail value of \$845.00. An MBCT in-person course was found on the British Tinnitus Association website (McKenna & Marks, 2019). This course is given at the Royal National Throat Nose and Ear Hospital by Dr. McKenna and Dr. Marks whose research study on MBCT was presented in Chapter II (McKenna et al., 2018). Further research on mindfulness courses with a focus on tinnitus did not yield any other results,

While there are some differences in what is concentrated on through a general MBSR course and an MBSR course focused on tinnitus, preliminary research has shown benefits with both types of MBSR for patients suffering from the effects of tinnitus (Arif et al., 2017; Gans et al., 2014, 2015; McKenna et al., 2018; Philippot et al., 2012; Roland et al., 2015). This suggests that if an audiologist recommends using mindfulness in conjunction with other management options or as the sole management option (when evidence becomes stronger in the area of mindfulness and tinnitus), either a general MBSR course or an MBSR course focused on tinnitus will be beneficial. The mindfulness concepts found in either type of course can potentially give patients with tinnitus a reprieve from the tinnitus, reminding them that there is more to be aware of and giving their brains a potential chance to rewire in terms of their personal response to the perception of tinnitus.

Further research in the areas of mindfulness and tinnitus could focus on the benefits of mindfulness by asking the following questions: Does mindfulness offer a reprieve from tinnitus when learning how to attend to the present moment? Does learning about self-kindness offer a reduction in the perception of tinnitus or acceptance of the tinnitus? Does understanding how the body responds to stress provide a reduction in the patient's response to tinnitus? To provide maximum benefit, does a patient with tinnitus need to understand multiple mindfulness techniques and strategies?

Overall Summary

How best to manage the large number of patients with tinnitus has been a longstanding question. There are numerous management options available to select from when attempting to reduce the negative effects of tinnitus that a patient experiences. Tinnitus is a very common complaint, with approximately one in ten adults having tinnitus (ATA, 2021). There is a need for an evidence-based management option tailored to specific patient groups due to the diverse and complex manifestations of tinnitus in these patients. Higher rates of tinnitus are seen in those with exposure to loud noise; however, tinnitus can still occur in those with normal hearing sensitivities. The overall economic cost of tinnitus is upwards of \$26 billion annually with an annual aggregate cost of \$1.5 billion awarded to veterans (ATA, 2021). With such a big financial consequence, the need to find a cure for tinnitus is warranted.

Tinnitus is complex. Research into the theoretical pathophysiology of tinnitus suggests that both the auditory system (Han et al., 2009; Jastreboff, 1990) and the brain (Allan et al., 2016; Boyen et al., 2013; Noreña & Eggermont, 2006) each play a role in tinnitus. Tinnitus parallels models of pain perception in that both bothersome tinnitus and chronic pain are

phantom symptoms, and both occur from the reorganization of the central nervous system (Møller, 2000; Trevis et al., 2016; Vanneste et al., 2019).

Patients with tinnitus may manifest negative changes in physical health, psychological health, and quality of life. They may experience tinnitus-related distress, negative thoughts about tinnitus, and negative mood states. These consequences of having tinnitus drive the design of tinnitus management approaches. There are several factors (i.e., comorbidities, stress, depression, anxiety, financial burdens) that could influence the success of tinnitus management, especially when one considers the variation of symptoms present within and between patients with tinnitus. The diverse and complex nature of the disorder has resulted in a number of tinnitus management options that are available, but not all are universally applicable.

Regardless of the choice of a tinnitus management approach, there are clinical challenges. These challenges can be complicated for audiologists as tinnitus-related complaints vary and can be complex. There is a lack of objective, diagnostic measures of tinnitus in humans. There are many gaps in the literature regarding successful management of tinnitus. Several factors including unclear definitions of tinnitus, unclear pathophysiology of tinnitus, diverse characteristics of tinnitus, lack of RCTs, small sample sizes, and lack of funding have contributed to these gaps (Agency for Healthcare Research and Quality, 2019; McFerran et al., 2019). Further, access to trusted information can create a clinical challenge since some studies could potentially mislead readers due to the way the research is reported (“spin;” Velde et al., 2021). Other influential factors include a lack of adequate training in the area of tinnitus for healthcare professionals. Additionally, because there are almost 60 different management options reported in the literature for tinnitus, audiologists will probably not be familiar with all the possible tinnitus management approaches, including mindfulness (Zenner et al., 2017).

The AAO-HNSF tinnitus guidelines were developed to help manage the effects of tinnitus with tinnitus education, sound therapies, hearing aids, and/or CBT, which were all identified as evidence-based management options in the literature (Henry et al., 2005; McNeill et al., 2012; Saltzman & Ersner, 1947; Tunkel et al., 2014; Zenner et al., 2017). Other management options such as ACT, TRT, and PTM have also been found to be effective (Baracca et al., 2007; Bauer et al., 2017; Henry et al., 2017; Westin et al., 2011). Mindfulness was not included in the AAO-HNSF guidelines, likely due to the limited number of studies investigating this technique.

The fundamentals of mindfulness and mindfulness programs are rooted in Buddhist meditative practices to help reduce the cycle of thoughts that are caused by rumination/worry, anxiety, and depression, which can cause maladaptive habits and behaviors (Gans, 2010; Segal et al., 2002). Mindfulness can be used to train the brain to identify the presence of a thought without giving it an emotional attachment to help reduce maladaptive habits and behaviors (Kabat-Zinn, 2013; Neff, 2003.) Mindfulness further cultivates a way to purposefully pay attention to give rise to self-compassion (Kabat-Zinn, 2013). There is strong evidence for the use of mindfulness in disorders that parallel tinnitus (i.e., depression, anxiety, chronic pain, stress; Hoge et al., 2013; Kabat-Zinn, 1982; Ludwig & Kabat-Zinn, 2008; Segal et al., 2002; Shapiro et al., 1998; Teasdale et al., 2000). Research into the effectiveness of implementing a mindfulness-based program for the management of tinnitus has begun with preliminary results being promising (American Speech-Language-Hearing Association, 2021; American Tinnitus Association, 2021; Arif et al., 2017; Gans et al., 2014, 2015; McKenna et al., 2018; Philippot et al., 2012; Roland et al., 2015).

Preliminary results of taking a general MBSR course or an MBSR course focused on tinnitus have shown a decrease in tinnitus distress, psychological distress, tinnitus awareness,

negative emotion, irritability, and rumination, as well as improvements with tinnitus acceptance, and an increase in functional connectivity of the neural attention networks (Arif et al., 2017; Gans et al., 2014, 2015; McKenna et al., 2018; Philippot et al., 2012; Roland et al., 2015).

Audiologists should follow clinical guidelines for the management of tinnitus and continue to monitor the research literature as evidence-based practice evolves. Using mindfulness as an evidence-based practice is not recommended at this time because evidence is not as strong as for other management options; however, results from preliminary studies are encouraging and suggest potential benefits for patients with tinnitus. Audiologists may offer mindfulness as an adjunct to other therapies recognized in professional practice guidelines until evidence is stronger (Creswell, 2017; Gans, 2010; Gans et al., 2014; McKenna et al., 2018; Tunkel et al., 2014).

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APPENDIX A
TINNITUS EDUCATION HANDOUT

TINNITUS

“tin-EYE-tus” or “TIN-uh-tus”

WHAT IS TINNITUS?

Commonly referred to as a “ringing in the ears.” It is the perception of sound when no external sound is present. It can be perceived as loud or quiet and in one or both ears. It can sound different to different people (ringing, buzzing, chirping, crickets, humming, static, etc.).

IS TINNITUS COMMON?

It affects approximately 1 in 10 adults in the United States. Around 50 million American adults have tinnitus. It is found more commonly in males than females and has a peak occurrence around 60-69 years of age, however any age can experience tinnitus.

WHY DOES TINNITUS OCCUR?

Tinnitus can have many causes. Some causes are unknown. Some causes could be exposure to loud sounds, hearing loss, head injury, medications, ear wax, or even a number of health conditions.

IS THERE A CURE?

The symptoms of tinnitus may be different in each individual. This means that the exact known cause of tinnitus may be hard to identify. This results in no known cure, however scientists around the world are looking for a cure.

IS TINNITUS PREVENTABLE?

In some cases, tinnitus may be prevented by protecting your hearing when exposed to loud sounds. Protecting your hearing from loud sounds may also help prevent your tinnitus from worsening.

COMMON SYMPTOMS OF TINNITUS

Some common symptoms of tinnitus may include anxiety, depression, sleep disturbances, annoyance, irritability, distress, frustration, lack of joy, anger, difficulty relaxing, concentration difficulties, etc. Others may merely notice the presence of tinnitus but not emotionally react to it.

CAN ANYTHING HELP THE PERCEPTION OF TINNITUS?

If hearing loss is present, using hearing aids may help reduce the perception of tinnitus by stimulating the auditory pathways and providing distraction to the brain. Managing the reactions to tinnitus may also help reduce the perception of tinnitus.

HOW DO THEY MEASURE TINNITUS?

There is no direct measurement of tinnitus because it is something that is only perceived by the patient. However, an audiologist will be able to provide more information on tinnitus by asking questions about the perceived tinnitus. These questions may include:

- What does the tinnitus sound like to you?
- Is it in one ear or both?
- How long have you experienced tinnitus?
- Does the tinnitus sound change?
- Is there anything that makes your tinnitus worse or better?
- Does it affect your sleep, work, daily life?

MANAGEMENT OPTIONS

Management options may include hearing aids, use of sounds playing in the background (such as a fan, white noise, music, or ocean waves), or therapies (mindfulness, cognitive behavioral therapy, acceptance and commitment therapy, progressive tinnitus management). Talk with your audiologist about the different management options that may be available, and which approach they think would be beneficial for you.

Created by Trista Ann Hauser-Smith. Sources included: American Speech-Language-Hearing Association, American Academy of Audiology, American Tinnitus Association, National Institutes of Health and the National Center for Rehabilitative Auditory Research

APPENDIX B
TINNITUS EDUCATION WEBSITES HANDOUT

TINNITUS EDUCATION WEBSITES

AMERICAN SPEECH-LANGUAGE-HEARING ASSOCIATION — ASHA

[HTTPS://WWW.ASHA.ORG/SITEASSETS/UPLOADEDFILES/AIS-TINNITUS.PDF](https://www.asha.org/siteassets/uploadedfiles/ais-tinnitus.pdf)

[HTTPS://WWW.ASHA.ORG/SITEASSETS/UPLOADEDFILES/AIS-TINNITUS-POSTER.PDF](https://www.asha.org/siteassets/uploadedfiles/ais-tinnitus-poster.pdf)

AMERICAN ACADEMY OF AUDIOLOGY — AAA

[HTTPS://WWW.AUDIOLOGY.ORG/CONSUMERS-AND-PATIENTS/HEARING-AND-BALANCE/TINNITUS/](https://www.audiology.org/consumers-and-patients/hearing-and-balance/tinnitus/)

AMERICAN TINNITUS ASSOCIATION — ATA

[HTTPS://WWW.ATA.ORG/UNDERSTANDING-FACTS](https://www.ata.org/understanding-facts)

NATIONAL INSTITUTES OF HEALTH — NIH

[HTTPS://WWW.NIDCD.NIH.GOV/HEALTH/TINNITUS](https://www.nidcd.nih.gov/health/tinnitus)

NATIONAL CENTER FOR REHABILITATIVE AUDITORY RESEARCH — NCRAR

[HTTPS://WWW.NCRAR.RESEARCH.VA.GOV/DOCUMENTS/TINNITUSQA.PDF](https://www.ncrar.research.va.gov/documents/tinnitusqa.pdf)

APPENDIX C
MINDFULNESS EDUCATION HANDOUT

MINDFULNESS

“SIMPLY PUT, MINDFULNESS IS MOMENT-TO-MOMENT NON-JUDGMENTAL AWARENESS. IT IS CULTIVATED BY PURPOSEFULLY PAYING ATTENTION TO THINGS WE ORDINARILY NEVER GIVE A MOMENT’S THOUGHT TO. IT IS A SYSTEMATIC APPROACH TO DEVELOPING NEW KINDS OF AGENCY, CONTROL, AND WISDOM IN OUR LIVES, BASED ON OUR INNER CAPACITY FOR PAYING ATTENTION AND ON THE AWARENESS, INSIGHT, AND COMPASSION THAT NATURALLY ARISE FROM PAYING ATTENTION IN SPECIFIC WAYS.”

—JON KABAT-ZINN, *FULL CATASTROPHE LIVING*

MINDFULNESS IS ACCEPTING WHAT IS IN THIS MOMENT AND LETTING GO OF THE DESIRE TO CONTROL EVERYTHING. IT IS AN INTENTION TO SPEND MOMENTS ANCHORED TO THE PRESENT MOMENT WITH AN OPEN HEART AND MIND WHILE BEING RECEPTIVE AND CURIOUS.

“MINDFULNESS IS OFTEN DESCRIBED AS A BELL THAT REMINDS US TO STOP AND SILENTLY LISTEN.” —THICH NHÁT HANH, *SILENCE: THE POWER OF QUIET IN A WORLD FULL OF NOISE*

“MEDITATION IS NOT PASSIVE SITTING IN SILENCE. IT IS SITTING IN AWARENESS, FREE FROM DISTRACTION, AND REALIZING THE CLEAR UNDERSTANDING THAT ARISES FROM CONCENTRATION.” —THICH NHÁT HANH, *PRESENT MOMENT WONDERFUL MOMENT*

STRESS IMPAIRS THE BRAIN CELLS’ ABILITY TO TRANSPORT AND USE GLUCOSE WHICH CAUSES THE CELLS TO BE LESS RESILIENT AND VULNERABLE TO DAMAGE. IN TURN THIS CAN LEAD TO NEGATIVE EFFECTS ON THE ABILITY TO LEARN, MEMORY, AND MOOD. CHRONIC STRESS CAN LEAD TO STRENGTHENED CONNECTIONS BETWEEN THE AMYGDALA AND HIPPOCAMPUS CAUSES INCREASED “FIGHT, FLIGHT, OR FREEZE MODE” WITH LESS ABILITY TO CALM DOWN AND CAUSES MORE NEGATIVE REACTIONS. MINDFULNESS INCREASES THE CONNECTIVITY BETWEEN THE PREFRONTAL CORTEX AND AMYGDALA TO REDUCE THE STRESS IN THE BRAIN. BY BEING MORE MINDFUL THE MORE INNER CALM IS CREATED TO GIVE PEACE TO THOUGHTS AND FEELINGS IN THE PRESENT MOMENT AND REDUCES THE NEGATIVE EFFECTS ON THE BRAIN. —MELANIE GREENBERG, *THE STRESS PROOF BRAIN*

MINDFULNESS IS USED TO BE LESS “MIND FULL” AND MORE “MINDFUL” BY BECOMING MORE AWARE AND OBSERVE MORE IN THE PRESENT MOMENT WITHOUT JUDGEMENT.

APPENDIX D
MINDFULNESS EDUCATION WEBSITES HANDOUT

MINDFULNESS WEBSITES

[HTTPS://WWW.MINDFUL.ORG/MEDITATION/MINDFULNESS-GETTING-STARTED/](https://www.mindful.org/meditation/mindfulness-getting-started/)

- | | |
|---|---|
| <ul style="list-style-type: none"> • DESCRIPTION OF MINDFULNESS • DESCRIPTION OF MEDITATION • HOW TO PRACTICE MINDFULNESS • FREE GUIDED MEDITATIONS | <ul style="list-style-type: none"> • ANSWERS TO COMMON QUESTIONS • BENEFITS TO MINDFULNESS • ADDITIONAL RESOURCES FOR ONLINE COURSES AND FINDING AN INSTRUCTOR |
|---|---|

[HTTPS://GREATERGOOD.BERKELEY.EDU/TOPIC/MINDFULNESS/DEFINITION#WHAT-IS-MINDFULNESS](https://greatergood.berkeley.edu/topic/mindfulness/definition#what-is-mindfulness)

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|--|---|
| <ul style="list-style-type: none"> • DESCRIPTION OF MINDFULNESS • WHAT ARE THE LIMITATIONS TO MINDFULNESS? | <ul style="list-style-type: none"> • WHY PRACTICE MINDFULNESS? • CULTIVATING MINDFULNESS • PODCASTS ON MINDFULNESS |
|--|---|

[HTTPS://WWW.UMMHEALTH.ORG/UMASS-MEMORIAL-MEDICAL-CENTER/SERVICES-TREATMENTS/CENTER-FOR-MINDFULNESS/FAQS](https://www.umhealth.org/umass-memorial-medical-center/services-treatments/center-for-mindfulness/faqs)

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|--|--|
| <ul style="list-style-type: none"> • DESCRIPTION OF MINDFULNESS • LINKS TO RESEARCH ARTICLES SHOWING BENEFITS OF MINDFULNESS IN VARIOUS MEDICAL AND PSYCHOLOGICAL CONDITIONS | <ul style="list-style-type: none"> • Q&A ON MBSR COURSES • LINKS TO MBSR COURSES PROVIDED THROUGH UMASS • INFORMATION ON MBSR TEACHER TRAININGS |
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[HTTPS://WWW.MINDFUL TINNITUSRELIEF.COM](https://www.mindfultinnitusrelief.com)

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|---|---|
| <ul style="list-style-type: none"> • 8-WEEK MINDFULNESS COURSE FOCUSED SPECIFICALLY ON TINNITUS • AWARENESS TO THE EXPERIENCE OF TINNITUS • APPROACHING TINNITUS WITH ACCEPTANCE | <ul style="list-style-type: none"> • COMPASSION, OPENNESS, AND CURIOSITY TO TINNITUS • CULTIVATING MINDFULNESS • AWARENESS TO THE MOMENT |
|---|---|

APPENDIX E
MINDFULNESS EXERCISES HANDOUT

MINDFULNESS EXERCISES

MINDFULNESS MEDITATION

SIT UPRIGHT WITH GOOD POSTURE WITH FEET FLAT ON THE FLOOR OR CROSS-LEGGED. BEGIN BY FOCUSING ON YOUR BREATHING. NOTICE THE SENSATIONS OF THE AIR FLOWING IN AND OUT OF YOUR BELLY RISING AND FALLING. ONCE YOUR FOCUS IS NARROWED TO THESE SENSATIONS BEGIN TO WIDEN YOUR FOCUS TO BE MORE AWARE OF SOUNDS, SENSATIONS, AND IDEAS. EMBRACE AND CONSIDER EACH SENSATION WITHOUT JUDGING IT GOOD OR BAD. IF YOUR MIND WANDERS SIMPLY RETURN YOUR FOCUS TO YOUR BREATHING AND EXPAND YOUR AWARENESS AGAIN.

SITTING MEDITATION

SIT COMFORTABLY IN GOOD POSTURE WITH YOUR BACK STRAIGHT AND HANDS IN YOUR LAP. BREATHE THROUGH YOUR NOSE AND FOCUS ON YOUR BREATH AS IT MOVES IN AND OUT OF YOUR BODY. IF ANY PHYSICAL SENSATIONS OR THOUGHTS INTERRUPT THE MEDITATION, BE AWARE OF THEM AND PASS NO JUDGEMENT ON THEM AND SIMPLY RETURN YOUR FOCUS TO YOUR BREATH.

WALKING MEDITATION

FIND A QUIET PLACE TO WALK SLOWLY. FOCUS ON THE EXPERIENCE OF WALKING AND BECOME AWARE OF THE SENSATION OF STANDING, SUBTLE MOVEMENTS TO KEEP YOU BALANCED, THE FEELING IN YOUR FEET, THE TEMPERATURE OF THE AIR, ANY NATURE SOUNDS, ETC. MAINTAIN THAT AWARENESS THROUGHOUT THE MEDITATION.

BOX BREATHING

FIND A QUIET ENVIRONMENT AND SIT UPRIGHT WITH GOOD POSTURE. PLACE YOUR FEET FLAT ON THE FLOOR AND HANDS RELAXED IN THE LAP WITH YOUR PALMS FACING UP. SLOWLY EXHALE THROUGH THE MOUTH THEN INHALE SLOWLY AND DEEPLY THROUGH THE NOSE FOR 4 SLOW SECONDS. HOLD YOUR BREATH FOR 4 SLOW SECONDS. EXHALE THROUGH THE MOUTH FOR 4 SLOW SECONDS. REPEAT.

BODY SCAN

LIE ON YOUR BACK. LEGS EXTENDED AND ARMS PLACED BY YOUR SIDES WITH THE PALMS FACING UP. SLOWLY FOCUS YOUR ATTENTION ON EACH BODY PART IN ORDER FROM THE HEAD TO THE TOES OR THE TOES TO YOUR HEAD. DRAW AWARENESS TO ANY SENSATIONS, EMOTIONS, OR THOUGHTS THAT ARE ASSOCIATED WITH EACH PART OF YOUR BODY.

AWARENESS IN DAILY LIFE

CHOOSE ANY TASK OR MOMENT AND START BY BRINGING AWARENESS TO THE SENSATIONS IN YOUR BODY. BREATHE THROUGH YOUR NOSE. LET THE AIR FILL YOUR LUNGS AND YOUR BELLY EXPAND FULLY. THEN BREATHE OUT SLOWLY THROUGH YOUR MOUTH. REPEAT. NOTICE THE SENSATIONS OF YOUR BREATH. CONTINUE WITH THE TASK AT HAND SLOWLY. BRING AWARENESS TO YOUR SENSES BY NOTICING EACH THING YOU SEE, TOUCH, TASTE, AND/OR HEAR. SAVOR EACH SENSATION. WHEN YOU NOTICE THAT YOUR MIND HAS WANDERED GENTLY BRING YOUR MIND BACK TO THE TASK AND SENSATIONS AT HAND.

MINDFULNESS VISUALIZATION

SIT COMFORTABLY. CLOSE YOUR EYES AND BREATHE SLOWLY IN THROUGH THE NOSE AND OUT THROUGH THE MOUTH. SCAN THE BODY FROM HEAD TO TOE AND BECOME AWARE OF HOW THE BODY FEELS AND THE UNDERLYING MOOD. IMAGINE A PINPRICK OF LIGHT IN THE MIDDLE OF THE BODY. WHILE IMAGINING THIS REMEMBER A TIME WHEN YOU'VE DONE SOMETHING OR SAID SOMETHING TO ANOTHER PERSON THAT HAS BEEN APPRECIATED. AS YOU RECALL THAT FEELING THE SPECK OF SUNLIGHT EXPANDS IN THE BODY AND MOVES OUTWARD IN EVERY DIRECTION TO FILL THE BODY WITH WARMTH AND LIGHT UNTIL ITS REACHED EVERY PART OF YOUR BODY. LET YOUR MIND REST IN THAT SPACE FOR ABOUT 10 SECONDS AND THEN GENTLY BRING YOUR ATTENTION BACK TO THE PHYSICAL SPACE AROUND YOU.