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## Audiologists and Tinnitus

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**Abstract**

Chronic tinnitus is a complaint of 10-15% of all adults, and highly prevalent with patients who receive an audiologic assessment. In spite of these numbers, audiologists generally are untrained in best practices for tinnitus management. Audiology graduate programs, as a rule, do not provide comprehensive instruction in tinnitus clinical care. Various training programs exist, but they are inconsistent in their recommendations. Audiologists have the latitude to perform just about any tinnitus procedures they wish as there are no standards to prevent the delivery of unvetted services, which are often expensive for patients. The net result is that patients seeking professional services by an audiologist have no basis upon which to be assured they are receiving evidence-based care. The purpose of this article is to describe the current status of tinnitus management services that exist within the general field of Audiology, and to suggest specific approaches for improving those services.

## Introduction

Tinnitus is a “phantom” auditory perception that is experienced chronically by one in 10-15 adults (Bhatt, Lin, & Bhattacharyya, 2016; Hoffman & Reed, 2004). For many, the perception disrupts their sleep, interferes with concentration, and causes depression and anxiety (Henry, Dennis, & Schechter, 2005). These individuals frequently describe high levels of distress and functional limitations. The present authors have worked with thousands of tinnitus sufferers who have described the frustration and hopelessness they come to feel when their healthcare providers can offer them little or no relief. Fortunately, some researchers and clinicians are passionate about, and dedicated to, improving functioning and quality of life for people who experience bothersome tinnitus.

From the manufacturing perspective, tinnitus has a potential market equal to that of hearing aids, considering: (1) 20-40% of people with hearing loss also have tinnitus (Hoffman & Reed, 2004). (2) About 80% of people with tinnitus present some form of hearing loss (Coles, 2000; P. J. Jastreboff & Hazell, 2004; Nuttall, Meikle, & Trune, 2004). (3) One study revealed two out of five (43%) of people with tinnitus have hearing loss and do not use hearing aids (even though about half of those with both conditions who used hearing aids reported the amplification provided relief from the tinnitus) (Kochkin, Tyler, & Born, 2011). It can be argued, from a volume perspective, that the device market for tinnitus is potentially even larger than for hearing loss, considering people who might have intermittent tinnitus, or short bouts of tinnitus, which does not generally occur for hearing loss. The market for protective devices for tinnitus patients such as musicians earplugs or more sophisticated plugs is also not negligible.

We are faced with the problem of a high number of people requiring clinical services for tinnitus, but a dearth of healthcare providers who have the knowledge and expertise to provide

1  
2  
3 these services competently and expeditiously. Audiologists commonly encounter patients  
4  
5 complaining of tinnitus, and audiologists may constitute the primary nexus between these  
6  
7 patients and the healthcare community. Because there is no consensus on the management of  
8  
9 tinnitus and no cure, otolaryngologists often feel unable to provide effective services and may  
10  
11 prefer referring their tinnitus patients to audiologists. Indeed, audiologists may be the best-  
12  
13 positioned healthcare providers to assess tinnitus and to provide intervention if needed, because  
14  
15 they:  
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- 18  
19 • are trained and knowledgeable in auditory system functioning and disorders  
20  
21 (Searchfield & Baguley, 2011)  
22  
23
- 24 • are skilled in the assessment of hearing function, with these skills being adaptable to  
25  
26 evaluate psychoacoustic attributes of tinnitus (Henry, 2004)  
27  
28
- 29 • can manage tinnitus patients with sound-based therapies, namely with hearing aids  
30  
31 and custom devices that can deliver personalized sound stimulation, which have  
32  
33 considerable evidence for alleviating effects of tinnitus (dos Santos et al., 2014;  
34  
35 Henry, Frederick, Sell, Griest, & Abrams, 2015; Henry, McMillan, et al., 2017;  
36  
37 Shekhawat, Searchfield, & Stinear, 2013)  
38  
39
- 40 • are generally in possession of good counseling skills, which are needed to be effective  
41  
42 tinnitus practitioners (Hall III & Ruth, 1999; Sweetow, 1985)  
43  
44
- 45 • are closely affiliated with otolaryngologists, who are essential to conduct medical  
46  
47 evaluations for certain forms of tinnitus (Wackym & Friedland, 2004)  
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49

50 In spite of all these reasons why audiologists are ideally suited to provide tinnitus services,  
51  
52 relatively few of them work with the tinnitus population. Even fewer audiologists provide  
53  
54 services according to proper tinnitus management protocols. The purpose of this article is to  
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2  
3 describe the status of tinnitus care within the audiologist community, and to offer  
4  
5 recommendations for audiologists to become mutually aligned in their approach to tinnitus  
6  
7 management, using evidence from controlled trials, systematic literature reviews, and clinical  
8  
9 guidelines based on systematic reviews.  
10

### 11 **Gaps in Tinnitus Care**

12  
13  
14 Tinnitus research is prolific—over 300 tinnitus-related publications appear yearly in peer-  
15  
16 reviewed journals. With so much research completed, it would seem tinnitus care procedures  
17  
18 should be well established and broadly disseminated. In reality, surveys with providers have  
19  
20 consistently revealed that tinnitus care is not evidence based, is highly variable across clinics,  
21  
22 and does not incorporate standardized measurement of patient outcomes (Carlson et al., 2016;  
23  
24 Carlson et al., 2016; Schmidt, Kaelin, Henselman, & Henry, 2017; Tuepker, Elnitsky, Newell,  
25  
26 Zaugg, & Henry, 2018). Bhatt, Lin, and Bhattacharyya (2016) evaluated the adherence of  
27  
28 tinnitus services in the United States to the clinical practice guidelines published by the  
29  
30 American Academy of Otolaryngology-Head and Neck Surgery Foundation (AAO-HNSF;  
31  
32 Tunkel et al., 2014), and concluded the guidelines were “followed infrequently.” This might be  
33  
34 explainable because most published trials of tinnitus interventions do not meet the standards of  
35  
36 high-quality evidence required by synthesis reviews (e.g., Cochrane). Hence, clinical practice  
37  
38 guidelines that rely on such reviews have little basis for making recommendations (Fuller et al.,  
39  
40 2017; Tunkel et al., 2014), leaving scant evidence for top-down support from decision and policy  
41  
42 makers. It is therefore not surprising that tinnitus assessment and management practices are  
43  
44 typically not required curriculum in relevant graduate programs, not only for Audiology but also  
45  
46 for Otolaryngology and Mental Health—disciplines that commonly encounter patients  
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48 complaining of tinnitus. Effective, research-based clinical practices for helping patients manage  
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3 their tinnitus are largely unknown to the great majority of these providers and are therefore not  
4  
5 routinely offered in settings where patients seek care.  
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8 Many audiologists are overloaded with diagnostics, hearing instrument fittings, and follow-  
9  
10 up visits. They do not have the time to invest into setting up proper tinnitus services in their  
11  
12 clinic. Further, there is no clear third-party reimbursement (insurance) for most tinnitus services,  
13  
14 resulting in clinicians having to offer these services using a “pay out of pocket” approach, which  
15  
16 many are not comfortable requesting (Combs, 2014). Tinnitus evaluation protocols that can  
17  
18 provide audiologists with quick, accurate, and convenient results have a better chance of  
19  
20 resonating with the clinical community.  
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22

23  
24 Manufacturers and researchers have attempted to educate and train audiologists on tinnitus  
25  
26 management services, but with little success judging by the relatively few providers who  
27  
28 currently offer such services. For many of the reasons discussed above as to why audiologists do  
29  
30 not work with the tinnitus population in spite of their suitability as tinnitus-care providers, it has  
31  
32 been difficult to inspire audiologists to ramp up their clinical services to be more inclusive of  
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34 tinnitus management in their scope of practice. There may not be the payoff for time invested in  
35  
36 the minds of many audiologists, in addition to the fact that the large majority are not comfortable  
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38 in their professional skills with respect to tinnitus. The difficult equation audiologists have to  
39  
40 solve is to propose a clinical approach that is efficient in improving the tinnitus condition and at  
41  
42 the same time is viable economically. In this context, the “problem” with tinnitus is that it often  
43  
44 takes time to manage. No medication is capable of suppressing the percept—management  
45  
46 therefore consists of limiting the impact of tinnitus on quality of life. For audiologists, many  
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48 appointments involving long counseling sessions may be required. What is needed is a  
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50 standardized and evidence-based clinical management protocol provided at the right cost for both  
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3 patient and provider. It is therefore first an application challenge before being an educational  
4 challenge. That being said, there are a few bright shining audiologists who have invested in their  
5 training and created tinnitus management services in their clinics, and are profitable as well.  
6  
7 These audiologists have committed to learning and implementing tinnitus services into their  
8 clinical scope of practice and they have a genuine interest in serving this population. They may  
9 typically be the more savvy clinicians and have provided tinnitus services long enough to  
10 appreciate the benefit of offering them.  
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### 19 **Conducting a Tinnitus Evaluation**

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21 Measuring tinnitus is complicated, considering the only person who can perceive the tinnitus  
22 is the patient, thereby making all measurements inherently subjective. In fact, many clinicians  
23 and researchers dismiss attempts to measure the psychophysical properties of tinnitus as  
24 unhelpful, and choose to focus instead on the patient's reactions to tinnitus (i.e., how much it  
25 bothers him or her) (Rabau et al., 2015; Raj-Koziak et al., 2019). Others argue that tinnitus  
26 psychoacoustic measures are important for counseling purposes (Basile, Fournier, Hutchins, &  
27 Hebert, 2013; P.J. Jastreboff, 1996; Suzuki, Suzuki, Onishi, & Penido, 2018). It is not possible to  
28 completely escape from measurements of tinnitus perception due to their prevalence in treatment  
29 protocols designed to reduce tinnitus loudness, as well as their persistence in medical coding and  
30 past literature.  
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### 44 **Measuring Tinnitus Perception**

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46 To measure tinnitus perception, four tests (loudness matching, pitch matching, maskability,  
47 and residual inhibition) are part of a typical tinnitus psychoacoustic evaluation, which has a CPT  
48 code for reimbursement in the United States. The series of tests has been around for over 30  
49 years (Vernon & Meikle, 1988) and is still performed by some audiologists. Psychoacoustic  
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3 testing for auditory attributes of tinnitus is generally not recommended because the results of  
4 testing do not inform clinical decision making, except for pitch matching as described in the next  
5 paragraph. A more complete description of these different measures than what is provided here is  
6 available elsewhere (Henry, 2016).  
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12 Numerous tinnitus sound-therapy methods require a tinnitus pitch match (PM) to shape the  
13 sound stimulus that is used with their protocol. As examples: (1) A PM is considered important  
14 for Tinnitus Masking to select the optimal masking sound and for monitoring potential changes  
15 in the tinnitus percept resulting from treatment (Vernon & Meikle, 2000). (2) Neuromonics  
16 Tinnitus Treatment obtains a PM to shape the broadband noise embedded in their relaxation  
17 music (Sinopoli, Davis, & Hanley, 2007). (3) A method of “notching” the sound stimulus around  
18 the PM frequency has been reported effective for reducing the loudness of tinnitus (Okamoto,  
19 Stracke, Stoll, & Pantev, 2010; Pantev, Okamoto, & Teismann, 2012). (4) The method of  
20 Acoustic Coordinated Reset Neuromodulation requires a PM to identify their four stimulation  
21 tones—two above and two below the PM frequency (Adamchic et al., 2017). (5) Patients  
22 undergoing treatment with the Levo device (Otoharmonics) provide a tinnitus “sound print” to  
23 identify the sound most closely matched to the sound of their tinnitus (Theodoroff et al., 2017).  
24 Many commercial therapies reliant on knowing the tinnitus pitch use their own method to obtain  
25 a PM. Because of the different methods used to obtain a PM, and the generally poor test-retest  
26 reliability of pitch matches (Henry, 2016), evidence for the validity of these proprietary sound-  
27 therapy methods is equivocal.  
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49 Loudness is perhaps the most germane attribute of tinnitus pertaining to treatment intended to  
50 reduce the perception of tinnitus. Although not proven, a reduction of tinnitus loudness would  
51 logically lessen the impact of tinnitus for an individual (depending of course on the amount of  
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3 loudness reduction and patient characteristics). Tinnitus loudness is typically measured two  
4 ways. First, loudness matching is performed such that patients match the loudness of their  
5 tinnitus to the loudness of a pure tone—usually at the PM frequency, but also at 1 kHz, which  
6 may better reflect the actual loudness of tinnitus (Goodwin & Johnson, 1980). The second  
7 method is to use a loudness rating scale, such as 0-10 (with 10 being the loudest sound  
8 imaginable), which is used to select the number that best represents the tinnitus loudness.  
9 Loudness rating scales tend to correlate with scores from tinnitus-severity questionnaires  
10 (Manning, Grush, Thielman, Roberts, & Henry, 2019), thus loudness rating scales are not  
11 reliable for measuring tinnitus loudness.  
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24 Minimum masking level (MML) is not a measure of tinnitus per se, but rather a measure of  
25 the susceptibility of tinnitus to being rendered inaudible, or “masked,” by an external sound.  
26 Testing is usually conducted with broadband noise, and the MML may be different between the  
27 two ears. The MML has been reported to be prognostic for patients treated with Tinnitus  
28 Masking—those who are easily masked, and find the noise acceptable, are most likely to benefit  
29 from masking (Vernon, 1992) MMLs were reportedly reduced for patients following successful  
30 sound therapy (Davis, Paki, & Hanley, 2007; P.J. Jastreboff, Hazell, & Graham, 1994). Further  
31 research is needed to facilitate interpretation of MML measures both for baseline and outcome  
32 purposes.  
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44 Residual inhibition testing (to determine if sound induces a temporary suppression of  
45 tinnitus) is normally conducted after obtaining the MML, by raising the sound to a level above  
46 the MML in the attempt to induce the effect. Using the standard clinical test, residual inhibition  
47 of brief duration (typically <1 minute) was reported to occur for about 90% of patients (Henry &  
48 Meikle, 2000; Vernon & Meikle, 2000). The value of testing for residual inhibition is currently  
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3 debated. It has been argued that the testing is not recommended because it can give patients the  
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5 false sense that tinnitus can be permanently suppressed by sound (P. J. Jastreboff & Hazell,  
6  
7 2004). Others have argued that residual inhibition can restore hope and a feeling of control  
8  
9 (Vernon & Meikle, 2003). It may very well be there is a way for sound to suppress tinnitus  
10  
11 (Fournier et al., 2018), but research has not yet determined how to accomplish that in a  
12  
13 systematic and consistent fashion.  
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15

### 16 17 **Measuring Tinnitus Reactions**

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19 The cure for tinnitus would be to eliminate the phantom sound entirely. This has not yet been  
20  
21 discovered, nor has a partial cure (permanent *reduction* in tinnitus loudness). In lieu of  
22  
23 eliminating/reducing the perception of tinnitus, treatment is limited to reducing the functional  
24  
25 effects of tinnitus (disruption of sleep, concentration, and/or emotions). At least a dozen  
26  
27 questionnaires have been developed and validated for assessing functional effects of tinnitus.  
28  
29 Any of these questionnaires is adequate for intake assessment purposes, i.e., to determine the  
30  
31 severity of tinnitus and the potential need for intervention. A caveat, however, is that, if a person  
32  
33 has both tinnitus and unaddressed hearing loss, that person may ascribe the hearing difficulties to  
34  
35 the tinnitus, which would inflate the questionnaire score (Coles, 1995; Ratnayake, Jayarajan, &  
36  
37 Bartlett, 2009; Zaugg, Schechter, Fausti, & Henry, 2002). When that happens, the tinnitus  
38  
39 appears to be a worse problem than it really is. It is therefore argued that administering a tinnitus  
40  
41 questionnaire to a person with unaddressed hearing needs can exaggerate the extent of the  
42  
43 reported tinnitus problem. The Tinnitus and Hearing Survey (THS) was developed expressly  
44  
45 because of this concern (Henry, Griest, et al., 2015). The THS is brief (10 items), and provides a  
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47 score specific to tinnitus problems and a separate score specific to hearing problems.  
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3 If a patient is to receive intervention for bothersome tinnitus, then it is important to obtain a  
4 baseline measure of the tinnitus severity. The same measure is repeated following the  
5  
6 intervention to determine if the functional effects of tinnitus have been mitigated. Most tinnitus  
7  
8 questionnaires are not validated for tinnitus outcome assessment (i.e., responsiveness). One that  
9  
10 is validated for responsiveness is the Tinnitus Functional Index (TFI; Meikle et al., 2012). It is  
11  
12 recommended to administer the TFI only after any hearing needs have been met, and prior to  
13  
14 intervention. It is then administered following intervention, and the desired result is that the  
15  
16 index score is reduced from baseline to post-intervention. In general, perceived benefit from  
17  
18 intervention increases in direct proportion to the degree of index score reduction. The TFI  
19  
20 includes eight subscales, representing eight different functional domains of tinnitus. Each of  
21  
22 these subscales has its own score, so the different domains can be looked at separately to  
23  
24 determine within-domain effects of intervention.  
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31 The TFI has been translated into over 20 languages. However, not all of these translations  
32  
33 have been validated for their psychometric properties. In general, practitioners should use the  
34  
35 most validated tinnitus questionnaire for their particular language.  
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37

### 38 **Tinnitus Intervention by Audiologists**

39  
40 Audiologists have many options available to them to provide intervention for tinnitus. The  
41  
42 options are generally limited to using sound in some way to mitigate effects of tinnitus. The  
43  
44 commercial methods listed above that require a PM are all possibilities. It needs to be pointed  
45  
46 out, however, that no one method of sound therapy has been shown to be any more effective than  
47  
48 any other. Further, there are many apps that can be downloaded to smartphones that are either  
49  
50 free or very low cost. These free/low cost apps may be as effective as the more expensive sound  
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52 therapies; they should therefore be the first choice for this purpose. For example, the free  
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3 ReSound Relief app was recently shown to be efficacious for reducing functional effects of  
4  
5 tinnitus (Skarzynski, Kutymba, Cywka, & Sztabnicka, 2019). If tinnitus apps have been tried for a  
6  
7 patient without success, then the more expensive devices can be considered—assuming they are  
8  
9 desired and affordable by the patient.  
10

11  
12 It should be further pointed out that “sound therapy” is not recommended by the AAO-HNSF  
13  
14 guidelines (Tunkel et al., 2014). Rather, it is considered “optional” for tinnitus intervention  
15  
16 because of the relative lack of randomized controlled trials (RCTs) demonstrating the efficacy of  
17  
18 different methods of sound therapy. Sound therapy does not have as strong an evidence-base as  
19  
20 for Cognitive Behavioral Therapy (CBT), but that may be because of the limited RCTs for sound  
21  
22 therapy reported in the literature—not necessarily because sound therapy is any less effective. It  
23  
24 is suggested, however, that patients with very bothersome tinnitus be referred to a behavioral  
25  
26 health provider who has expertise in CBT for tinnitus. Such providers may be difficult to find,  
27  
28 but many have expertise in CBT for depression and anxiety. It would seem likely that CBT in  
29  
30 general would be helpful to teach patients coping skills for tinnitus management.  
31  
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35 The method of Progressive Tinnitus Management (PTM) uses a stepped-care approach.  
36  
37 Patients receive an audiologic exam and hearing aids if warranted (Henry & Manning, 2019) If  
38  
39 their tinnitus is bothersome following the audiologic services, a combination of sound therapy  
40  
41 and CBT is recommended for intervention. The intervention involves teaching sessions that  
42  
43 focus on using sound as therapy, and certain skills derived from CBT (relaxation, distraction  
44  
45 activities, and changing thoughts about tinnitus) (Henry, Zaugg, Myers, & Kendall, 2010). PTM  
46  
47 has been vetted for efficacy in a multi-site RCT (Henry, Thielman, et al., 2017).  
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51 Although PTM is mentioned, other methods of tinnitus management have been developed  
52  
53 that have various levels of research evidence. It will be important to conduct RCTs to evaluate  
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3 each of these therapies by comparing effect sizes and the duration of treatment required to obtain  
4  
5 each effect size.  
6

### 7 8 **Suggested Protocol for Audiologists** 9

10 As already argued, audiologists are the clinicians in the best position to at least initiate  
11  
12 tinnitus clinical services. Audiologists can be considered the gateway to healthcare services for  
13  
14 tinnitus sufferers. Those who currently provide tinnitus services often just do what they think is  
15  
16 best (or most profitable) without following research-based guidelines. A research-based protocol  
17  
18 for audiologists that requires very little additional time (~5 minutes) to determine what a  
19  
20 patient's needs are with respect to tinnitus and hyperacusis is available (Henry & Manning,  
21  
22 2019) Audiologists need to at least know what to do when a patient reports the presence of  
23  
24 tinnitus, and this brief protocol will address that concern. The protocol involves essentially  
25  
26 administration of the THS along with a standard audiologic evaluation. The information derived  
27  
28 from that testing would normally be sufficient to know if the patient requires intervention for  
29  
30 tinnitus, for hearing loss, or for both. The THS also provides screening for a sound tolerance  
31  
32 problem (hyperacusis/misophonia), which can also be largely addressed by audiologists (Henry  
33  
34 et al., 2010).  
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40 Approximately 80% of all people with tinnitus (not just those looking for help with tinnitus)  
41  
42 have hearing loss (Kim et al., 2011). There is considerable evidence that providing amplification  
43  
44 through hearing aids for people with hearing loss can be beneficial in reducing functional effects  
45  
46 of tinnitus (dos Santos et al., 2014; Henry, Frederick, et al., 2015; Henry, McMillan, et al., 2017;  
47  
48 Shekhawat et al., 2013). Although more controlled research is needed, an abundance of evidence  
49  
50 supports the use of hearing aids for tinnitus management. So, if "profitability" is a concern for  
51  
52 audiologists, the fact that hearing aids or combination instruments have research evidence for  
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3 tinnitus management, along with a 5-minute protocol for conducting the tinnitus assessment with  
4 the THS, should be sufficient to convince many audiologists to add tinnitus services to their  
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8 practice.

## 9 10 **Conclusions**

11  
12 Because of the diverse and ethereal nature of tinnitus, it is important to develop a  
13  
14 global/holistic view of the field of clinical management for this condition. The field is composed  
15  
16 primarily of four players: patients, clinicians, researchers, and industry—who should interact  
17  
18 strongly with each other. Researchers and clinicians should listen to patients and understand their  
19  
20 concerns and needs. Patient needs are diverse and the corresponding clinical management should  
21  
22 be adapted and individualized. Researchers need to develop the appropriate tests to ideally  
23  
24 identify tinnitus sub-groups and orient patients to the adapted treatment. Clinicians can of course  
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26 add to our knowledge base because of their direct interaction with patients on a daily basis.  
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31 Whereas this global/holistic view is the ideal, we are far from achieving that goal. In the  
32  
33 meantime, audiologists can augment their basic skills to become a cadre of competent tinnitus  
34  
35 specialists. The challenge is to provide clinical services that are consistent, research based, and in  
36  
37 the patients' best interest with respect to cost of services and timeliness. Any audiologist can  
38  
39 perform a basic tinnitus assessment with the THS and provide hearing aids or combination  
40  
41 instruments as intervention for tinnitus. As explained above, these basic tinnitus services require  
42  
43 very little time on top of standard audiologic services. A higher level of services depends on  
44  
45 whether the services are viable economically. These higher-level services should find the right  
46  
47 balance between efficacy and time and cost for patients. Follow-up is a sine qua non to provide  
48  
49 adequate care for these patients. Some audiologists are interested in advanced training, which  
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51 elevates them to the status of providing more extensive tinnitus services. If the majority of  
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3 audiologists would learn to provide basic tinnitus services, then only a subgroup would need to  
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5 become proficient in providing more comprehensive tinnitus services. This scenario is  
6  
7 achievable if audiologists will coordinate their efforts with this goal in mind.  
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