J Clin Psychol Med Settings (2016) 23:310–318
DOI 10.1007/s10880-015-9444-5

The Emotional and Functional Impact of the Type of Tinnitus Sensation

John Moring[1] · Anne Bowen[2] · Jenifer Thomas[3] · Lindsay Bira[1]

Published online: 27 November 2015

Abstract One to three percent of individuals with tinnitus experience significant reduction in quality of life. Factors that contribute to distress include personality variables, intolerance to loud noises, external locus of control, and pre-existing anxiety. Characteristics of tinnitus itself, such as perceived loudness, can also cause functional impairment. It is unknown whether different tinnitus sensations have various effects on either emotional or functional impairment, which can reduce quality of life. While audiological tests can determine pitch and loudness of tinnitus, questionnaires also can be easily used to assess subjective characteristics of tinnitus. In this study, 370 participants, recruited via email from a national tinnitus organization, completed online surveys that assessed tinnitus-related distress and provided qualitative descriptions of their tinnitus sensation. Self-reports of tinnitus sensation were rated by five independent coders, with excellent agreement. Individuals who reported a combination of tinnitus sensations were found to experience significantly more functional impairment and avoidant behavior. Future research should utilize more sophisticated approaches to categorize individuals' tinnitus sensation and to examine associated emotional and functional differences. Providers should appropriately refer patients for tinnitus management and empirically-supported therapies aimed at reducing tinnitus related distress and functional impairment.

Keywords Tinnitus · Impairment · Emotional distress · Avoidant behavior · Type of tinnitus sensation

Tinnitus is commonly experienced after exposure to loud auditory stimuli (Schlee et al., 2009). Most often, exposure to noise trauma induces transient tinnitus, in which individuals experience a ringing perception that lasts approximately 5 min (Bauer, Brozoski, Rojas, Boley, & Wyder, 1999). Parving, Hein, Suadicani, Ostri, and Gyntelberg (1993) found the prevalence of transient tinnitus to be between 8 and 17 % of the general population. However, a smaller percentage of people experience chronic, unrelenting tinnitus (Vattoth, Shah, & Cure, 2010) that significantly reduces quality of life (Eggermont & Roberts, 2004).

Tinnitus has been documented to negatively impact cognitive functioning (Andersson, Eriksson, Lundh, & Lyttkens, 2000) and is associated with anhedonia (Briner, 1995), anxiety (Henry, Dennis, & Schechter, 2005; Hesser & Andersson, 2009; Kaldo et al., 2008), sensitivity to everyday sounds, otherwise known as hyperacusis (Sood & Coles, 1998, depression (Henry et al., 2005; Hesser & Andersson, 2009; Kaldo et al., 2008), and insomnia (Hesse, Laubert, Schaaf, & Almeling, 2006). Thoughts about suicide also have been reported among those with severe tinnitus (Vogel, van de Looij-Jansen, Mieloo, Burdorf, & de Waart, 2014). Meric, Pharm, and Chéry-Croze (2000) found a positive correlation between tinnitus-related functional impairment and the Depression, Psychaesthenia, and Anxiety subscales of the Mini-Mult, a short-form of the Minnesota Multiphasic Personality Inventory (Collet et al.,

✉ John Moring
moringJ@uthscsa.edu

[1] Division of Behavioral Medicine, Department of Psychiatry, University of Texas Health Science Center at San Antonio, 7550 IH 10 West, Suite 1325, San Antonio, TX 78229, USA

[2] Department of Psychology, University of Arizona, Tucson, AZ, USA

[3] Fay W. Whitney School of Nursing, University of Wyoming, Laramie, WY, USA

1990). Given the potential distress caused by tinnitus, it is important to investigate factors that may influence emotional and behavioral functioning.

Several factors have been identified to be influential in promoting functional impairment among tinnitus patients. Individuals' cognitive responses to tinnitus (e.g., "I can't stand this noise," or "I must have a terrible disease") are proposed to be the most important factor in subjective distress (Sweetow, 1986). Studies show that individuals with tinnitus who participate in interventions that focus on restructuring cognitive distortions experience a decrease in the perceived loudness and discomfort of their tinnitus (Lindberg, Scott, Melin, & Lyttkens, 1989), life problems (Wise, Rief, & Goebel, 1998), and psychiatric comorbidity (Henry & Wilson, 1998). Locus of control is another factor that can influence distress related to tinnitus. Handscomb (2006) categorized tinnitus patients based upon their scores on a tinnitus questionnaire, and the degree to which they perceived themselves to be in control of their tinnitus sensation. Results suggested that high perceived uncontrollability of tinnitus symptoms positively correlated with tinnitus severity. Additional factors that contribute to distress include pre-existing anxiety, intolerance to loud noises, hearing loss, and the anatomy and chemistry of the ear and brain (Dauman & Tyler, 1992).

Other research suggests that characteristics of the tinnitus sensation itself may contribute to distress and functional impairment. Dauman and Tyler (1992) assert that the magnitude of the tinnitus perception significantly influences emotional distress. However, it is argued that subjectively perceived loudness is separate from objective loudness, measured by psychoacoustic matching procedures (Henry & Meikle, 2000). Studies have found that severe tinnitus-related distress is actually associated with low subjective loudness (Hiller & Goebel, 2007) and that subjective loudness of tinnitus is related to permanent awareness (Wallhäusser-Franke et al., 2012). Other qualitative factors, such as the subjective nature of the tinnitus sensation, have remained largely ignored.

Tinnitus sensation qualitatively varies between individuals, and can include ringing, buzzing, or a rushing sound (Andersson, Baguley, McKenna, & McFerran, 2005). To date, no studies have investigated how such qualitative variances may affect tinnitus-related distress. Therefore, the current exploratory study seeks to determine whether level of distress is related to the type of tinnitus sensation (i.e., buzzing, whooshing, hissing). A separate goal of this study is to explore the prevalence of different types of qualitative sensation among individuals with tinnitus.

Methods

Participants

People with presumed tinnitus were contacted through the American Tinnitus Association (ATA) listserv. Staff of the ATA sent emails to members who subscribed to the organization's email listserv. The email contained information about the nature of the study, eligibility requirements, compensation for participation, and directions for participation.

All individuals who accessed the online study completed a brief screening questionnaire to determine eligibility. All participants had to be at least 18 years of age or older. Participants who met inclusion criteria indicated that (1) they experienced ringing, buzzing, or whooshing in one or both ears, (2) the ringing, buzzing, or whooshing lasted longer than 3 months, and (3) the ringing, buzzing, or whooshing was "all of the time." Beyond the age and symptom requirements, no exclusion criteria existed. This study was approved by the Institutional Review Board at the University of Wyoming.

The data reported in this manuscript were collected as part of a larger research project that examined implicit attitudes among individuals with tinnitus (Moring, Bowen, & Thomas, 2014). At the same point in time, participants completed demographics, an Implicit Association Task (Greenwald, McGee, & Schwartz, 1998), Loud Noises Inventory, NEO Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1989), Tinnitus Handicap Inventory (THI; Newman, Jacobsen, & Spitzer, 1996), Anxiety Sensitivity Index-3 (ASI-3; Taylor et al., 2007), and Acceptance and Action Questionnaire (AAQ; Hayes et al., 2004). Participants in the larger investigation were randomly assigned to complete measures in various orders and withdrew from the study at various intervals. Therefore, separate manuscripts report on different and unique subsets of participant data. Results from the larger investigation included individuals who completed all measures and tasks (Participants with Tinnitus, $N = 258$). A separate manuscript reported the data of individuals who completed both the ASI-3 and THI ($N = 267$; Moring et al. 2014).

Measures

Demographics

Demographics included gender, ethnicity, and age. Participants were given the following options for reporting ethnicity: Caucasian, African American, Hispanic/Latino, Asian or Pacific Islander, Native American/American Indian, or "Other." Individuals were asked in an open-

response format, "How long, in months, have you experienced tinnitus," and had to fit their typed response into a space that was 24 character spaces long. Additionally, participants were asked in an open-response format, "Please describe your tinnitus sensation to the best of your ability. For example, responses could include "ringing" or "buzzing." Participants could type whatever verbal characterization of their tinnitus sensation they wished, but the space provided did not allow their description to be more than 120 character spaces in length.

Tinnitus Handicap Inventory

The Tinnitus Handicap Inventory (THI; Newman et al., 1996) consists of 25 items assessing the impact of tinnitus on individuals. The THI consists of three subscales, including the: Functional Subscale (12 items; e.g., "It is difficult for me to concentrate because of my tinnitus" and "My tinnitus makes me confused"), Emotional Subscale (8 items; e.g., "My tinnitus makes me angry" and "I feel depressed because of my tinnitus"), and Catastrophic Subscale (5 items; e.g., "I feel I can no longer cope with my tinnitus" and "My tinnitus makes me feel that I have a terrible disease"). The subscales have adequate to excellent test–retest reliabilities: functional ($r = .94$), emotional ($r = .88$), catastrophic ($r = .84$), and total scale ($r = .92$; Newman, Sandridge, & Jacobson, 1998), and added together, yield a Total THI Score. Higher scores on all subscales and the total score indicate greater impairment or distress. Originally, individuals who completed the THI were asked to identify the problems that are caused by tinnitus by selecting either, "Yes," "No," or "Sometimes," to each item. However, in this study, a Likert scale from 1 = *Totally Disagree* to 5 = *Totally Agree* was used for each item, for a possible range of 25 to 125. The Likert scale was utilized in order to prevent restriction of range and to increase variability of the data. Cronbach alpha values in this study were .97 (Overall THI Score), .93 (Functional THI Subscale Score), .94 (Emotional THI Subscale Score), and .82 (Catastrophic Subscale Score). Previous research has demonstrated that the THI is unifactorial (Zachariae et al., 2000); however, it was decided to use the four factor structure identified by the scale developers (Newman et al., 1996) in order to explore the impact of tinnitus sensation on a variety of domains; this approach was supported by reliability analyses, which demonstrated excellent alpha values as noted above. Means and standard deviations of THI scores can be found in Table 1. Bivariate correlations between total and subscale scores are available in Table 2.

Tinnitus Reaction Questionnaire

The Tinnitus Reaction Questionnaire (TRQ; Wilson et al., 1991) is a 26-item measure that assesses psychological distress associated with tinnitus. Overall, the TRQ has demonstrated very good test–retest reliability ($r = .88$) and internal consistency ($\alpha = .96$; Wilson et al., 1991). The TRQ consists of four subscales, including: General Distress (15 items; e.g., "My tinnitus has made me unhappy" and "My tinnitus has made me feel annoyed"), Interference (6 items; e.g., "My tinnitus has made me feel less interested in going out" and "My tinnitus has interfered with my ability to work"), Severity (3 items; e.g., "My tinnitus has led me to avoid quiet situations" and "My tinnitus has made it hard for me to relax"), and Avoidance (2 items; "My tinnitus has led me to avoid noisy situations" and "My tinnitus has led me to avoid social situations"). A Likert scale from 1 = *Totally Disagree* to 5 = *Totally Agree* was used for each item, for a possible total score range of 26 to 130. Higher scores represent greater distress. Cronbach alpha values in this study were .97 (Overall TRQ Score), .97 (General Distress TRQ Subscale Score), .93 (Interference TRQ Subscale Score), .76 (Severity TRQ Subscale Score), and .74 (Avoidance TRQ Subscale Score). Means and standard deviations of TRQ scores are contained in Table 1. Bivariate correlations between total and subscale scores can be found in Table 2.

Procedure

Members of the ATA were sent emails explaining the study and the link to the online screening questionnaire. Potential participants who were 18 years of age or older and who provided consent completed the screening measure, which assessed whether participants endorsed tinnitus symptoms. Individuals who endorsed tinnitus symptoms then completed the demographics form, which included items asking them to describe their tinnitus sensation (see Demographics section above) prior to the completion of the Tinnitus Handicap Inventory and the Tinnitus Reaction Questionnaire. The ordering of the demographics and self-report measures was designed to limit any influence of the questionnaires on how participants describe or think about their own tinnitus. After completing the demographics form, THI, and TRQ, the nature and goal of the study was described to the participants, as well as other resources concerning tinnitus from the American Tinnitus Association. Participants also were given the opportunity to provide their email address to be eligible to win 1 of 20 electronic gift cards worth $20 for their involvement with the study.

Table 1 Scale and subscale reliabilities

Scale	Number of items	Mean	SD	Range		
				Low	High	Cronbach α
Tinnitus Handicap Inventory	25	70.32	25.17	25	100	.97
Functional	12	33.86	12.38	12	60	.93
Emotional	8	21.50	9.07	8	40	.94
Catastrophic	5	14.96	4.97	5	25	.82
Tinnitus reaction questionnaire	26	68.05	27.11	26	130	.97
General Distress	15	36.72	16.00	15	75	.97
Interference	6	16.64	7.05	6	30	.93
Severity	3	8.77	3.55	3	15	.76
Avoidance	2	5.91	2.56	2	10	.74

For the Tinnitus Handicap Inventory, $N = 303$; for the Tinnitus Reaction Questionnaire, $N = 270$

Table 2 Bivariate correlations among total and subscale scores

Scale	THI				TRQ				
	Total	Functional	Emotional	Catastrophic	Total	Gen Distress	Interference	Severity	Avoidance
THI Total	1.00	.97*	.96*	.89*	.92*	.90*	.91*	.74*	.61*
THI Functional	–	1.00	.89*	.81*	.90*	.86*	.91*	.75*	.61*
THI Emotional	–	–	1.00	.82*	.89*	.88*	.87*	.68*	.59*
THI Catastrophic	–	–	–	1.00	.82*	.82*	.79*	.64*	.50*
TRQ Total	–	–	–	–	1.00	.98*	.97*	.80*	.68*
TRQ Gen Distress	–	–	–	–	–	1.00	.92*	.73*	.60*
TRQ Interference	–	–	–	–	–	–	1.00	.76*	.68*
TRQ Severity	–	–	–	–	–	–	–	1.00	.41*

* $p < .01$

Analyses

Inter-Rater Agreement

A coding team was organized to categorize participants' qualitative descriptions of their tinnitus sensation. The coding team consisted of five research assistants and the first author. The coding team was instructed to read relevant literature on tinnitus and tinnitus-related distress (e.g., Dauman & Tyler, 1992; Henry et al., 2005; Vattoth et al., 2010) and an introduction to grounded theory and qualitative data analysis (Charmaz, 2010). Each member of the team was instructed on the process of categorizing participants' responses using a focused coding process (Charmaz, 2010). The five independent raters coded 20 % of the sample in order to determine level of agreement on how to classify participants' qualitative responses. A random selection of 20 % of the total responses was used in order to more accurately reflect overall agreement probabilities and decrease probabilities of artificially inflating kappa statistics (Gwet, 2008). In the case of disagreements, the first author's classification was used in the analyses. Fleiss' kappa was calculated at .98, which is considered an excellent degree of reliability. Six categories of tinnitus sensation were identified through an inductive process of initial coding (Charmaz, 2010). These six categories were

uncovered during the initial coding process. Coders were sent an electronic spreadsheet that contained participant numbers and their respective verbatim descriptions of their tinnitus sensation and were instructed to remain independent and not communicate each others' responses. During the first-round of coding, a key was provided for coders to dummy-code the responses based on previous research concerning descriptions of tinnitus sensation (i.e., 1 = ringing; 2 = buzzing; 3 = whooshing). After group discussion about additional responses and ambiguous descriptions, three dummy-codes were added and included (4 = combination; 5 = hissing; 6 = white noise).

Coding descriptions of tinnitus sensations for most participants were easily distinguishable because their description was a one-word response. Other participants used modifiers to describe their tinnitus sensation (e.g., "loud ringing" or "high pitched ringing") or used the words "and," commas, backslashes or forward slashes to distinguish their tinnitus as a combination/complex sensation (e.g.," ringing, buzzing, whooshing" or "buzzing/whooshing"). The combination/complex category included two or more distinct descriptions of tinnitus sensation. In the case of ambiguous wording (e.g., "challenging and loud" or "a noisy beep of different frequencies" or "a convention of locusts chirping") team members discussed their coding decision. When agreement was not achieved, the participant data was coded as "other."

MANOVA

In order to determine whether distress is related to the type of tinnitus experienced by individuals, one MANOVA was conducted. The independent variables included the six mutually exclusive categories of tinnitus sensations experienced by participants (ringing, buzzing, combination, whooshing, hissing, and other), as shown in Table 3. The dependent variables were the eight measures of the impact of tinnitus, i.e., the four scores on the Tinnitus Handicap Inventory and four scores on the Tinnitus Reaction Questionnaire, as shown in Table 4. Thus, the analysis examines the differential correlates of six patterns of tinnitus sensations on eight measures of tinnitus' impact on participants. Levene's tests for equality of variances were non-significant for the MANOVA conducted, indicating no differences between the variances in the sample. Fisher's Least Significant Differences (LSD) post hoc analyses were planned if significant results were apparent from the MANOVA. LSD post hoc analyses were used to protect against increases in Type 1 errors by limiting the number of comparisons that can be made (Stangor, 2004).

Table 3 Description of tinnitus sensations, the MANOVA independent variables

Tinnitus sensation	Frequency (n)	Percent (%)
Ringing	202	54.60
Combination ("Complex")	75	20.30
Buzzing	46	12.40
Hissing	12	3.20
Whooshing	9	2.40
Other	26	7.00
Total	370	100.00

Results

Participants

The online research survey was accessed by 458 individuals. Of these, 370 participants with tinnitus were eligible for participation based on age and report of tinnitus symptoms, and provided descriptions of their tinnitus sensations. The participants had a mean age of 59.09 years (SD = 11.77), and were mostly male (70.8 %). Caucasians represented 93.5 % of the sample. Other ethnicities that were represented in this sample included Hispanic Latino (1.9 %), Black/African American (1.4 %), Asian (1.4 %), Middle Eastern (0.8 %), and Native American (0.8 %). On average, participants had experienced tinnitus for 14.66 years. Of the 370 participants who provided their demographic information and description of their tinnitus, 270 participants (73 %) completed the TRQ and 303 participants (82 %) completed the THI.

A majority of participants (72.51 %) with self-reported symptoms of tinnitus indicated a single type of sensation (i.e., ringing or buzzing). Ringing was the most common single sensation with 54.6 % of the participants reporting it, followed by a combination of two or more sounds (e.g., ringing and buzzing; or hissing and whooshing; or buzzing, hissing, and humming; or beeping sounds and ringing; or ringing, roaring, beeping, and buzzing; adding up to a total of 20.3 %), buzzing (12.4 %), hissing (3.2 %), whooshing (2.4 %), and other (7 %). Sensations that were described as "crickets," "white noise," and "like hot electrical wire hitting," were arbitrarily placed in the "other" category due to their infrequency. Frequency data regarding types of tinnitus sensation experienced by participants are found in Table 3.

Differences in Tinnitus Distress Based on Sensation

One MANOVA was conducted, and significant differences based on type of tinnitus sensation were found on the Functional Subscale Score of the Tinnitus Handicap Inventory, F (5, 302) = 2.76, $p < .05$ (Table 4). Fisher's

Table 4 MANOVA values, the MANOVA dependent variables

Scale	Sum of squares	*df*	Mean square	*F*
THI Total	2037.05	5,302	1353.94	2.19
THI Functional	2037.05	5,302	407.41	2.76*
THI Emotional	636.82	5,302	127.36	1.57
THI Catastrophic	243.89	5,302	48.78	1.99
TRQ Total	7222.89	5,269	1444.58	2.00
TRQ General Distress	1937.29	5,269	387.46	1.53
TRQ Interference	568.51	5,269	113.70	2.34*
TRQ Severity	106.56	5,269	21.32	1.71
TRQ Avoidance	112.60	5,269	22.52	3.60*

* $p < .05$

Least Significant Difference (LSD) post hoc analyses revealed that individuals who described their tinnitus as a "combination" of sounds (i.e., two or more sensations) experienced significantly greater functional impairment ($M = 37.53$, $SD = 12.87$) than individuals who described their tinnitus as "hissing" ($M = 23.78$, $SD = 9.54$, $p = .02$), "ringing" ($M = 33.13$, $SD = 12.18$, $p = .01$), and "whooshing" ($M = 26.44$, $SD = 10.08$, $p = .02$). See Table 5 to review results from post hoc analyses.

Per the same MANOVA, significant differences based on type of tinnitus sensation were found on the Interference Subscale Score of the Tinnitus Reaction Questionnaire, F (5, 269) = 2.34, $p < .05$ (Table 4). Fisher's LSD post hoc analyses revealed that individuals who described their tinnitus as a "combination" of sounds experienced significantly greater interference ($M = 18.87$, $SD = 7.19$) than individuals who described their tinnitus as "hissing" ($M = 12.00$, $SD = 6.19$, $p = .01$), "ringing" ($M = 16.40$, $SD = 6.94$, $p = .03$), and "whooshing" ($M = 13.00$, $SD = 4.32$, $p = .04$). See Table 5 to review results from post hoc analyses. It is important to recognize that the extremely small number of cases who identified their tinnitus as either "hissing" ($n = 12$) or "whooshing" ($n = 9$) limits the generalizability of results for these two groups.

The MANOVA also indicated significant differences between type of tinnitus sensation on the Avoidance Subscale Score of the Tinnitus Reaction Questionnaire, F (5, 269) = 3.60, $p < .01$ (Table 4). Fisher's LSD post hoc analyses revealed that individuals who described their tinnitus as a "combination" of sounds experience greater

Table 5 Fisher's LSD post-hoc analyses

Subscale name	Combination group (Mean score, SD)	Other types of tinnitus sensation groups (Mean score, SD)
THI Functional Subscale	Combination (37.53, 12.87)	
		Ringing (33.13, 12.18)*
		Buzzing (35.91, 10.47)
		Hissing (23.78, 9.54)*
		Whooshing (26.44, 10.08)*
		Other (32.58, 13.83)
TRQ Interference Subscale	Combination (18.87, 7.19)	
		Ringing (16.40, 6.94)*
		Buzzing (16.03, 6.66)
		Hissing (12.00, 6.19)*
		Whooshing (13.00, 4.32)*
		Other (16.35, 8.11)
TRQ Avoidance Subscale	Combination (6.91, 2.44)	
		Ringing (5.78, 2.50)*
		Buzzing (6.07, 2.59)
		Hissing (4.00, 1.93)*
		Whooshing (5.29, 2.43)
		Other (4.76, 2.77)*

* $p < .05$

avoidance behaviors ($M = 6.91$, $SD = 2.44$) compared to individuals who described their tinnitus as "hissing" ($M = 4.00$, $SD = 1.93$, $p = .00$), "ringing" ($M = 5.78$, $SD = 2.50$, $p = .01$) and "other" types of sound ($M = 4.76$, $SD = 2.77$, $p = .00$). See Table 5 to review results from post hoc analyses. Similar to the problems discussed in the previous paragraph, two of the comparison groups have very small numbers of cases. Only 12 individuals described their tinnitus as "hissing," and 9 participants described their tinnitus as "whooshing," making it difficult to interpret the findings.

Overall, it is important to note that in Table 5, of the nine significant comparisons that contrast the "Combination" tinnitus sensation group ($n = 75$) with other tinnitus sensations groups, five of those comparisons are with either the "hissing" sensation group for which $n = 12$, or the "whooshing" sensation group for which $n = 9$. The very small number of cases in these two groups necessarily limits one's confidence in the meaningfulness of the obtained significant effects. Only in the three comparisons between the "ringing" sensation group ($n = 202$) and the combination sensation group ($n = 75$), is the number of cases in both groups sufficiently large to inspire confidence that the significant difference reflects a true difference.

Discussion

Tinnitus is associated with comorbid psychological problems and decreased functional capacity, demonstrated in research studies that utilize measures such as the Tinnitus Handicap Inventory and the Tinnitus Reaction Questionnaire. While these associations are pivotal for the understanding and treatment of tinnitus, it is still unclear whether other qualitative factors may influence the psychological and behavioral reactions of those suffering from tinnitus. This study explored whether emotional distress and functional impairment vary with the type of tinnitus sensation (i.e., ringing, buzzing, whooshing, etc.) experienced by the sampled population.

Results demonstrated that most types of distress are not impacted by the type of tinnitus sensation. However, functional distress was significantly higher among individuals who experienced a combination of tinnitus sensations (e.g., both ringing and buzzing) compared to individuals with simple tinnitus (e.g., either ringing, whooshing, or hissing). For instance, individuals with a combination of tinnitus sensations indicated that they had more difficulty sleeping, concentrating, and experience more confusion and irritability. They also reported more problems accomplishing work related tasks and less enjoyment in social activities. It is suggested that individuals with multiple tinnitus sensations be fully evaluated for areas of their life that are impacted by tinnitus. Though the results indicated greater functional impairment among those individuals, qualitative data may be needed in order to fully assess the extent to which there is clinical significance. Interventions such as relaxation strategies may be particularly beneficial for individuals with multi-faceted tinnitus sensations to decrease and manage stress effectively (Robinson et al., 2008; Zoger, Erlandsson, Svedlund, & Holgers, 2008).

This study also found that individuals with complex tinnitus engage in significantly more avoidant strategies compared to individuals with simple tinnitus sensations. For example, individuals with a combination of tinnitus sensations reported that they avoid noisy environments, social situations, and quiet places. Previous studies have shown that embarrassment is one of the main reasons included for avoiding social situations among tinnitus patients, while other reasons included lack of interest in the conversation, frustration, and withdrawal (Stephens, Jaworski, Lewis, & Aslan, 1999). Masking behaviors, or the attempt to "cover-up" tinnitus sensations with objective noise sources, is another common behavior among tinnitus patients (Andersson et al., 2005). Masking tinnitus may offer temporary relief, but may also increase cognitive interference Hesser, Pereswetoff-Morath, & Andersson, (2009). Individuals with complex tinnitus may benefit from therapies that clarify personal values and aim to increase exposure to sound-enriched environments. These activities can be included in manualized therapies for tinnitus, such as Acceptance and Commitment Therapy Hesser, Westin, Hayes, & Andersson, (2009), or Cognitive Behavioral Therapy for Tinnitus (Robinson et al., 2008) to increase quality of life among tinnitus patients.

Most participants indicated that they experienced only ringing. However, individuals who indicated that they experienced a combination of sounds (i.e., ringing and buzzing, or buzzing and hissing) accounted for 20 % of the sample. This is an important distinction, given that these individuals may be at increased risk for emotional and functional impairment, as well as engage in more avoidant behaviors. Future studies should determine whether specific types of tinnitus sensation are associated with neurologically-based (Rauschecker, 1999) versus physiologically-based (Vattoth et al., 2010) tinnitus.

Limitations

Participants were asked to describe their tinnitus by using words such as "ring," "buzz," "whoosh," or "hiss." Self-generated descriptions of tinnitus sensations are important; however, it is still unclear whether the words used by any particular participant can accurately describe their "true" tinnitus sensation, which may impact the prevalence

statistics. For instance, an individual may interpret their sensation as a "buzz," while another person with the same sensation could describe it as a "ring." In order to more accurately distinguish between these sounds, pitch testing should be conducted in future studies, which can account for more complex sensations of tinnitus. Additionally, a small number of participants described their tinnitus sensation as "hissing" (n = 12) or "whooshing" (n = 9), which limits the reliability of the MANOVA analysis. Future research studies should measure sound intensity and pitch objectively, and attempt to recruit more individuals with a variety of tinnitus sensation.

This study did not utilize objective diagnostic criteria to differentiate between somatic tinnitus and subjective chronic tinnitus. Somatic tinnitus, caused by physiological abnormalities (El-Begermy & Rabie, 2010, Vattoth et al., 2010, De Ridder, Heijneman, Haaram, van der Loo, 2007) may create the same sensations as subjective tinnitus, and participants may not be aware of their particular type of tinnitus. Future studies should incorporate the expertise of audiologists and physicians in order to screen for participants based on the type of tinnitus.

Additionally, it is important to recognize that individuals who participated in this study may not be well-representative of others who suffer from tinnitus. Participants with tinnitus were members of a large tinnitus organization and received emails from a listserv. Individuals who choose to become active members of an association may differ from non-members with respect to level of education and socioeconomic status. It is also possible that these individuals who belong to an association dedicated to the cure of tinnitus may have more chronic and severe symptoms. Concurrently, typed examples of tinnitus sensations (e.g., ringing and buzzing) were provided at the time participants were asked to type their own verbal characterizations of their tinnitus sensation. The provision of only a few examples of tinnitus sensation may have indicated to some participants that the study was not relevant for someone with their specific type of tinnitus sensation, and so might have encouraged these individuals to withdraw from participating. Increased clarity is needed by notification that tinnitus sensation is heterogeneous in nature, and can include many different sounds. For these reasons, the generalizability of the results could be limited.

Conclusion

Individuals with tinnitus experience a wide variety of psychological and functional distress as a consequence of their tinnitus symptoms. First, this study demonstrated that most individuals experience a "simple ringing" as their tinnitus sensation. However, 20 % of individuals with tinnitus experienced more complex sensations, which included a combination of ringing, buzzing, whooshing, hissing, or other sounds. Second, this study showed that individuals who experience a combination of tinnitus sensations are at significant risk for increased functional impairment and engage in more avoidant behaviors compared to individuals with a single tinnitus sensation. Primary care providers should be willing to discuss these difficulties with their patients who suffer from tinnitus. Recommendations include relaxation training and empirically-supported therapies, such as ACT and CBT, for emotional distress.

Acknowledgments The authors would like to thank the ATA for the support of this research and the assistance in participant recruitment. The authors would also like to thank Kristina Chen, Juan Carlos Aguilera, Clara Stiefel, Robert Villarreal, Nadia McLaughlin, and Elizabeth Buel for coding descriptive data. There are no funding resources to report.

Compliance with Ethical Standards

Conflicts of Interest John Moring, Anne Bowen, Jenifer Thomas, and Lindsay Bira declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent All procedures performed in studies involving human participants were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the 1964 Helsinki declaration and its later amendments, or comparable ethical standards. Informed consent was obtained from all individual participants included in this study.

References

Andersson, G., Baguley, D. M., McKenna, L., & McFerran, D. J. (2005). *Tinnitus: A multidisciplinary approach*. London: Whurr.

Andersson, G., Eriksson, J., Lundh, L.-G., & Lyttkens, L. (2000). Tinnitus and cognitive interference: A stroop paradigm study. *Journal of Speech, Hearing, and Language Research, 43*, 1168–1173.

Bauer, C. A., Brozoski, T. J., Rojas, R., Boley, J., & Wyder, M. (1999). Behavioral model of chronic tinnitus in rats. *Otolaryngology, 121*, 457–462.

Briner, W. (1995). A behavioural nosology for tinnitus. *Psychological Reports, 77*, 27–34.

Charmaz, K. (2010). *Constructing grounded theory: A practical guide through qualitative analysis*. Thousand Oaks: SAGE Publications Inc.

Collet, L., Moussu, M. F., Disant, F., Ahami, T., & Morgon, A. (1990). Minnesota multiphasic personality inventory in tinnitus disorders. *Audiology, 29*, 101–106.

Costa, R. R., & McCrae, P. T. (1989). Rotation to maximize the construct validity of factors in the NEO personality inventory. *Multivariate Behavioral Research, 24*, 107–124.

Dauman, R., & Tyler, R. S. (1992). Some considerations on the classification of tinnitus. In J.-M. Aran & R. Dauman (Eds.), *Proceedings of the Fourth International Tinnitus Seminar, Bordeaux, France* (pp. 225–229). Amsterdam: Kugler.

De Ridder, D., Heijneman, K., Haarman, B., & van der Loo, E. (2007). Tinnitus vascular conflict of the eighth cranial nerve: a

surgical pathophysiological approach to ABR changes. *Progress in Brain Research, 166*, 401–411.

Eggermont, J. J., & Roberts, L. E. (2004). The neuroscience of tinnitus. *Trends in Neuroscience, 27*, 676–682.

El-Begermy, M. A., & Rabie, A. N. (2010). A novel surgical technique for management of tinnitus due to high dehiscent jugular bulb. *Otolaryngology- Head and Neck Surgery, 142*, 576–581.

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology, 74*, 1464–1480.

Gwet, K. L. (2008). Computing inter-rater reliability and its variance in the presence of high agreement. *British Journal of Mathematical and Statistical Psychology, 61*, 29–48.

Handscomb, L. (2006). Analysis of responses to individual items on the Tinnitus Handicap Inventory according to severity of tinnitus handicap. *American Journal of Audiology, 15*, 102–107.

Hayes, S. C., Strosahl, K. D., Wilson, K. G., Bissett, R. T., Pisorello, J., Toarmino, D.,…McCurry, S. M. (2004). Measuring experiential avoidance: A preliminary test of a working model. *The Psychological Record, 54*, 553–578.

Henry, J. A., Dennis, K. C., & Schechter, M. A. (2005). General review of tinnitus: Prevalence, mechanisms, effects, and management. *Journal of Speech, Language, and Hearing Research, 48*, 1204–1235.

Henry, J. A., & Meikle, M. B. (2000). Psychoacoustic measures of tinnitus. *Journal of the American Academy of Audiology, 1*, 138–155.

Henry, J. L., & Wilson, P. H. (1998). An evaluation of two types of cognitive intervention in the management of chronic tinnitus. *Scandinavian Journal of Behaviour Therapy, 27*, 156–166.

Hesse, G., Laubert, A., Schaaf, H., & Almeling, M. (2006). Integrative psychosomatic and otologic models in the therapy of chronic tinnitus. In M. E. Abelian (Ed.), *Trends in psychotherapy research* (pp. 53–70). Hauppauge: Nova Science Publishers Inc.

Hesser, H., & Andersson, G. (2009). The role of anxiety sensitivity and behavioral avoidance in tinnitus disability. *International Journal of Audiology, 48*, 295–299.

Hesser, H., Pereswetoff-Morath, C. M., & Andersson, G. (2009a). Consequences of controlling background sounds: The effect of experiential avoidance on tinnitus interference. *Rehabilitation Psychology, 54*, 381–389.

Hesser, H., Westin, V., Hayes, S. C., & Andersson, G. (2009b). Clients' in-session acceptance and cognitive defusion behaviors in acceptance-based treatment of tinnitus distress. *Behaviour Research and Therapy, 47*, 523–528.

Hiller, W., & Goebel, G. (2007). When tinnitus loudness and annoyance are discrepant: Audiological characteristics and psychological profile. *Audiology and Neurotology, 12*, 391–400.

Kaldo, V., Levin, S., Widarsson, J., Buhrman, M., Larsen, H., & Andersson, G. (2008). Internet versus group cognitive-behavioral treatment of distress associated with tinnitus: A randomized controlled trial. *Behavior Therapy, 39*, 348–359.

Lindberg, P., Scott, B., Melin, L., & Lyttkens, L. (1989). The psychological treatment of tinnitus: An experimental evaluation. *Behavior Research and Therapy, 6*, 593–603.

Meric, C., Pham, E., & Chéry-Croze, S. (2000). Validation assessment of a French version of the Tinnitus Reaction Questionnaire: A comparison between data from English and French versions. *Journal of Speech, Language, and Hearing Research, 43*, 184–190.

Moring, J., Bowen, A., & Thomas, J. (2014). The utilization of the Implicit Association Test for the measurement of tinnitus-related distress. *American Journal of Audiology, 23*, 293–302.

Newman, C. W., Jacobson, G. P., & Spitzer, J. B. (1996). Development of the tinnitus handicap inventory. *Archives of Otolaryngology—Head and Neck Surgery, 122*, 143–148.

Newman, C., Sandridge, S., & Jacobson, G. (1998). Psychometric adequacy of the tinnitus handicap inventory for evaluating treatment outcome. *Journal of the American Academy of Audiology, 9*, 153–160.

Parving, A., Hein, H. O., Suadicani, P., Ostri, B., & Gyntelberg, F. (1993). Epidemiology of hearing disorders some factors affecting hearing. *The Copenhagen male study. Scandinavian Audiology, 22*, 101–107.

Rauschecker, J. P. (1999). Auditory cortical plasticity: A comparison with other sensory systems. *Trends in Neuroscience, 22*, 74–80.

Robinson, S. K., Viirre, E. S., Bailey, K. A., Kindermann, S., Minassian, A. L., Goldin, P. R.,…McQuaid, J. R. (2008). A randomized controlled trial of cognitive-behavior therapy for tinnitus. *International Tinnitus Journal, 14*, 119–126.

Schlee, W., Mueller, N., Hartmann, T., Keil, J., Lorenz, I., & Weisz, N. (2009). Mapping cortical hubs in tinnitus. *BMC Biology, 7*, 80.

Sood, S. K., & Coles, R. R. A. (1998). Hyperacusis and phonophobia in tinnitus patients. *British Journal of Audiology, 41*, 545–554.

Stangor, C. (2004). *Research methods for the behavioral sciences* (2nd ed.). Boston, MA: Houghton Mifflin Company.

Stephens, S. D. G., Jaworski, A., Lewis, P., & Aslan, S. (1999). An analysis of the communication tactics used by hearing-impaired adults. *British Journal of Audiology, 33*, 17–27.

Sweetow, R. W. (1986). Cognitive aspects of tinnitus patient management. *Ear and Hearing, 7*, 390–396.

Taylor, S., Zvolensky, M. J., Cox, B. J., Deacon, B., Heimberg, R. G., Ledley, D. R.,…Cardenas, S. J. (2007). Robust dimensions of anxiety sensitivity: Development and initial validation of the Anxiety Sensitivity Index-3. *Psychological Assessment, 19*, 176–188.

Vattoth, S., Shah, R., & Cure, J. K. (2010). A compartment-based approach for the imaging evaluation of tinnitus. *American Journal of Neuroradiology, 31*, 211–218.

Vogel, I., van de Looij-Jansen, P. M., Mieloo, C. L., Burdorf, A., & de Waart, F. (2014). Risky music listening, permanent tinnitus and depression, anxiety, thoughts about suicide and adverse general health. *PLoS One, 9*, e98912.

Wallhäusser-Franke, E., Brade, J., Balkenhol, T., D'Amelio, R., Seegmüller, A., & Delb, W. (2012). Tinnitus: Distinguishing between subjectively perceived loudness and tinnitus-related distress. *PLoS One, 7*, e34583.

Wilson, P. H., Henry, J., Bowen, M., & Haralambous, G. (1991). Tinnitus reaction questionnaire: Psychometric properties of a measure of distress associated with tinnitus. *Journal of Speech and Hearing Research, 34*, 197–201.

Wise, K., Rief, W., & Goebel, G. (1998). Meeting the expectations of chronic tinnitus patients: Comparison of a structured group therapy program for tinnitus management with a problem-solving group. *Journal of Psychosomatic Research, 44*, 681–685.

Zachariae, R., Mirz, F., Johansen, L. V., Andersen, S. E., Bjerring, P., & Pedersen, C. B. (2000). Reliability and validity of a Danish adaptation of the tinnitus handicap inventory. *Scandinavian Audiology, 29*, 37–43.

Zoger, S., Erlandsson, S., Svedlund, J., & Holgers, K. (2008). Benefits from group psychotherapy in the treatment of severe refractory tinnitus. *Audiological Medicine, 6*, 62–72.