For any issues with this document, please contact your library.

Title: Clinical pediatrics.
ArticleTitle: The Impact of Mental Health Symptoms in Children With Tinnitus and Misophonia: A Multi-disciplinary Approach
ArticleAuthor: Chan
ISSN - 00099228; LCN - 68003710;
Publisher: 2023-11-06
Source: LibKeyNomad
Copyright: CCG

The Impact of Mental Health Symptoms in Children With Tinnitus and Misophonia: A Multi-disciplinary Approach

Kenny H. Chan, MD[1,2], Amanda Baker, AuD, CCC-A[3],
Deborah Gilbert, RN, BSN, MS[1,2], Suhong Tong, MS[4], Julie Rinaldi, PhD[5],
Scott Cypers, PhD[5], Austin Zhu, BA[1,2] (iD),
and Alyssa Schoenborn, AuD, CCC-A[3]

Abstract

Tinnitus and misophonia are important "sound annoyance" disorders in pediatric otolaryngology and audiology practices. There is scant published literature to suggest increased anxiety and depression symptoms in these disorders. This study aimed at assessing the clinical characteristics of these 2 disorders and their prevalence in mental health–related symptoms in a 2-year retrospective chart review of a multi-disciplinary (otolaryngology, audiology, and psychology) clinic cohort. Analyses were based on 54 (tinnitus = 33 and misophonia = 21) children consisting of 19 males and 35 females with a mean age (standard deviation) of 14.3 (3.0) years. The entire cohort was negatively affected by diagnosis-based symptom severity instruments as assessed by Tinnitus Functional Index and Amsterdam Misophonia Scale. Both subgroups exhibited elevated anxiety and depression symptoms in psychometric instruments as assessed by Screen for Child Anxiety Related Emotional Disorders and Short Mood and Feelings Questionnaire. Evidence-based management of these disorders is lacking, and clinical trials are needed.

Keywords

tinnitus, misophonia, mental health, anxiety, depression

Objectives

Among the most common disorders that can be coined as "sound annoyance" disorders frequently encountered by pediatric otolaryngologists and audiologists are hyperacusis, tinnitus, and misophonia. This grouping is problematic because each has its own presentation, etiology, natural history, and proposed treatment modality. Pediatric perspective of each of these disorders is difficult to fully understand due to a paucity of publications in these fields. Further complicating the field is that hyperacusis can coexist with phonophobia, tinnitus, and misophonia in their presentations.

Hyperacusis is a chronic condition defined as a lowered tolerance or increased sensitivity to everyday environmental sounds. Research in hyperacusis in children is limited and the most recent synopsis of this field was a scoping review by Potgieter et al[1] published in 2020. Interestingly, only 21 publications could be gleaned between 1994 and 2020 suggesting the paucity of clinical

understanding and research in this topic. The authors profiled this disorder to have the commonest presentation age at 3 to 4 years with a male dominance. Autism spectrum disorder and tinnitus are the most common co-occurring conditions. The most troublesome noises for individuals with hyperacusis are household electrical appliances according to the authors. The most common

[1]Department of Otolaryngology, School of Medicine, University of Colorado, Aurora, CO, USA
[2]Department of Otolaryngology, Children's Hospital Colorado, Aurora, CO, USA
[3]Department of Audiology, Speech and Learning, Children's Hospital Colorado, Aurora, CO, USA
[4]Research Institute, Children's Hospital Colorado, Aurora, CO, USA
[5]Department of Psychiatry, School of Medicine, University of Colorado, Aurora, CO, USA

Corresponding Author:
Kenny H. Chan, Department of Otolaryngology, Children's Hospital Colorado, 13123 East 16th Avenue, B455, Aurora, CO 80045, USA.
Email: kenny.chan@childrenscolorado.org

reaction is to cover their ears, cry, and present with aggressive behavior. The most common impact is on family functioning, including getting out of the house attending social events and on school performance. Several modes of therapy including cognitive behavioral therapy (CBT) have been tried with theoretical improvement. Notably, because misophonia involves decreased sound tolerance and can coexist with hyperacusis, publications concerning misophonia were excluded in this scoping review.

Tinnitus is defined as the perception of a sound without an external source. In a recent meta-analysis of childhood tinnitus and hyperacusis published by Rosing et al,[2] 25 studies were included (only the tinnitus portion of the publication is discussed here). Generalizations of the patient characteristics are difficult due to the heterogeneity of the studies. The population characteristics of childhood tinnitus have a wide range of prevalence based on age, but prevalence increased with age during the teenage years. There appeared to be minimal differences between prevalence in gender. Cogent to this study is the prevalence of "bothersome" tinnitus and it ranged from 0.6% to 49.2%. Hearing loss (HL) prevalence was difficult to estimate due to age ranges of the studies analyzed. The only comorbidity identified by the authors was on mental health symptoms in 1 publication by Holgers and Juul[3] in 2006. Using the Hospital Anxiety Depression Scale in a cohort of 55 children, the authors found the percentage above the cutoff for clinical anxiety and depressive disorders to be 32% and 14.5%, respectively.

Misophonia is a relatively new term coined by Jastreboff[4] in 2002. It is a disorder of decreased tolerance to specific sound triggers by oral sounds (eg, chewing and swallowing), and clicking sounds (eg, keyboard tapping and finger tapping) and results in a range of responses from anger to fight-or-flight responses. Potgieter et al[5] in 2019 performed a scoping review of research on misophonia wherein 31 publications were included. This disorder borders both psychiatry and audiology and currently there are those who have proposed that it be categorized within the obsessive-compulsive spectrum of disorders. The onset of misophonia has been found to emerge in childhood or adolescence with only 2 publications reporting an adult onset. Specifically, Wu et al[6] reported prevalence in a college student cohort with a 20% rate of experiencing sensitivity to some triggers and strong associations with general sensory, obsessive-compulsive, anxiety, and depressive symptom impairments. Most studies based the diagnosis on unstructured clinical interviews. Guzick et al[7] reported on 102 subjects (8-17 years old) with misophonia, noting the most common triggers included eating, breathing, throat sounds, and tapping. High rates of comorbidity with internalizing and neurodevelopmental disorders were also found.

There is literature support concerning the interplay between mental health symptoms and 2 of these entities, tinnitus and misophonia. Tinnitus and misophonia symptom severity assessment is challenging for the pediatric population due to a lack of pediatric-specific validated instruments. The most widely used adult-validated tinnitus instruments include the Tinnitus Handicap Questionnaire, the Tinnitus Handicap Inventory, and the Tinnitus Functional Index (TFI); only the TFI is validated for both initial assessment and clinical surveillance. As such, Nemholt et al[8] have found the pediatric tinnitus literature to contain arbitrary descriptive terms such as troublesome, bothersome, uncomfortable, worried, and concerned. In the misophonia field, the Amsterdam Misophonia Scale (A-MISO-S) instrument appears to be the dominant instrument in assessing misophonia symptom severity in adult and pediatric publications. In a misophonia study[9] comprised of adolescents and adults that utilized A-MISO-S, severity was rated as severe (mean/range = 15.1/9-22) in the pediatric cohort.

Elevated symptoms of anxiety and depression have been reported as comorbidities in both tinnitus and misophonia in adults but are not well publicized in pediatric studies. In a clinical practice guideline on tinnitus sponsored by the American Academy of Otolaryngology Head and Neck Surgery, 48% to 60% of adults reported depression and anxiety.[10] In Nemholt's pediatric tinnitus systematic review, only 1 of 25 articles even considered anxiety and depression as an outcome. Holgers and Juul[3] in 95 children (9-16 years) showed that 32% of the cohort scored above the cutoff level for possible/probable clinical emotional/anxiety disorder and 14.5% scored above the cutoff for possible/probable clinical depression based on the Tinnitus Severity Questionnaire, visual analog scales, and Hospital Anxiety and Depression Scale instruments. The methodology of Guzick's et al[7] study on 102 youths with misophonia included a clinical interview in addition to completing questionnaires including A-MISO-S. This allowed them to report 45% of the subjects experiencing a current anxiety or obsessive-compulsive disorder and 47% experiencing a major depressive disorder.

At Children's Hospital Colorado, Aurora, CO, a multi-disciplinary (otolaryngology, audiology, and psychology) clinic was formed to evaluate and manage children with sound annoyance disorders (tinnitus, misophonia, and hyperacusis but hyperacusis ultimately was excluded from the analyses due to its rarity) since September 2020. The basis of the clinic formation lied

in requests for evaluation and management of these populations to the Departments of Otolaryngology and Audiology coupled with our sense of mental health comorbidities in these children. The objectives of this study are to describe the demographic and clinical characteristics, as well as to estimate the prevalence of mental health–related (anxiety and depression) symptoms of this cohort.

Study Design

Following approval by our hospital's institutional review board, a retrospective chart review was performed using our institutional electronic health records, and demographic and clinical data were obtained from the multidisciplinary clinic during the span of September 2020 to August 2022. It should be noted that clinic subjects were screened for "bothersome" tinnitus. To qualify for an evaluation in the multi-disciplinary clinic, the patient must have experienced "bothersome" tinnitus as defined as always present in quiet and noisy environments, at least 6 months in duration, unilateral or bilateral, and negative impact on quality of life including mental health. No restriction was placed on subjects with a possible diagnosis for misophonia. This study only analyzed subjects with "bothersome" tinnitus and misophonia; only 1 hyperacusis subject was identified in the patient cohort and was excluded.

All caregivers seen by this clinic were requested to complete either tinnitus or misophonia symptom severity instruments based on predominant symptom and caretakers of ambiguous symptom subjects were requested to complete both instruments. Diagnosis-based symptom instrument analyses were performed specific to the final diagnoses. Two psychometric instruments were used to measure anxiety and depression symptoms. All caregivers and patients were requested to complete these instruments and data were analyzed for the entire clinic population. A brief description of each of the 4 instruments is described below.

Tinnitus Functional Index

Tinnitus Functional Index[11] is a 25-question self-report questionnaire that is used for both clinical and research purposes. The TFI measures the severity of tinnitus symptoms across 8 different domains including (1) intrusiveness, (2) sense of control, (3) cognitive interference, (4) sleep disturbance, (5) auditory difficulties, (6) interference with relaxation, (7) impact on quality of life, and (8) emotional distress. The TFI monitors treatment-related changes in tinnitus severity across the different domains. Scoring ranges are classified as: mild

impact (<25), significant impact (25-50), and severe impact (>50). This instrument is only validated in adults and its Cronbach's alpha was reported to be 0.97. Since no pediatric instruments exist, the authors were compelled to use this as a proxy instrument for children.

Amsterdam Misophonia Scale

The A-MISO-S[9] is a 6-item self-reported questionnaire (ranging 0-4 with 4 being the most adverse response) that measures the severity of misophonia symptoms. It is an adapted version of the Yale-Brown Obsessive-Compulsive Scale that quantifies (1) time spent on thoughts about misophonia, (2) impact on social functioning, (3) amount of distress from misophonia, (4) resistance of the misophonia triggers, (5) lack of control of misophonia, and (6) avoidance of events due to misophonia. Scoring for each of the 6 categories is summated as: subclinical impact (0-4), mild impact (5-9), moderate impact (10-14), severe impact (15-19), and extreme impact (20-24). This tool has consistently shown high internal consistency.[12] Similar to the TFI, this is also a validated instrument for adults with a reported Cronbach's alpha of 0.81, and it was used as a proxy for pediatric cohort in this study.

Screen for Child Anxiety Related Emotional Disorders

The Screen for Childhood Anxiety Related Emotional Disorders (SCARED), a validated instrument, is a 41-item self-report and parent-report measure for children aged 8 to 18.[13] It consists of statements which are meant to assess symptoms of anxiety, for example, "When I feel frightened, it is hard to breathe." The measure includes 5 subscales aimed at assessing panic/somatic symptoms, generalized anxiety, separation anxiety, social phobia, and school phobia. The respondent is asked to indicate whether they (or their child) have experienced symptoms over the past 3 months on a 3-point Likert scale (0 = "Not True or Hardly Ever True," 1 = "Somewhat True or Sometimes True," and 2 = "Very True or Often True"). The measure has solid psychometric properties. In a review of 8 anxiety measures, the psychometric properties including norms, test-retest reliability, internal consistency, content validity, treatment sensitivity, among others, were rated as "adequate," "good," or "excellent."[14] The psychometric properties of the SCARED ranged from good to excellent on both the self-report and parent-report versions, with more "excellent" ratings on the parent-report version. A total score of 25 or more may indicate the presence of an anxiety disorder and was used as the

Table 1. Demographic and Clinical Characteristics of the Tinnitus and Misophonia Diagnostic Groups.

Clinical characteristics	Total $N = 54$	Tinnitus group $N = 33$	Misophonia group $N = 21$	P value
Demographics				
Age (years), mean (SD)	14.3 (3.0)	14.2 (3.3)	14.4 (2.6)	.82
Male, *n* (%)	19 (35.2)	15 (45.5)	4 (19.1)	.05
Hearing loss				
None	48	27 (81.8%)	21 (100%)	.64
Unilateral hearing loss				
CHL		0 (0%)		
SNHL		1 (3.0%)		
Bilateral hearing loss				
CHL		3 (9.1%)		
SNHL		1 (3.0%)		
Mixed		1 (3.0%)		
TFI, mean (SD)		41.0 (21.3)		NA
A-MISO-S, mean (SD)			15.8 (3.4)	NA
SCARED, mean (SD)	28.2 (16.2)	27.9 (18.2)	28.6 (13.7)	.92
SMFQ, mean (SD)	8.4 (6.9)	6.5 (5.7)	11.9 (7.7)	.02
Prior counseling, *n* (%)	20 (37.0)	10 (30.3)	10 (52.4)	.25

Abbreviations: CHL, conductive hearing loss; SNHL, sensorineural hearing loss; NA, not applicable; TFI, Tinnitus Functional Index; A-MISO-S, Amsterdam Misophonia Scale; SCARED, Screen for Childhood Anxiety Related Emotional Disorders; SMFQ, Short Mood and Feelings Questionnaire; SD, standard deviation.

cutoff score in this study. The reported Cronbach's alpha was 0.90.[13]

Short Mood and Feelings Questionnaire

The Short Mood and Feelings Questionnaire (SMFQ), a validated instrument for children, is a 13-item self-report questionnaire for children aged 6 and up.[15] It measures the presence of depressive symptoms over the previous 2 weeks. The scale consists of descriptive phrases regarding how the child had been feeling or acting. Examples include "I cried a lot" and "I didn't enjoy anything at all." The respondent is asked to rate each statement on a 3-point Likert scale (0 = "Not True," 1 = "Sometimes," and 2 = "True"). The scale has been found to reliably predict depression in children and adolescents. A total score on the child version of the SMFQ of 8 or more is considered significant with a sensitivity of 60% and specificity of 85% for major depression. The reported Cronbach's alpha was 0.85 for the child-report version, and 0.87 for the parent-report version.

Study data were collected and managed using REDCap (Research Electronic Data Capture) tools.[16] REDCap is a secure, web-based software platform designed to support data capture for research studies, providing (1) an intuitive interface for validated data capture; (2) audit trails for tracking data manipulation and export procedures; (3) automated export procedures for seamless data downloads to common statistical packages; and (4) procedures for data integration and interoperability with external sources. A total of 60 subjects were seen in the multi-disciplinary clinic. Subjects were excluded for age >18 years (*n* = 2) and non-tinnitus and misophonia diagnoses which consisted of auditory processing disorder (*n* = 3) and hyperacusis (*n* = 1). The 2 remaining diagnostic groups were tinnitus (*n* = 33) and misophonia (*n* = 21). It should be noted that if misophonia was diagnosed as the overriding complaint, those with a secondary complaint of tinnitus were grouped under misophonia. The reverse (ie, primary complaint of tinnitus and secondary complaint of misophonia) did not occur. Demographics and clinical characteristics were summarized in Table 1 by descriptive statistics. Shapiro-Wilk test was used to check for normality of data distribution, and as such, two-sample *t*-test was used to compare the means. Fisher's exact test was performed to compare the proportions between 2 groups. General linear regression and logistic models were applied to explore the associations between mental health (SCARED and SMFQ) and symptom severity (TFI and A-MISO-S) instruments for subjects exceeding cutoff thresholds for SCARED and SMFQ. Parent and child anxiety and depression assessments were compared using paired *t*-test. All tests were conducted as 2-sided with *P* value <.05 to determine statistical significance. SAS Version 9.4; SAS Institute Inc, Cary, North Carolina was used for all data analyses.

Table 2. Subgroup Analysis Showing Association Between TFI or A-MISO-S and SCARED or SMFQ for Subjects Above Clinical Cutoffs.

Dependent variables	N	Parameters	Estimate	Standard error	LCL	UCL	*P* value
Subjects with SCARED >25	5	Intercept	22.7	14.7			.20
		TFI	0.5	0.3	−0.2	1.2	.24
		Intercept	12.0	16.1			.49
		A-MISO-S	1.7	1.0	−0.3	3.7	.16
Subjects with SMFQ >8	9	Intercept	9.9	2.5			.00
		TFI	0.1	0.1	0.0	0.2	.04
		Intercept	11.5	10.6			.31
		A-MISO-S	0.3	0.6	−1.0	1.6	.65

Abbreviations: LCL, lower confidence level; UCL, upper confidence level; TFI, Tinnitus Functional Index; A-MISO-S, Amsterdam Misophonia Scale; SCARED, Screen for Childhood Anxiety Related Emotional Disorders; SMFQ, Short Mood and Feelings Questionnaire.

Results

A total of 54 subjects were included in the analysis with 33 subjects with the diagnosis of tinnitus and 21 subjects with misophonia. The demographic and clinical characteristics of the cohort are detailed in Table 1. The cohort's mean age (standard deviation [SD]) of 14.3 (3.0) years suggests an adolescent population with a preponderance of female/male ratio of 35/19. No differences were found in age between the tinnitus and misophonia subgroups. No gender difference was noted in the tinnitus subgroup, but females dominated in the misophonia subgroup. Hearing loss was only diagnosed in the tinnitus group, present in 6 individuals with a distribution of unilateral sensorineural hearing loss (SNHL; $n = 1$), bilateral conductive hearing loss (CHL; $n = 3$), bilateral SNHL ($n = 1$), and bilateral mixed HL ($n = 1$). The distribution of HL subjects between the 2 diagnostic groups showed no statistical difference.

Tinnitus symptom severity as measured by TFI was available in 22 of 33 tinnitus subjects. Tinnitus Functional Index's mean (SD) score was 41.0 (21.3) indicating significant tinnitus. Misophonia symptom severity as measured by A-MISO-S was available in 17 of 21 misophonia subjects. Amsterdam Misophonia Scale's mean (SD) score was 15.8 (3.4) indicating severe misophonia symptoms.

Mental health symptom scores were more complete when the patients were the respondents than when the caretakers were the respondents. Thus, analyses of mental health instrument scores solely relied on children being the respondents. Mean SCARED scores (SD) between the tinnitus 27.9 (18.2) and misophonia 28.6 (13.6) groups failed to reach statistical significance ($P = .92$) for anxiety symptoms. Seven of 15 (46.7%) tinnitus subjects and 7 of 11 (63.4%) misophonia subjects reached anxiety symptom cutoff ($P = .4527$ from Fisher's exact test. Depression symptom score as measured by the SMFQ was available in 39 of 54 subjects.

Nine of 25 (36.0%) tinnitus subjects and 8 of 11 (72.3%) misophonia subjects reached depression symptom cutoff ($P = .3137$ from Fisher's exact test). The tinnitus subgroup's SMFQ mean score (6.5) was below the threshold for elevated depression symptoms; however, the misophonia subgroup's SMFQ mean score (11.9) was above the threshold and had a statistically higher mean than the tinnitus subgroup ($P = .02$).

The subgroups that exceeded clinical cutoffs for SCARED and SMFQ were further examined. Their associated number of subjects from the tinnitus and misophonia groups are represented in Table 2 which illustrates how elevated these mean scores were in these subgroups. Logistic regression model showed that for each unit increase of A-MISO-S score, a subject was 13% (−21%, 62%, $P = .54$) more likely to have SCARED scored above the threshold, and 22% (−13%, 71%, $P = .67$) more likely to have the SMFQ scored above the threshold. Tinnitus Functional Index did not show a strong association with SCARED. Using a linear regression model to test the association between TFI and A-MISO-S scores with subjects above the clinical cutoffs in SCARED and SMFQ, only TFI was found to be significantly associated with SMFQ ($P = .04$).

Sub-analyses were performed to determine if differences could be found between the parent- and child-completed mental health instruments. The incompleteness of the SMFQ parent scores became obvious when only 5 of 33 in the tinnitus group and 2 of 21 in the misophonia group were found to have completed their questionnaires. However, 23 paired parent and child scores were available (14 in tinnitus and 9 in misophonia groups) for the SCARED. The mean (SD) for the child- and parent-completed SCARED scores was 28.2 (16.2) and 18.3 (13.5), respectively, $P = .0009$. This suggests a significantly higher perceived anxiety symptom elevation by the patients than by their respective caretakers.

Table 3. Comparisons of Demographics, Symptom Scores, and Sound Diagnosis Between Respondents and Non-respondents of Mental Health Instruments.

Clinical characteristics	Respondents[a]	Non-respondents	*P* value
Demographics			
N	24	30	
Age (years), mean (SD)	15.4 (2.2)	13.4 (3.3)	.01
Male, n (%)	5 (20.8)	14 (46.7)	.05
TFI, mean (SD)	36.6 (16.5)	45.8 (21.9)	.21
A-MISO-S, mean (SD)	15.2 (3.6)	15.6 (4.3)	.81
Sound diagnosis			.71
Misophonia, n (%)	10 (41.7)	11 (36.7)	
Tinnitus, n (%)	14 (58.3)	19 (63.3)	

Abbreviations: TFI, Tinnitus Functional Index; A-MISO-S, Amsterdam Misophonia Scale; SD, standard deviation.
[a]Have mental health instrument assessments.

Prior mental health counseling broadly defined as all types of counseling ranging from clinical psychologists in private practice to school counselors was noted among 10 in 33 (30.3%) subjects in the tinnitus group versus 10 in 21 (52.4%) subjects in the misophonia group and this distribution was found to be statically insignificant.

An analysis was performed between the responders and the non-responders of the mental health instruments and it is summarized in Table 3. There were statistical demographic differences between the groups in that the non-responders were younger and predominantly male. There were no differences noted in terms of TFI and A-MISO-S scores between the groups to suggest similar symptom scores. In addition, there were no differences between the groups in terms of diagnostic classifications.

Conclusions

This represents the first report of children with bothersome tinnitus and misophonia who were evaluated in a multi-disciplinary clinic setting at Children's Hospital Colorado, with an emphasis to evaluate the severity of symptoms and elevation of anxiety and depression symptom scores. Both cohorts shared similar age of presentation and had elevated symptoms based on each of the symptom severity instruments. The tinnitus group had elevated mean anxiety symptom scores above the clinically significant cutoff but not for depression symptoms. The misophonia group had elevated mean anxiety and depression symptom scores above the clinical cutoffs based on both mental health screening instruments. Both populations had some proportion of prior mental health counseling prior to being seen in the clinic.

The data suggest an overall disproportional female adolescent representation in both diagnostic subpopulations and a statistical female dominance in the misophonia group. Whereas pediatric epidemiologic data on misophonia are lacking, it has been noted by Baguley et al[17] that epidemiologic data within the tinnitus research field are conflicting and it had been suggested that caution should be exercised in its interpretation. Nemholt et al have stated that these "inconsistencies" are seemingly due to differences in study designs, definitions, and inclusion criteria in published studies. Juxtaposed to this study is a 2017 pediatric tinnitus publication from our institution[18] utilizing general pediatric otolaryngology clinic subjects rather than screening subjects with bothersome tinnitus. Beyond the obvious mean age of 11.5 years as compared to the 14.2 years in the current study, 40 of 180 (22.2%) subjects had HL consisting of a mixture of SNHL, CHL, and mixed HL that was unilateral and bilateral in nature. The current study showed 18.2% of the tinnitus cohort had HL and none in the misophonia cohort had HL. To our knowledge, this is the first pediatric misophonia cohort that underwent audiologic evaluation. Despite the limited sample size, the authors would conclude that HL is likely not highly associated with misophonia.

Elevation of SCARED anxiety scores was noted in both tinnitus and misophonia groups in our study. Only the misophonia group had a higher SMFQ mean score, statistically different as compared to the tinnitus group. These findings are in contrast to findings in a 2017 tinnitus study, where only 2 subjects (7.1%) showed severe changes in quality of life and 1 subject (3.6%) with anxiety. A convenience clinic sampling clearly underestimated its effects on mental health symptoms. The dichotomy seen in the elevated symptom score noted between the child-reported SCARED as compared to parent-reported SCARED, highlighting the perceptual differences in anxiety between parent and child in this study, is worth noting and this finding is corroborated with published findings of Wren et al.[19]

It is not the intent of this study to address treatment for tinnitus and misophonia, and yet 30% of our tinnitus group and 52% of our misophonia group had already received some form of counseling at entry. Treatment of pediatric tinnitus has included CBT, medications (risperidone and topiramate), tinnitus retraining therapy, and sound therapy.[1] Published treatment of pediatric misophonia has only included CBT.[20] Recently, Smith et al[21] published an online survey on various treatment approaches reported by patients (adults and children) which allows readers to understand the patients' and parents' mindsets in seeking treatment options as well as the diverse treatment alternatives provided by practitioners/clinicians. The pediatric treatment modalities included medications (unnamed anxiolytics and antidepressants being the majority), dietary supplements, lifestyle modifications, relaxation, psychological treatment (CBT and supportive psychotherapy being most common), audiologic treatment (active noise canceling), and neuromodulation. The epidemiologic research of tinnitus and misophonia is already complex based on what has been published. To move the management of these clinical entities along the evidence-based path, randomized clinical trials with a rigorous methodology must be conducted.

The strength of this study lies in the multi-disciplinary approach to the evaluation of tinnitus and misophonia. Each specialty contributed to the overall execution of the multi-disciplinary clinic and the collaboration led to the production of the data set. The first weakness lies in the referral patterns of these 2 clinical disorders which might have created selection bias. The screening of subjects with bothersome tinnitus might be viewed as arbitrary. The other weakness of the study lies in the incomplete return of the 4 instruments by the caretakers and the mental health instruments by the patients. However, no symptom severity score differences were noted between the responders and non-responders. This was unavoidable because the study was carried out in a clinical setting and not part of a research protocol.

The relationships between 2 sound annoyance disorders, tinnitus and misophonia, and mental health symptoms as measured by SCARED and SMFQ have been found in this study. Analyses to explore the relationship between the symptom severity and mental health symptoms failed to yield meaningful associations likely due to small subgroup sizes. To advance this field, a treatment randomized clinical trial is needed. Pragmatically, if a future treatment trial is designed to measure treatment effects on anxiety and depression symptoms, the need for TFI and A-MISO-S measurements is limited. Therefore, it would be more cogent to only include subjects that have exceeded the clinical cutoffs for SCARED and/or SMFQ in such a study.

Author Contributions

RHC: Concept, data analysis, manuscript writing and revision.
AB: Data collection, manuscript revision.
DG: Data collection, manuscript revision.
ST: Data analysis, manuscript revision.
JR: Data analysis, manuscript revision.
SC: Data collection, mansucript revision.
AZ: Data analysis, manuscript revision.
AS: Concept, data collection, data analysis, mansucript revision.

Declaration of Conflicting Interests

Funding

Ethical Approval

This study was approved by the Colorado Multiple Institutional Review Board (COMIRB), approval number 22-1693. Since this was a retrospective chart review through the electronic medical record, no informed consent was required by COMIRB. Our study was approved with ethical consideration and approved for research.

ORCID iD

Austin Zhu https://orcid.org/0000-0003-1542-3113

Supplemental Material

Supplemental material for this article is available online.

References

1. Potgieter I, Fackrell K, Kennedy V, Crunkhorn R, Hoare DJ. Hyperacusis in children: a scoping review. *BMC Pediatr*. 2020;20:319. doi:10.1186/s12887-020-02223-5.

2. Rosing SN, Schmidt JH, Wedderkopp N, Baguley DM. Prevalence of tinnitus and hyperacusis in children and adolescents: a systematic review. *BMJ Open*. 2016;6(6):e010596. doi:10.1136/bmjopen-2015-010596.

3. Holgers KM, Juul J. The suffering of tinnitus in childhood and adolescence. *Int J Audiol*. 2006;45(5):267-272. doi:10.1080/14992020500485668.

4. Jastreboff PJ. Tinnitus habituation therapy (THT) and tinnitus retraining therapy (TRT). In: RS Tyler, ed. *Tinnitus Handbook*. San Diego, CA: Singular, Thomson Learning; 2000:357-376.

5. Potgieter I, MacDonald C, Partridge L, Cima R, Sheldrake J, Hoare DJ. Misophonia: a scoping review of research. *J Clin Psychol*. 2019;75(7):1203-1218. doi:10.1002/jclp.22771.

6. Wu MS, Lewin AB, Murphy TK, Storch EA. Misophonia: incidence, phenomenology, and clinical correlates in an undergraduate student sample. *J Clin Psychol*. 2014;70(10):994-1007. doi:10.1002/jclp.22098.

7. Guzick AG, Cervin M, Smith EEA, et al. Clinical characteristics, impairment, and psychiatric morbidity in 102 youth with misophonia. *J Affect Disord*. 2022;324:395-402. doi:10.1016/j.jad.2022.12.083.

8. Nemholt SS, Schmidt JH, Wedderkopp N, Baguley DM. Prevalence of tinnitus and/or hyperacusis in children and adolescents: study protocol for a systematic review. *BMJ Open*. 2015;5(1):e006649. doi:10.1136/bmjopen-2014-006649.

9. Schröder A, Vulink N, Denys D. Misophonia: diagnostic criteria for a new psychiatric disorder. *PLOS ONE*. 2013;8(1):e54706. doi:10.1371/journal.pone.0054706.

10. Tunkel DE, Bauer CA, Sun GH, et al. Clinical practice guideline: tinnitus. *Otolaryngol Head Neck Surg*. 2014;151(2 suppl.):S1-S40. doi:10.1177/0194599814545325.

11. Meikle MB, Henry JA, Griest SE, et al. The tinnitus functional index: development of a new clinical measure for chronic, intrusive tinnitus. *Ear Hear*. 2012;33(2):153-176. doi:10.1097/AUD.0b013e31822f67c0.

12. Naylor J, Caimino C, Scutt P, Hoare DJ, Baguley DM. The prevalence and severity of misophonia in a UK undergraduate medical student population and validation of the Amsterdam misophonia scale. *Psychiatr Q*. 2021;92(2):609-619. doi:10.1007/s11126-020-09825-3.

13. Birmaher B, Brent DA, Chiappetta L, Bridge J, Monga S, Baugher M. Psychometric properties of the Screen for Child Anxiety Related Emotional Disorders (SCARED): a replication study. *J Am Acad Child Adolesc Psychiatry*. 1999;38(10):1230-1236. doi:10.1097/00004583-199910000-00011.

14. Etkin RG, Shimshoni Y, Lebowitz ER, Silverman WK. Using evaluative criteria to review youth anxiety measures, part I: self-report. *J Clin Child Adolesc Psychol*. 2021;50(1):58-76. doi:10.1080/15374416.2020.1802736.

15. Angold A, Costello EJ, Messer SC, Pickles A, Winder F, Silver D. The development of a short questionnaire for use in epidemiological studies of depression in children and adolescents. *Int J Meth Psychiatr*. 1995;5:237-249.

16. Harris PA, Taylor R, Thielke R, et al. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed*. 2009;42(2):377-381.

17. Baguley DM, Bartnik G, Kleinjung T, Savastano M, Hough EA. Troublesome tinnitus in childhood and adolescence: data from expert centres. *Int J Pediatr Otorhinolaryngol*. 2013;77(2):248-251. doi:10.1016/j.ijporl.2012.11.009.

18. Chan KH, Jensen EL, Gao D. Pediatric tinnitus: a clinical perspective. *Laryngoscope*. 2018;128(3):727-731. doi:10.1002/lary.26851.

19. Wren FJ, Bridge JA, Birmaher B. Screening for childhood anxiety symptoms in primary care: integrating child and parent reports. *J Am Acad Child Adolesc Psychiatry*. 2004;43(11):1364-1371. doi:10.1097/01.chi.0000138350.60487.d3.

20. Lewin AB, Dickinson S, Kudryk K, et al. Transdiagnostic cognitive behavioral therapy for misophonia in youth: methods for a clinical trial and four pilot cases. *J Affect Disord*. 2021;291:400-408. doi:10.1016/j.jad.2021.04.027.

21. Smith EEA, Guzick AG, Draper IA, et al. Perceptions of various treatment approaches for adults and children with misophonia. *J Affect Disord*. 2022;316:76-82. doi:10.1016/j.jad.2022.08.020.