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PSYCHOLOGICAL AND PSYCHIATRIC COMORBIDITIES ASSOCIATED WITH  
TINNITUS: A SYSTEMATIC LITERATURE REVIEW

By

Shanna Hymowitz

A capstone research project submitted to the Graduate Faculty in Audiology in partial fulfillment of the requirements for the degree of Doctor of Audiology, The City University of New York

2016

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TINNITUS: A SYSTEMATIC REVIEW

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This manuscript has been read and accepted for the  
Graduate Faculty in Audiology in satisfaction of the  
capstone project requirement for the degree of Au.D.

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## Abstract

# PSYCHOLOGICAL AND PSYCHIATRIC COMORBIDITIES ASSOCIATED WITH TINNITUS: A SYSTEMATIC LITERATURE REVIEW

by

Shanna Hymowitz

Advisor: Barbara Weinstein, Ph.D.

The purpose of this systematic literature review was to examine the current literature evidence pertaining to the relationship between tinnitus and psychological and psychiatric comorbidities. Literature was found discussing the prevalence of tinnitus with psychological and psychiatric comorbidities, differences in self-reports, and whether the perception of tinnitus is aided with the use of psychological counseling and psychotropic medications. Relative search strings applied to Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medline Complete, and PubMed identified studies to be included in this review. (Will put total amount of studies found once collected). An assessment of all research literature found revealed a high prevalence of individuals with anxiety or depression that were also suffering from severe tinnitus. Limited research was found regarding the differences in self-reports of tinnitus severity in relation to etiology and comorbidity. Further research is needed regarding this area in the future. However, research results did show perceived improvement in the presence of tinnitus when these individuals were treated using counseling and psychotropic medications.

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## TABLE OF CONTENTS

Abstract .....	iv
Acknowledgements.....	v
List of Tables .....	vii
Introduction .....	1
Methods .....	11
Results .....	13
Discussion .....	35
Conclusions .....	39
References .....	41

## LIST OF TABLES

Table 1. Hierarchy of Levels of Evidence for Research Studies.....	12
Table 2. Levels of Evidence and Study Characteristics.....	13
Table 3. Studies on Prevalence/Correlation of Tinnitus and Psychological Comorbidities.....	22
Table 4. Studies on Psychological Self-Report with Differing Etiologies.....	25
Table 5. Studies on Use of Psychotropic Medication and Counseling for Tinnitus.....	34

## INTRODUCTION

Tinnitus can be defined as the perception of sound in the absence of an acoustic stimulus (Shargorodsky, Curhan, & Farwell, 2010). Tinnitus can either be objective or subjective. Objective tinnitus is sound from the ear canal that can be perceptible to another person, while subjective tinnitus is only perceptible to the patient. The majority of tinnitus cases are classified as subjective, while objective tinnitus is very rare. Objective tinnitus can also be referred to as somatic tinnitus, and when it does occur, is often caused by muscular or vascular structures within the head and neck. The sound caused by the contraction of these structures is transported to the ear through body tissues where it can be heard. Pulsatile tinnitus, a type of objective tinnitus, is caused by constriction in blood flow. Spontaneous tinnitus, another type of objective tinnitus can be caused by spontaneous otoacoustic emissions of the outer hair cells (Chan, 2009).

### **Prevalence**

Tinnitus occurs in about 50 million adults in the United States, which is equivalent to about 17% of the population. Of this 17%, about 5% reports that their tinnitus is moderately annoying, while nearly 1% reports that their tinnitus is truly debilitating. While the prevalence of tinnitus does increase with age, it does seem to plateau between the ages of 60-69 years. Studies have shown that tinnitus is also more common in Caucasian individuals compared to other races. Causes of tinnitus other than hearing loss may be associated to noise induced exposure, such as with music or firearms, as well as a higher presence of tinnitus in individuals who are frequent smokers. Studies have also shown increased prevalence of tinnitus in individuals with hypertension, and individuals with anxiety disorders. (Shargordoksy et al. 2010)

Tinnitus is often more prevalent in individuals with hearing loss, occurring in about 75-80% of those with hearing loss. It is also common for the severity of the tinnitus to increase with greater degrees of hearing loss. Tinnitus is also known to have increased prevalence as a function of age, however it has been seen in studies that this function of prevalence decreases around 70 years of age (Shagorodsky et al., 2010). Tinnitus has also been found to be more common in men than in women (Ahmad & Seidman, 2004).

The onset of tinnitus can usually be attributed to hearing loss and prolonged noise exposure, however some other pathological causes are Meniere's disease, impacted cerumen, and otosclerosis. Tinnitus may also be caused by neurologic disorders such as head injury, Multiple Sclerosis, acoustic neuromas, and cerebellopontine-angle tumors. In addition to these causes tinnitus can also be a result of certain medications. Some of these medications include: chemotherapy agents, salicylates, nonsteroidal anti-inflammatory drugs, loop diuretics, and aminoglycoside antibiotics (Hon, Lee, Kim, Lim, & Shin, 2009)

## **Pathophysiology**

Tinnitus was originally believed to be associated with disorders of the inner ear, however over the years evidence is mounting which suggests that the central nervous system also plays a role in the pathophysiology of tinnitus. As tinnitus was thought to be a disorder of cochlear damage, it was believed that the perception of tinnitus was due to the damage of cochlear hair cells, which was then perceived as sound by the auditory cortex. However, it is possible for individuals with auditory nerve resection to still perceive tinnitus, proving that tinnitus is not solely due to cochlear damage. The presence of tinnitus in individuals with auditory nerve

resection supports another hypothesis, that tinnitus is a result of central nervous system involvement. This hypothesis states that increased spontaneous neural activity generates the sound perception of tinnitus. Another hypothesis states that lesions upon the auditory tract cause cortical neurons to become more sensitive to frequencies of adjacent neurons, thus allowing them to perceive the sound of tinnitus. Understanding the etiology of tinnitus can potentially help with therapeutics management. (Ahmad & Seidman, 2004).

### **Quantification of Tinnitus**

Tinnitus self-report measures are important in the evaluation of the impact of subjective and objective tinnitus in daily life. The use of patient reported outcome measures (PROM) helps both the clinician and patient assess the degree to which the tinnitus impacts the individual's life. PROMs help determine the situations in which the tinnitus is most bothersome, and can also be used to monitor the effectiveness of treatment. Tinnitus questionnaires can be divided into two categories: namely, qualitative and quantitative. The former allows for descriptive responses and do not make use of final scores to analyze the impact of the tinnitus. Qualitative questionnaires include the Tinnitus Problems Questionnaire (TPQ), as well as self-report daily diaries. Use of the TPQ and reviewing daily diaries allow for open ended commentary regarding the tinnitus and the impact it may have on a patient's daily functioning (Newman & Sandbridge, 2004). These open ended questionnaires can be important in counseling, as they allow the patient to focus on specifically on how the tinnitus affects them on a daily basis, rather than answering a set of pre-determined questions. However, the use of qualitative questionnaires makes it difficult to make comparison of patient difficulties with

others (Tyler, 1993).

The latter type of questionnaire provides responses that can be scored, allowing for description of severity. Some quantitative questionnaires are the Tinnitus Handicap Inventory (THI), Tinnitus Handicap Questionnaire (THQ), Tinnitus Reaction Questionnaire (TRQ), and the Tinnitus Severity Scale. These questionnaires address both the difficulties caused by tinnitus (ex: trouble sleeping, understanding speech), as well as the emotion associated with these difficulties (Tyler, 1993). Quantitative questionnaires typically provide a list of questions or statements. The THQ includes 27 statements that assess the physical, emotional, and social effects of tinnitus. The TRQ includes 26 statements that assess patient distress, severity, and avoidance of tinnitus. The Tinnitus Severity Scale includes 16 questions that assess the intrusiveness, distress, hearing loss, sleep disturbance, and use of medication associated with tinnitus (Tyler, 1993). The Tinnitus Handicap Inventory (THI) is a 25-question questionnaire with the aim of assessing the impact of tinnitus on daily life. It has three subscales of functional, emotional, and catastrophic effects. Individuals answer with “yes, sometimes, or no” with a point value for each answer. (Newman, Jacobson, and Spitzer, 1996). All of these tinnitus questionnaires give specific answers to each item that the individual can choose from. The answers can be in the form of a specific numerical value that can then be added together at the completion of the questionnaire or simply an answer of “yes/no” (Newman & Sandbridge, 2004).

Both qualitative and quantitative PROMs can provide a better assessment of the patient’s priorities in regards to the areas in which tinnitus affects their daily life, allowing clinicians to better provide patient-centered counseling. PROMs can also provide baseline assessments of

tinnitus severity and the difficulties associated with it, as well as be used to assess severity during treatment, and monitor the progress of a patient over time (Tyler et al., 2008).

## **Options**

Tinnitus can be treated in a variety of ways, depending on the severity of the tinnitus and how debilitating it may be to the individual experiencing it, as well as the tinnitus etiology. Treatment can be in the form of counseling, lifestyle changes, or medication.

When the tinnitus is associated with hearing loss, it is common that the use of hearing aids will help mitigate the perception of tinnitus. The hearing aids may reduce the awareness of the tinnitus, thus reducing the stress associated with it. Research has shown that although there is a need for a larger number of randomized controlled trials regarding the subject, overall there is a suggested benefit in the use of hearing aids for tinnitus (Shekhawat, Searchfield & Stinear, 2013). Masking devices can also be used to help decrease perception. As the overall etiology of tinnitus is still largely unknown, the aspect of treatment becomes somewhat difficult. This has led to a variety of treatments, some of which are more successful than others. Due to the lack of etiological evidence and in large part, the varying degree of severity of tinnitus, discovering a treatment that is helpful to all individuals becomes somewhat problematic. Some treatments revolve around the idea of counseling, such as Cognitive Behavioral Therapy, or Tinnitus Retraining Therapy, while other treatments utilize the use of medications or supplements (Ahmad & Seidman, 2004).

Cognitive Behavioral Therapy (CBT) looks at the way individuals feel about the presence of their tinnitus and aims to improve their awareness of the tinnitus and alter the

negative cognitive and emotional beliefs they may have towards their tinnitus (different source?). Cognitive Behavioral Therapy (CBT) is a more psychology-based treatment, and focuses on changing an individual's attitude toward the stressor, or in this case, the presence of tinnitus. By doing so, CBT aims to reduce the severity of the tinnitus through the changes in attitude (Grewal, Spielmann, Jones, & Hussain, 2014).

Mindfulness-based stress reduction (MBSR) is a behavioral therapy that stems from CBT. MBSR focuses on the psychological distress, depression, and anxiety associated with tinnitus. MBSR consists of ten group sessions in which individuals go through training on being mindful and living from moment to moment. They observe their emotions and sensations related to tinnitus, while learning meditation skills and psycho-education in order to learn to feel more positive in dealing with tinnitus (Cima, Anderson, Schmidt, & Henry, 2014).

Another counseling technique to help individuals with tinnitus is referred to as Tinnitus Retraining Therapy (TRT). According to Grewal et al. (2014), TRT is a considered a habituation technique that focuses on manipulating the limbic, autonomic, and auditory systems to reduce the response of tinnitus. By manipulating these systems the objective is to decrease the perception of the tinnitus via the auditory nervous system, the emotions associated with the tinnitus, which is processed by the limbic system, and make any necessary changes to behavior caused by the tinnitus, which is processed by the autonomic system. In order for TRT to be successful, numerous counseling sessions are needed over several months (Grewal et al, 2014).

Progressive Audiologic Tinnitus Management (PAMT) focuses on a multidisciplinary treatment for the suffering of tinnitus. It consists of five levels of management on a hierarchal scale, so that individuals suffering from tinnitus can be managed to the degree with which they will benefit most. The five levels include: 1) triage, consisting of referral guidelines for tinnitus,

2) audiologic evaluation to determine whether a hearing loss is present, as well as use self-report measures to determine the degree of impact of the tinnitus, 3) Group Education to learn about the use of hearing aids and self-managing tinnitus using every day noise, 4) Tinnitus Evaluation which may consist of the use of maskers if self-managing was not beneficial, as well as mental health and sleep disorder evaluations due to the high prevalence of psychological disorders and tinnitus, and 5) Individualized Management for those who cannot benefit from the other levels and need more one on one, specialized treatment (Henry, Zaug, Myers & Schechter, 2008).

Another option is the use of tinnitus masking devices. Sound maskers are used in order to distract an individual from their tinnitus. The use of white noise allows there to be a reduction in the perception of tinnitus. The level of the white noise can either be raised to effectively mask the perception of the tinnitus sound, or to a level at which both the tinnitus and white noise are heard simultaneously and are blended together. When the white noise is raised to overcome the tinnitus, an appropriate level needs to be found where the tinnitus is masked, but the white noise is not too distracting. Individuals who cannot find an appropriate level may not benefit from the use of maskers and would benefit more from attempting another form of tinnitus treatment. If the white noise is raised to a level in which it “blends” with the tinnitus, the goal of the masker is habituation, which is a technique that is used in TRT. Maskers are now commonly in the form of the behind the ear hearing aids, which can be discreetly worn all day. Individuals who do make use of hearing aids can have the masker combined with the hearing aid if necessary (Hobson, Chisholm, El Refaie, 2012). More and more companies provide a tinnitus masking option with hearing aids.

In addition to counseling and behavioral modifications, the use of medication to aid in the perception of tinnitus has also been attempted. Although there have been no findings that

there is one overall medication that eradicates tinnitus symptoms, research has shown that certain medications may reduce its presence. Two types of medications that are commonly prescribed for tinnitus are classes of drugs known as tricyclic antidepressants and benzodiazepines (Ahmad & Seidman, 2004). Antidepressants and benzodiazepines are both drug classes that are typically used for the treatment of psychological disorders such as anxiety, which is a typical reaction of persons with debilitating tinnitus. Recently selective serotonin reuptake inhibitors have also been used, such as fluoxetine and paroxetine. As the prevalence of tinnitus increases in the presence of psychological disorders, the use of these drugs may in fact help in the reduction of tinnitus symptoms, however it is uncertain whether the drugs are directly affecting the tinnitus or if they are in fact just reducing the anxiety and depression causing a decreased perception of the bothersome tinnitus (Baldo, Doree, Molin, McFerran & Cecco, 2012).

In addition to psychotropic medications, the use of other alternative medications such as ginkgo biloba extract, carbamazepine and betahistine, as well as supplements of Vitamin B, Magnesium, and Calcium have also been utilized. Many of these drugs can be found over the counter, making it easier for individuals to try various medications at their own leisure. These drugs however have not been found to have significant effects in research studies as compared to the results of psychotropic medications. In fact, studies have shown that these remedies show very little significant improvement compared to the placebos used in the same studies. (Folmer, Theodoroff, Martin & Shi, 2014)

While the use of counseling and medication may help some individuals, the majority of those suffering from tinnitus may need a combination of the two. The presence of psychological factors may exacerbate the annoyance and distress to the perceived tinnitus. Individuals with higher rates of stress due to their tinnitus are more likely to suffer from psychological

comorbidities, including depression and anxiety. The presence of the psychological comorbidities also causes individuals with tinnitus to be less able to handle the associated stress, thus making the tinnitus more debilitating. Those who suffered from psychological disorders prior to the presence of tinnitus may also have a greater perception of their subjective tinnitus as compared to individuals with tinnitus that does not have any psychological disorders. (Zirke et al, 2013).

Until further research can support the use of a standardized treatment method, each case of tinnitus needs to be treated individually. The subjective nature of tinnitus requires an individualized approach for each patient, so that their overall needs will be met and that they will be able to benefit as much as possible.

## OBJECTIVES AND RESEARCH QUESTIONS

Tinnitus is a very prevalent disorder in the adult population. Although many individuals face the problem of tinnitus, the degree to which the tinnitus affects them can vary. Many individuals can get by from day to day with a mild form of tinnitus, however tinnitus can in fact can be debilitating to the daily functioning of an individual if its presence is severe. The degree of impact tinnitus has on an individual can also be impacted by the presence of psychological and psychiatric comorbidities. These comorbidities may increase the perception of the tinnitus or the ability to cope with the affects of tinnitus. The ability to self-report the impact of tinnitus may differ in individuals with and without these psychological comorbidities. In the presence of these comorbidities, treatment may also be affected in terms of therapy and pharmacological treatment with psychotropic medications.

This systematic review is designed to review existing data on the prevalence of tinnitus in the presence of psychological comorbidities, differences in the self-reports measurements of tinnitus severity in the presence of these comorbidities, as well as the affects of psychological counseling and pharmacological treatment in the form of psychotropic medications on the perceived tinnitus of individuals with psychological comorbidities. Research questions are as follows:

- 1) What is the prevalence of psychological/psychiatric difficulties in adults with tinnitus?
- 2) Do self-reports of the psychological effects of tinnitus differ by etiology or by comorbidity?
- 3) Is the perception of tinnitus improved by the use of psychological counseling and use of psychotropic medications?

## **METHODS**

To facilitate the systematic review, it was necessary to find articles pertaining to the subject of tinnitus and its relationship with psychological comorbidities. In order to do so, a search strategy was needed to seek out appropriate articles that could be used to answer the proposed research questions. A criterion for inclusion of articles was also needed in order to ensure that articles were reliable in answering the overall questions intended for the systematic review.

### **Search Strategy**

In order to select articles to be included in the systematic review on the psychological and psychiatric comorbidities associated with tinnitus; a search strategy was developed to evaluate articles published in peer reviewed journals. Articles were searched for using an assortment of search term combinations, with the majority of searches including the word “tinnitus”. Search terms included: tinnitus prevalence, adult, hearing loss, tinnitus and anxiety prevalence, tinnitus etiology, tinnitus review, tinnitus treatment, tinnitus self-report measures, tinnitus counseling, cognitive behavioral treatment, tinnitus retraining therapy, tinnitus psychotropic treatment, psychotropic medication, tinnitus and psychological disorders, tinnitus self-report, anxiety, treatment, psychosocial, psychological, hearing aids, outcomes.

Using these search terms, articles were found with the use of online databases. Databases including Medline Complete, Google Scholar, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), and PubMed are all databases that provided access to peer reviewed research articles pertaining to tinnitus in the fields of audiology, otolaryngology, and psychology. The reference sections of acceptable articles found through these databases were also checked manually to ensure that articles that did not come up using the listed search terms

could be found. Articles were also found by using the above search terms in Google Scholar. The website for the American Tinnitus Association was also viewed, and references on this website were manually searched on the above-mentioned online databases.

### **Study Inclusion Criteria**

Study design criteria for inclusion in the systematic review on the psychological and psychiatric comorbidities associated with tinnitus were: level of evidence regarding the research hierarchy levels, subject selection criteria, and the presence of valid and reliable outcome measures used within research studies when applicable. Subjects needed to be adult participants who suffered from debilitating tinnitus. Research measures used in controlled studies needed to be reliable in order to ensure that results were valid. Articles were also assessed based on levels of research hierarchy, which was adapted from levels found on the ASHA website. The levels of evidence included were: Level 1a- meta analysis of randomized controlled study, Level 1b- randomized controlled study, Level 2a- controlled study without randomization, Level 2b- quasi experimental study, Level 3- non experimental studies, and Level 4- expert committee report, consensus conference, clinical experience.

**Table 1. Hierarchy of Levels of Evidence for Research Studies**

1a	Meta-analysis of randomized controlled study
1b	Randomized Controlled Study
2a	Controlled Study without randomization
2b	Quasi experimental study
3	Non experimental studies
4	Expert committee report, consensus conference, and clinical experience

## RESULTS

The search and retrieval process for this systematic review utilized the above-mentioned databases and keywords to yield eighteen studies that qualified for inclusion based on the previously mentioned study criteria. Of these studies, seven related to the prevalence or correlation of tinnitus and psychological comorbidities; three studies related to self-report for differing etiology and comorbidities, and eight related to the effects of psychological counseling and psychotropic medications on perceived tinnitus distress.

The levels of evidence and characteristics of the included studies can be seen below.

**Table 2. Levels of Evidence and Study Characteristics**

Authors	Level of Evidence	Description of Methods	Tinnitus Assessment Measures	Psychological Assessment Measures	Findings
Bayar et al.	1b	Yes	ATA Tinnitus Questionnaire, subjective grade of tinnitus on a scale of 1-10	N/A	Reduction in tinnitus severity
Gul et al.	1b	Yes	N/A	ASI-3, STAI, SCL-90-R	Positive correlation between tinnitus and psychological comorbidities
Hesser et al.	1a	N/A	N/A	N/A	Reduction in overall distress
Holgers et al.	1b	Yes	N/A	General Well Being Index	Reduction in tinnitus and depression scores. Reduction of scores maintained at 28 week f/u
Jasper et al.	2a	Yes	THI, Mini Tinnitus Questionnaire	HADS, Insomnia Severity Index, Tinnitus	CBT and ICBT are effective treatments for anxiety/depression.

				Acceptance Questionnaire	ICBT is a viable alternative to traditional CBT
Kehrle et al.	3	Yes	THI	BDI, BAI	41.7% prevalence of tinnitus and psychological comorbidities
Kreuzer et al.	3	Yes	TSCHQ, THI, TQ	BDI, WHOQoL	Trauma related tinnitus may cause an increase in psychological comorbidities
Ooms et al.	3	Yes	THI	STAI, DSM-IV	Positive correlation between tinnitus and psychological comorbidities
Oishi et al.	2a	Yes	THI, visual analog scale	STAI, SDS	Reduction in tinnitus severity, anxiety, and depression
Pattyn et al.	1a	N/A	N/A	N/A	20.4%-47% prevalence of tinnitus and psychological comorbidities
Pajor et al.	3	Yes	Visual Scale	BDI, HADS, MMSE, TMT	Increase in psychological comorbidities with HL, but no variation w/ degree of HL
Udupi et al.	3	Yes	THI	STAI, IDS-SR30	Positive correlation between tinnitus and psychological comorbidities
Vielsmeier et al.	3	Yes	TSCHQ, THI, TQ	BDI, WHOQoL	No significant relationship found in psychological comorbidities w/ presence of absence of TMJ
Wah suhailah et al.	1a	N/A	N/A	N/A	CBT, as well as other psychological based treatments are effective for anxiety and

					depression
Zachriat & Kroner-Herwig	1b	Yes	TQ, TCQ, Questionnaire of catastrophizing cognitions, Questionnaire of Dysfunctional Cognitions	Questionnaire of Subjective Success, SCL-90R, Minimal Interview of Psychological Disorders	Significantly more reduction in distress for CBT and habituation, compared to education. Maintained at f/u
Zirke et al.	3	Yes	TQ	CIDI, HADS, GAD-7	46% prevalence of tinnitus and psychological comorbidities
Zoger et al.	1b	Yes	TSQ	DSM, HADS, CPRS-A	Reduction in tinnitus and depression scores
Zoger et al.	3	Yes	TSQ	DSM-IV, HAS, HDS, CPRS-S-A	39% prevalence of consecutive tinnitus, 74% prevalence of chronic tinnitus with psychological comorbidities

### **Prevalence/Correlation of tinnitus and psychological comorbidities**

Seven studies were found discussing the prevalence or correlation of tinnitus and psychological comorbidities. The majority of studies referred to the general correlation of tinnitus and psychological comorbidities, while two studies calculated the overall prevalence of psychological comorbidities in their tinnitus subjects. A meta-analysis review also referred to overall prevalence of tinnitus. Of the studies included in this systematic review, one was a meta-analysis literature review, considered Level 1a of the levels of evidence, and six were considered cross sectional studies, considered Level 3 of the levels of evidence. The studies varied in sample size, age, and assessment of tinnitus and psychological comorbidities.

All studies included reported a correlation between tinnitus and psychological comorbidities. All studies referred to psychological comorbidities as depression, anxiety, or a combination of the two. Study sizes ranged anywhere from 50 to 224 subjects with tinnitus being included. The study conducted by Zoger et al., recruited the most subjects as they compared differences in individuals with consecutive tinnitus and chronic tinnitus. Differences in prevalence findings were found between the Zirke, Zoger, and Kehrle studies and the Pattyn meta-analysis, with findings revealing prevalence of 46% in the Zirke study, 39% in consecutive patients and 79% in chronic tinnitus patients in the Zoger study, 41.7% in the Kehrle study, and a range of 20-47% in the Pattyn et al. meta-analysis. Although the prevalence findings are somewhat similar, the differences, especially that of the 79% of chronic tinnitus patients, could be attributed to differences in sample size, as well as differences in the definition of tinnitus and how tinnitus severity and psychological comorbidities were measured. Despite differences in prevalence findings, all studies did show a relationship between the presence of tinnitus and psychological comorbidities, with findings revealing an increase in anxiety or depression with increases in tinnitus severity. All studies use valid measures to assess the presence of tinnitus and the presence of depression and anxiety, although which assessment measure used varied across studies. Only the Gul et al. study did not quantify tinnitus severity; however the overall results followed the same trend as the findings of other included studies in that there is a correlation between tinnitus and psychological comorbidities.

The analysis of each study can be found below.

A study conducted by Zirke, Seydel, Arsoy, Klapp, Haupt, Szczeppek, Olze, Goebel, and Mazurek (2013) observed the relationship between tinnitus and psychological distress.

Researchers wanted to study the association between the two occurrences. Zirke, et al. (2013) assessed 100 participants, 55 women and 45 men, all of who suffered from tinnitus for at least 3 months. Psychological distress was evaluated utilizing the Composite International Diagnostic Interview (CIDI), the Hospital Anxiety Depression Scale (HADS), and the General Anxiety Disorder-7 (GAD-7), while tinnitus distress was evaluated using the Tinnitus Questionnaire (TQ). Researchers wanted to utilize the CIDI to determine the presence of mental disorders with the occurrence of tinnitus. Zirke, et al. (2013) noted that the CIDI is a tool with high reliability. Results revealed 46% of participants to have one or more mental disorder as diagnosed by the CIDI. Of those participants diagnosed with a mental disorder on the CIDI, had higher overall TQ scores. These participants were more likely to have affective or anxiety mental disorders. Researchers concluded that based off their findings there was a 46% prevalence of the occurrence of mental disorders and tinnitus when using the CIDI as measurement tool, and that individuals with higher rates of decompensated tinnitus are more likely to suffer from affective and anxiety disorders compared to individuals who have compensated tinnitus (Zirke et al., 2013).

Zoger, Svedlund, and Holgers (2006) studied not only the prevalence of anxiety and depression with tinnitus, but also its association with the strength of tinnitus present. Two groups of patients, one group consisting of 80 consecutive tinnitus patients, and a second group consisting of 144 tinnitus patients at high risk for chronic tinnitus participated in the study. All patients had pure tone averages less than 50 dBHL, so that any psychological effects were not related to social isolation caused by severe degrees of hearing loss. Researchers determined the two groups based on the Swedish version of the Nottingham Health Profile. Exclusion criteria included patients on sick leave, retired, had language difficulties, or were receiving psychiatric

treatment. Tinnitus severity was assessed in the consecutive tinnitus group with a single item question determining whether there was transient tinnitus, tinnitus in specific situation, or continuous tinnitus, while tinnitus severity was assessed in the chronic group utilizing the Tinnitus Severity Questionnaire (TSQ). Psychological disorders were assessed in both groups with the Structural Clinical Interview for DSM, the Hospital Anxiety and Depression Scale (HADS), the Comprehensive Psychopathological Rating Scale (CPRS-A). Results revealed in the consecutive group, 39% of subjects had minor depression, 33% had major depression, 45% had any anxiety disorder, and 13% had multiple anxiety disorders. Results of the chronic tinnitus group revealed 74% minor depression, 52% major depression, 49% any anxiety disorder, and 19% multiple anxiety disorders. Zoger, et al. (2006) found that there was significant correlation between tinnitus severity and depression in both groups, but only a significant correlation between tinnitus severity and anxiety in the chronic tinnitus group. It was concluded that there was a 74% prevalence of depression in chronic tinnitus sufferers and 39% in consecutive tinnitus sufferers, and overall tinnitus severity is associated with psychiatric disorders (Zoger, Svedlund, Holgers, 2006).

Another study by Udupi, Uppunda, Mohan, Alex, and Mahendra (2013) also looked at the relationship between tinnitus severity and depression/anxiety. Researchers also wanted to determine whether there was any correlation between the presence of depression/anxiety and age, gender and hearing status. 50 adult subjects between the ages of 19 and 60 years, 31 males and 19 females participated in the study. Anxiety and depression were assessed utilizing the State-Trait Anxiety Inventory (STAI) and the Inventory of Depressive Symptomatology-Self Report-30 (IDS-SR30), while tinnitus was assessed utilizing the Tinnitus Handicap Inventory. Results revealed between THI scores and scores on the STAI and IDS-SR30. Results also

revealed that there was no significant correlation between age, gender, and hearing status and THI scores. Researchers concluded that there was a significant relationship and high prevalence between the severity of tinnitus and the presence of anxiety or depression (Udupi et al., 2013).

Pattyn, Van Den Eede, Vanneste, Cassiers, Veltman, Van De Heyning, and Sabbe (2015) conducted a literature review to assess the association between tinnitus and anxiety disorders, as well as its clinical implications. Pattyn, et al. (2015) included 117 articles to be assessed for the prevalence of tinnitus and anxiety and depression. Results of the literature review revealed a prevalence range of 20.4-47% for individuals suffering from anxiety disorders in the presence of tinnitus. Results also suggested that there was a greater presence of psychological comorbidities with an increase in tinnitus severity. Based off the data found, it was concluded that there is a high prevalence between tinnitus and psychological comorbidity, and as such, screening and treatment of these disorders should be considered when dealing with patients with moderate to severe tinnitus (Pattyn et al., 2015).

According to Ooms, Vanheule, Meganck, Vinck, Watelet, and Dhooge (2012) there is a great deal of content overlap between tinnitus and anxiety questionnaires, and in order to truly determine the prevalence of tinnitus and psychological comorbidities this overlap must be controlled. Ooms, et al. (2012) believe that the presence of cognitive or somatic anxiety should be determined and then an evidence of a real relationship between the anxiety and tinnitus can be discovered. To do so, researchers recruited 71 participants with a mean age of 49 years with an average duration of 43.9 months of suffering from tinnitus before beginning the study. The Dutch version of the State and Trait Anxiety Inventory was utilized to measure cognitive anxiety, while somatic anxiety was measured using a list developed from the Diagnostic and Statistical Manual for Mental Disorders (DSM-IV). The Tinnitus Handicap Inventory (THI) was

utilized to measure tinnitus severity and its impact. In this study, pitch and loudness matching were also used as a psychoacoustic measure to quantify tinnitus. Results revealed no correlation between psychoacoustic measures of tinnitus and subjective measures of tinnitus or anxiety. Results however revealed almost 60% of participants scoring above average when assessing cognitive anxiety, as well as a significant positive correlation between THI and STAI results. Researchers also found a positive correlation between scores even when overlapping THI and STAI questions were deleted from the overall scoring. For somatic anxiety, 40.8% of participants reporting four or more somatic anxiety symptoms on the DSM-IV. Based on these results researchers concluded that there is a correlation between tinnitus and anxiety, and there is an overall important relationship between the two that should be kept in mind when working with tinnitus patients (Ooms et al., 2012).

The correlation between tinnitus and anxiety was also assessed by Gül, A. I., Özkırış, M., Aydın, R., Şimşek, G., & Saydam (2015) who utilized both an experimental and control group to observe correlations. 50 subjects with tinnitus complaints for 6 months or longer, and 50 subjects without tinnitus complaints were selected through a simple random sampling method. Exclusion criteria included concomitant neuropsychiatric or physical disease, alcohol or drug abuse, and treatment with drugs that may cause tinnitus as a side effect. The Anxiety Sensitivity Index-3 (ASI-3), State-Trait Anxiety Inventory (STAI), and Symptom Checklist -90-Revised (SCL-90-R) were utilized to assess anxiety. Tinnitus severity was not assessed in this study. Results revealed that individuals with self-reported tinnitus had higher scores on all questionnaires than the control group, especially on the SCL-90R; the tinnitus group had significantly higher anxiety (Gul et al., 2015).

A study by Kehrlé, Sampaio, Granjeiro, Oliveira, and Oliveira (2016) looked at the

differences in anxiety and depression in normal hearing individuals with and without tinnitus. The study consisted of 84 individuals with normal hearing and tinnitus and 47 individuals with normal hearing and no tinnitus between the ages of 18-48. Exclusion criteria included abnormalities in otolaryngologic or audiologic exams, recent medication use for tinnitus, recent exposure to ototoxic drugs, acoustic trauma, vascular, metabolic, or ear diseases, and vestibular, neurologic or psychiatric disorders. Auditory brainstem response (ABR) tests were performed on all subjects. To assess tinnitus, researchers utilized the THI, while the Beck Depression Inventory (BDI) and Beck Anxiety Inventory (BAI) were used to assess depression and anxiety. Results revealed that 41.7% of individuals in the tinnitus group suffered from depression and anxiety, while only 4.3% of individuals suffered from depression in the no tinnitus group. It was also revealed that there was a higher degree of tinnitus annoyance for individuals who suffered from depression and anxiety. Kehrle, et al. (2016) concluded that there was a strong correlation between tinnitus annoyance/severity and the presence of anxiety or depression (Kehrle et al., 2016).

**Table 3. Studies on prevalence/correlation of tinnitus and psychological comorbidities**

Authors	Year	Sample Size	Prevalence/Correlation	Tinnitus Measures	Psychological Measures
Zirke et al.	2013	100	46%	TQ	CIDI, HADS, GAD-7
Zoger et al.	2006	224	39% consecutive, 74% chronic	TSQ	DSM, HADS, CPRS-A
Udupi et al.	2013	50	Positive Correlation	THI	STAI, IDS-SR30
Pattyn et al.	2015	117 (studies)	20.4%-47%	N/A	N/A
Ooms et al.	2012	71	Positive Correlation	THI	STAI, DSM-IV
Gul et al.	2015	100	Positive Correlation	N/A	ASI-3, STAI, SCL-90-R
Kehrle et al.	2016	131	41.7%	THI	BDI, BAI

**Differences in self-reports of tinnitus severity**

Limited studies were found pertaining to the differences in psychological self-report for differing etiologies of tinnitus. Three studies reporting differences in psychological self-report were included in this systematic review. The studies included focused on differing etiologies of tinnitus, so no in depth comparisons could be made between regarding specific etiologies and psychological self-report. One studied observed differences in psychological self-report in tinnitus patients with co-occurring trauma, the second study observed psychological self-report in tinnitus patients with co-occurring temporomandibular joint disorder, and the third observed psychological self-report in tinnitus patients with co-occurring hearing loss. All studies were cross sectional studies considered Level 3 on the levels of evidence for included studies. Both the study assessing psychological self-report for temporomandibular joint disorder and for hearing loss concluded that there was no effect on psychological self-report for individuals with tinnitus

both with and without the etiologies. The study by Kreuzer et al. (2012) which assessed psychological self-report in patients with tinnitus associated with and without trauma concluded that there was in fact a difference in psychological self-report when there was a tinnitus etiology of trauma. Differences in findings can be attributed to the differing etiologies of tinnitus. Both the Kreuzer et al. (2012) and Vielsmeier et al. (2012) studies had large patient populations compared to that of the Pajor et al. (2013) study. The study populations may also play a large role in the findings of psychological self-report, as larger populations may have provided greater differences in self-report.

The characteristics and analysis of the included studies can be found below.

Kreuzer, Landgrebe, Schecklmann, Staudinger, Langguth, and the TRI Database Study Group (2012) conducted a study to determine differences in tinnitus characteristics when tinnitus onset etiology was and was not due to trauma. Subjects from the Tinnitus Research Initiative Database were screened, with 1,064 subjects being selected to participate. Patients were grouped based off their response to a question on the Tinnitus Sample Case History Questionnaire (TSCHQ) about initial onset of tinnitus. Answers included loud blast of sound, whiplash, change in hearing, stress, head trauma, or other. Subjects completed the TSCHQ as well as the Tinnitus Handicap Inventory (THI), the Tinnitus Questionnaire (TQ), the Beck Depression Inventory (BDI), and the World Health Organization Quality of Life Scale (WHOQoL) to assess tinnitus severity and its effects. Tinnitus loudness and annoyance were also assessed on a numerical scale of 1-10. Results revealed that individuals who reported their tinnitus to be a symptom of trauma (whiplash and head trauma) had higher scores on the TQ, THI, BDI, and WHOQoL. Kreuzer, et al. (2012) determined that trauma-related tinnitus may be connected with higher distress levels, resulting in the higher scores on the given questionnaires (Kreuzer et al., 2012).

Research has also shown that tinnitus is a common symptom of Temporomandibular Joint Disorder (TMJ). A study by Vielsmeier, Strutz, Kleinjung, Schecklmann, Kreuzer, Landgrebe, and Langguth (2012) used patients of the Tinnitus Research Initiative Database to determine whether there were differences in characteristics of individuals suffering from tinnitus with and without TMJ. The study looked at 1204 subjects with tinnitus, 261 of which there were complaints of TMJ and 943 subjects without any complaints of TMJ. Subjects were assessed using the Tinnitus Sample Case History Questionnaire, the Tinnitus Handicap Inventory, the World Health Organization Quality of Life Scale, the Tinnitus Questionnaire, and the Beck Depression Inventory. Researchers found that tinnitus and TMJ were more common in females, however results also revealed that there were no significant differences in the quality of life scales, THI, and BDI scores of the tinnitus and TMJ group and the solely tinnitus groups. These results reveal that the presence of TMJ does not necessarily increase the potential of psychological comorbidity when in occurrence with tinnitus (Vielsmeier et al., 2012).

A study by Pajor, Ormezowska, and Jozefowicz-Korczynska (2013) determined the effects of varying demographic and otologic variables on emotional distress caused by tinnitus. 100 subjects with tinnitus for at least 3 months were included in the study. Exclusion criteria included central nervous system and psychiatric diseases, middle ear disorders, conductive or mixed type of hearing loss, and poor visual-motor performance. All subjects underwent an audiological evaluation to evaluate hearing sensitivity. Tinnitus severity was assessed on a visual scale, while psychological effects were assessed with the Beck Depression Inventory (BDI) and Hospital Anxiety Depression Scale (HADS) for anxiety and depression, and the Mini-Mental State Examination (MMSE), and Trail Making Test (TMT) for cognitive status. Results revealed that in regards to hearing status, scores of the MMSE and TMT correlated with hearing status,

however no strong correlations were found between hearing status and BDI and HADS scores. It was concluded that the degree of hearing loss did not necessarily affect the level of anxiety or depression (Pajor et al., 2013).

**Table 4. Studies on psychological self-report with differing tinnitus etiologies**

Authors	Year	Sample Size	Tinnitus Etiology	Findings
Kreuzer et al.	2012	1,064	Trauma	Trauma related tinnitus may cause an increase in psychological comorbidities
Vielsmeier et al.	2012	1,204	TMJ	No significant relationship found w/ psychological comorbidities
Pajor et al.	2013	100	Hearing Loss	Increase in psychological comorbidities with HL, but no variation w/ degree of HL

### **Use of psychotropic medication and psychological counseling**

Eight studies were included in the systematic review regarding the use of psychotropic medication and psychological counseling for tinnitus. Four studies discussed the use of psychotropic medication and four discussed the use of counseling. All studies included for counseling studied the effects of Cognitive Behavioral Treatment (CBT) as it is the most psychology based counseling that was found during research review.

Of the four studies investigating psychotropic medication, three were randomized controlled studies considered Level 1b on the levels of evidence and one was considered a non-randomized controlled trial considered Level 2. For the studies investigating psychotropic medications, different forms of antidepressants were used. Two studies investigated the use of sertraline, while the other studies investigated the use of paroxetine and amitriptyline. The studies all varied in treatment dosage and length, as well as in the sample size of included participants. Each study included assessments of subjects at baseline and post treatment, with the Holgers et al. study including a follow up assessment at 28 weeks to study the long term effects of sertraline treatment. All four studies assessed tinnitus severity and anxiety and depression, with the exception of the Bayar et al. (2001) study that only assessed changes in tinnitus severity of the subjects. Despite differences in treatment dosage and length all studies had findings that the medications reduced tinnitus severity/anxiety and tinnitus, with the Holgers et al. (2011) study finding the reduction to be maintained over time.

The four studies investigating the use of CBT as treatment for tinnitus included two meta-analysis reviews, considered Level 1a, and two randomized controlled studies, considered Level 1b. The studies all varied in sample size, as well as in duration. Both randomized controlled studies included assessments of subjects at baseline, post treatment, as well as at a follow up point to determine whether results were maintained. The meta-analysis reviews and randomized controlled studies came to similar findings that the use of CBT is beneficial for tinnitus patients. Results of all studies revealed reduction in anxiety, depression, and tinnitus severity, as well as both randomized controlled studies showing this reduction to be maintained over time.

Analysis of the eight studies can be found below.

Zoger, Svedlund, and Holgers (2006) investigated the use of antidepressant sertraline in alleviating tinnitus symptoms. Sertraline is included in a group of antidepressants known as SSRI drugs. SSRI drugs recently have been considered to be better tolerated than tricyclic antidepressants. 76 subjects between the ages of 18 and 65 with pure tone averages better than 50dBHL in the worse hearing ear participated in the study. Participants could not be under any psychiatric treatment. Randomization of 10 subjects at a time was performed to form an experimental (sertraline) and placebo group. Subjects participated for 16 weeks, receiving 25mg of sertraline for the first week, and 50mg for the following weeks. The Tinnitus Severity Questionnaire (TSQ) was used to assess tinnitus distress and was performed at baseline and again following the 16 weeks of treatment. A visual analogue scale was also used to assess tinnitus severity. Psychological aspects were assessed with the Structured Clinical Interview for DSM IV, the Hamilton Anxiety Rating Scale (HAS), the Hamilton Depression Rating Scale (HDS) for clinician rating, and the Comprehensive Psychological Rating Scale (CPRS-S-A) for self-report, in order to supplement clinician rating. Results revealed significant improvement in anxiety scores for the HAS and CPRS-S-A, as well as depression scores on the CPRS-S-A between the two groups, but there were no significant different scores between the two groups regarding depression scores on the HDS. There was also greater reduction in TSQ scores, as well as tinnitus loudness for the sertraline group. Based on the results, it was concluded that sertraline could be an effective treatment for tinnitus (Zoger et al., 2006).

A follow up study by Holgers, Zoger, and Svedlund (2011) continued to look at the effects of sertraline on the health-related quality of life (HRQoL) in tinnitus sufferers. Holgers, et al. (2011) determined to expand their understandings of the effects of sertraline on tinnitus patients during a longer period of study time. The study consisted of 75 tinnitus patients.

Inclusion criteria included tinnitus as a primary complaint, pure tone averages less than 50dBHL in the worse hearing ear, and between the ages of 18-65. Exclusion criteria included any individual on sick leave or retirement, current psychiatric treatment, treatment with antidepressants in the last year, language difficulties, pregnancy, treatment with anticoagulants, psychiatrically severe conditions in need of treatment, or psychiatric and/or social problems making it difficult to participate. The study lasted for 28 weeks, 12 weeks longer than their original study. Similar to the study, randomization of subjects was performed in blocks of 10, with 5 subjects placed in the sertraline group and 5 in the placebo group. Treatment lasted for 16 weeks, with additional treatment offered for the remaining 12 weeks. 25mg/day were given for the first week, with 50mg/day given for the remaining weeks. Subjects met with a psychiatrist to complete the Psychological General Well Being Index at baseline, 16 weeks, and 28 weeks to assess psychological state and quality of life. Results revealed significant changes in HRQoL in the sertraline group as compared to the placebo group after 16 weeks. However, there were no significant changes in HRQoL when comparing the sertraline group at 16 and 28 weeks. It was concluded that sertraline was not only effective in treating tinnitus patients, but had treatment effects that were maintained over time (Holgers, et al. 2011).

Oishi, Kanzaki, Shinden, Saito, Inoue, and Ogawa (2010) studied the effects of another SSRI drug, paroxetine, on tinnitus patients. 56 subjects were selected based on inclusion criteria of chronic tinnitus lasting more than 3 months. Exclusion criteria included fluctuating hearing loss, subjects with concurrent tinnitus treatments, subjects with current or past psychiatric treatment, and subjects on current antidepressant or antipsychotic medication. Tinnitus severity was assessed utilizing the Tinnitus Handicap Inventory (THI) and a visual analog scale to rate tinnitus loudness and annoyance. Depression was assessed utilizing the State-Trait Anxiety

Inventory (STAI) and the Self-Rating Depression Scale (SDS). Tinnitus severity and depression were assessed at baseline and after 6 months. Based on assessment results subjects were split into 3 groups; anxiety and depression group (25 subjects), anxiety group (14 subjects), and the normal group (17 subjects). Treatment lasted for 6 months, and subjects were given 10mg/day for the first 2-4 weeks, and 20mg/day for the remaining time. Results revealed significant changes in THI, visual analog scale, STAI, and SDS scores for both the anxiety/depression group and the anxiety group. Only significant changes were seen in THI scores for the normal group. Researchers found that changes in THI and visual analog scores significantly correlated with changes in STAI and SDS scores, with the strongest correlation of scores seen in the depression/anxiety group. Oishi, et al. (2010) concluded that patients with comorbid depression and anxiety symptoms could benefit from the use of the SSRI drug paroxetine (Oishi et al., 2010).

A study by Bayar, Boke, Turan, and Belgin (2001) reviewed the effects of the use of another antidepressant, amitriptyline in the treatment of tinnitus. The study consisted of 37 patients with subjective tinnitus, all of who did not have tinnitus as a symptom of Meniere's, acoustic trauma, hypertension, glaucoma, or any retrocochlear pathology. Subjects ranged in age from 18 to 64 years. Subjects were randomly split into two groups, treatment and placebo, with 20 subjects being placed in the treatment group and 17 subjects placed in the placebo group. Patients were evaluated at baseline using an audiological evaluation, auditory brainstem response testing, tinnitus frequency and intensity matching, a tinnitus questionnaire based off the questionnaire of the American Tinnitus Association, and a subjective grade of tinnitus severity on a scale of 1 to 10. Treatment lasted for 6 weeks, with individuals in the treatment group receiving 50mg of amitriptyline a night for the first week, and 100mg per night for the following

5 weeks. Instead of amitriptyline, the placebo group was given lactose-starch tablets. After the 6 weeks of treatment the baseline evaluations were repeated. Results revealed statistically significant findings for reduced subjective tinnitus severity and reduced tinnitus intensity during tinnitus matching between the two groups. 95% of subjects in the amitriptyline group reported decreased severity, while only 12% of the placebo group reported any change. It was concluded that amitriptyline may have high benefit in reducing subjective tinnitus severity (Bayar et al., 2001).

Psychological comorbidities may not only be treated with the use of medications, but with the use of counseling as well. Studies researching the use of general psychological counseling were not found, however studies were found assessing the use of cognitive-behavioral therapy, a psychology based treatment. A review by Hesser, Weise, Westin, and Andersson (2011), reported that cognitive-behavioral therapy (CBT), or treatments based off CBT were the most studied treatments for tinnitus, and as such, wanted to examine the effectiveness of the use of CBT within these studies. After a review of the literature, 15 studies were included in the review. All studies included were randomized controlled studies. The studies included ranged from 6-12 treatment sessions over a span of 1 to 15 weeks. Results of the literature review revealed that the use of CBT and CBT based treatments did in fact reduce tinnitus distress and the psychological comorbidities associated with it. Out of the 15 studies, 10 studies included follow up information for subjects. Hesser, et al. (2011) analyzed these studies and reported that subjects had less tinnitus distress compared their baseline. Overall it was concluded that CBT is an effective tinnitus treatment (Hesser et al., 2011).

Zachriat and Kroner-Herwig (2004) conducted a randomized controlled study to compare the long-term efficacy of cognitive-behavioral treatment and habituation treatment. Subjects

included needed to have tinnitus for at least three months, no treatable causes of the tinnitus, did not have Meniere's, sufficient hearing for group communication, a tinnitus disability score equal to or greater than 25 on the Tinnitus Questionnaire, and did not have any ongoing psychotherapy or masking treatments. 75 total subjects were analyzed; 26 underwent cognitive-behavioral tinnitus coping (TCT); 29 underwent habituation-based treatment (HT), and 20 were in an educational control group (EDU). The TCT group underwent 11 weekly sessions in groups of 6-8 where they learned about the psychological factors of tinnitus, as well as relaxation techniques. These individuals were also educated on cognitive processes and the emotions associated with their tinnitus and how to modify them; they learned how to cope with tinnitus and the stress that resulted from it. The HT group met for 5 sessions, and mainly focused on education and sound generator use for habituation of tinnitus. Subjects were given sound generators and instructed on how to use them. The EDU group met for a single session where they learned about the physiology and psychology of tinnitus, similar to that of the HT group. Tinnitus was assessed with the Tinnitus Questionnaire, a Tinnitus Coping Questionnaire, a Questionnaire of Catastrophizing Cognitions (referring to tinnitus), and a Questionnaire of Dysfunctional Cognitions. Psychological aspects were measured with the Questionnaire of Subjective Success, The Symptom Checklist (SCL-90R), and the Minimal Interview of Psychological Disorders. Assessments were done at baseline, at 5, 10, and 15 weeks of treatment, and 6, 12, and 21 months after all treatments had ended. Results revealed significant decreases in scores for both the TCT and HT groups, but not the EDU group, and that at follow up decreases were maintained (Zachriat & Kroner-Herwig, 2004).

A review by Wan Suhailah, Mohd Zormani, Nik Adilah, Azizah, and Zuraida (2015) compared the effectiveness of psychological and non-psychological interventions in the

treatment of tinnitus. 21 studies were selected for inclusion, and were studies that investigated the use of psychological intervention, the comparison of psychological interventions with no treatment, and the use of psychological interventions compared to other interventions. The main psychological intervention found in the 21 articles was CBT. Other interventions that were analyzed were Acceptance and Commitment Therapy, Tinnitus Retraining Therapy, Tinnitus Coping Technique. Based on these findings, it was concluded that psychological interventions provided effective treatments for anxiety and depression associated with tinnitus, as it teaches individuals with tinnitus to confront and deal with the emotions associated with it in a healthy manner. It was further suggested that a more simplified and more accessible version of CBT or psychological intervention be made available to tinnitus patients, and that perhaps a combination of audiological and psychological approaches would be most beneficial (Wah Suhailah et al., 2015).

Jasper, Weise, Conrad, Andersson, Hiller, and Kleinstaubler (2014) examined the effects of internet based CBT as opposed to the traditional in-person CBT. The aim of the study was to determine whether internet-based CBT (ICBT) could be a viable option for patients who did not have access to traditional CBT (GCBT). The study consisted of 128 subjects over the age of 18 who suffered from tinnitus for at least 6 months. Subjects had scores greater than 18 on the Tinnitus Handicap Inventory and greater than 8 on the Mini Tinnitus Questionnaire. Tinnitus was their main problem, with no underlying etiology, and none of the subjects had previously participated in CBT or had any psychological tinnitus treatment or psychiatric conditions. Subjects were randomly assigned to one of three groups; ICBT, GCBT, and a web-based discussion forum (DF). Treatment lasted for ten weeks. The Tinnitus Handicap Inventory and Mini Tinnitus Questionnaire were used to assess tinnitus severity and the Hospital Anxiety and

Depression Scale, Insomnia Severity Index, and the Tinnitus Acceptance Questionnaire were used to assess psychological factors. Subjects were assessed pre and post treatment, as well as at a six-month follow up. Results revealed that while all three groups showed improvement, the DF group had significantly less improvement compared to that of the ICBT and GCBT groups. No significant differences were found between the ICBT and GCBT groups at either the post or follow up assessments. Jasper, et al. (2014) concluded that the use of CBT is effective for tinnitus treatment, and the use of ICBT may be considered a viable alternative for individuals who cannot participate in standard CBT.

**Table 5. Studies on the use of psychotropic medication and counseling for tinnitus**

Authors	Year	Sample Size	Intervention	Treatment	Assessment	Findings
Zoger et al.	2006	76	Medication (sertraline)	25mg/day week 1, 50mg/day week 2-16	Baseline and post treatment	Reduction in tinnitus and depression scores
Holgers et al.	2011	75	Medication (sertraline)	25mg/day week 1, 50mg/day week 2-16	Baseline, 16 weeks, 28 weeks	Reduction in tinnitus and depression scores. Maintained at 28 week f/u
Oishi et al.	2010	56	Medication (Paroxetine)	10mg/day week 1-4, 20mg/day up to 6 months	Baseline, 6 months	Reduction in tinnitus severity, anxiety, and depression
Bayar et al.	2001	37	Medication (Amitriptyline)	50mg/night week 1, 100mg/night week 2-5	Baseline and post treatment	Reduction in tinnitus severity. Anxiety/depression not assessed
Hesser et al.	2011	15 (studies)	CBT	N/A	N/A	Reduction in overall distress
Zachriat& Kroner-Herwig	2004	75	CBT	CBT, habituation, or education for 11, 5, and 1 weeks	Baseline, weeks 5, 10, 15, and 6, 12, and 21 months post treatment	Reduction in distress for CBT and habituation. Maintained at f/u
Wan Suhailah et al.	2015	21 (studies)	CBT, ACT, TRT, TCT	N/A	N/A	CBT, as well as other psychological based treatments are effective for anxiety and depression
Jasper et al.	2014	128	CBT, ICBT	CBT, ICBT, or DF for 10 weeks	Baseline and post treatment, as well as 6 month f/u	CBT and ICBT are effective treatments for anxiety/depression. ICBT is a viable alternative to traditional CBT

## **DISCUSSION**

This systematic review was designed with the purpose of examining the relationship between tinnitus and psychological comorbidities. Of this relationship, the prevalence of tinnitus and psychological comorbidities, psychological self-report with differing tinnitus etiologies, and the effects of psychotropic medication and counseling on tinnitus and severity and psychological disorders were specifically investigated for this review. Eighteen studies were obtained and analyzed for inclusion in this review. Of these included studies there was a combination of randomized controlled studies, non-randomized studies, and meta-analysis literature reviews. All studies aimed to determine a better understanding of the relationship between tinnitus and psychological comorbidities, and how this relationship affects the diagnosis and management of these patients.

The review of literature revealed studies focused on the presence of tinnitus and psychological comorbidities in adult populations. Several trends were noted regarding the relationship between tinnitus and psychological comorbidities during the analysis of acceptable studies. While the review revealed similar trends in the studies, it was also noted that additional research may be needed in this area of study to come to more definitive findings.

### **Prevalence**

Studies included revealed a high correlation between tinnitus and psychological comorbidities in the adult patient population. Tinnitus was assessed in the studies using the THI, TQ and TSQ, while anxiety/depression were assessed using CIDI, HADS, GAD-7, DSM, CPRS-A, IDS-SR30, DSM-IV, ASI-3, STAI, SCL-90-R, BDI, and BAI. While the overall prevalence

was determined in several studies, the majority of studies referred to the relationship in terms of whether or not a significant correlation present. When referring to psychological comorbidities, all researchers included anxiety, depression, or a combination of the two disorders. All studies revealed a significant relationship between tinnitus and psychological comorbidities. As tinnitus severity increased, so did the presence of a subject having a psychological comorbidity. Of the studies that assessed the overall prevalence there were various findings. A range of 20.4-47% encompasses all findings of prevalence studies included in this literature review, with exception of one study that assessed psychological comorbidity in chronic tinnitus patients and found a prevalence of 74% (Zoger et al., 2006). As the study of the relationship between tinnitus and psychological comorbidities is still developing, it is possible that enough research has not yet been done to obtain a reliable prevalence of individuals. Further research should be conducted in order to obtain a more uniform prevalence of psychological comorbidity.

### **Psychological Self-Report**

There were limited findings studying the psychological self-report of tinnitus patients with various tinnitus etiologies. Of the research included, one study assessed self-report in TMJ patients, a second assessed self-report in trauma patients, and a third assessed self-report in hearing loss patients. Of these studies, only the Kreuzler et al. and Pajor et al. studies revealed a relationship between etiologies of trauma or hearing loss and psychological comorbidities, while the Vieslmeiler et al. article revealed that tinnitus caused by TMJ had no effects on psychological self-report compared to individuals without TMJ. It should be noted that while Pejor et al. concluded that there was a relationship between hearing loss and psychological comorbidities, they also noted that there was no trend between the degree of hearing loss and psychological

comorbidities. As there were limited findings it is difficult to make overall conclusions regarding tinnitus and psychological self-report for varying etiologies. It would be beneficial if further research was conducted in order to determine whether the presence of tinnitus increased psychological comorbidities with certain etiologies, as clinicians would be better able to watch for signs and symptoms of depression and anxiety, and provide a more overall patient-centered care.

## **Treatment**

Studies included in the systematic review assessed both treatment with psychotropic medication, and treatment with the use of CBT counseling. Results revealed that use of both medication and counseling did have a positive effect on the present psychological comorbidities, with anxiety/depression and tinnitus distress being reduced in all studies. The studies including psychotropic medication all utilized various antidepressants, with two studies utilizing the same antidepressant, sertraline. Other medications were paroxetine and amitriptyline. Only one study determined whether the effects of the medication were sustained over time. In order to provide a successful treatment more information would be needed about whether the effects of medications were sustained. When studying the use of medication as treatment, the placebo effect should be accounted for. Three of the included studies utilized a placebo group, and while there was some benefit seen with placebo, there was still more benefit seen with treatment groups. The differences between treatment and placebo groups helps determine that there is some efficacy in the medications utilized in the included studies. The use of psychotropic medication is relatively new in the study of tinnitus, so more studies need to be conducted to determine whether these results are sustained with all types of psychotropic medications, or if some prove to be more

effective than others. The studies including the use of counseling focused on the use of CBT, as it is the most psychologically based. All studies showed that CBT was an effective treatment, with one revealing effects were maintained over time. As with medication, it would be important to determine in more studies whether effects are maintained. One study focused on the use of ICBT as an alternative to traditional CBT, with results showing both methods of treatment to be effective in reducing psychological comorbidities. More research regarding ICBT would be beneficial, as it is a treatment method that would be more available to a larger group of people. A search for research combining both the use of psychotropic medication and CBT was conducted, with limited findings. As such, it would be beneficial to determine whether a combination of medication and counseling would be an effective treatment for individuals with tinnitus and psychological comorbidities. Tinnitus is a subjective disorder that may not have a uniform treatment. It is important that various treatments be researched in order to find what will be effective so that we may provide an evidenced-based treatment for patients.

## CONCLUSIONS

### Research Implications

1. There is a need for further research regarding treatment for psychotropic medication, more specifically whether one medication is more effective. Further research regarding the effectiveness of ICBT is also needed, as it would be more easily accessed by larger numbers of patients.
2. Further studies on the self-report with differing etiologies for the presence of tinnitus should be conducted, as it would provide clinicians with a better idea of which patients may be at higher risk for psychological comorbidities
3. Further studies are needed to assess the true prevalence of tinnitus and psychological comorbidities in the adult population.

### Clinical Implications

1. As a positive correlation has been shown between tinnitus and psychological comorbidities, it is important for clinicians to be aware that tinnitus patients may be more prone to suffering from anxiety or depression. In conjunction with tinnitus PROMs, completion of the Physician Quality Reporting System (PQRS) for depression should also occur using measures such as the Patient Health Questionnaire (PHQ-9) or Center for Epidemiologic Studies Depression (CES-D) to assess depression. PQRS is required under Medicare.
2. Clinicians should be knowledgeable regarding the various treatments for tinnitus. All considered treatments, whether psychotropic medication or counseling, should be evidence based.

3. As there is a correlation between tinnitus and psychological comorbidities, with a potential effective treatment being the use of psychotropic medication, audiologists, psychologists, and psychiatrists should consider collaboration when treating patients with tinnitus and psychological comorbidities.

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